SCIENCE, PROCESS PHILOSOPHY AND THE IMAGE OF MAN
THE METAPHYSICAL FOUNDATIONS FOR A CRITICAL SOCIAL SCIENCE

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VOLUME I.

I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any University.

Arran Emrys Gare

ABSTRACT

The central aim of this thesis is to confront the world-view of positivistic materialism with its nihilistic implications and to develop an alternative world-view based on process philosophy in terms of which science and ethics can be reconciled. The thesis begins with an account of the rise of positivism and materialism to the dominant position in the culture of Western civilization and shows what effect this has had on the image of man and consequently on ethical views. After having shown the basic weaknesses of this world-view the positivist account of science is criticised and an alternative epistemology is developed in which the aim of disciplined inquiry is seen to be understanding. It is argued on the basis of this epistemology that science and metaphysics are indissociable and that the materialist conception of being is open to challenge from a different ontology. Having reviewed the various conceptions of being which have been developed in the past, a version of process philosophy is outlined and it is argued that this promises to be far more effective than materialism as a foundation for the natural sciences. In particular it is shown how in terms of process philosophy it is possible to conceive of living organisms as having emerged from inanimate being and this provides the basis for the development of a conception of humanity as an emergent form of life. The human order is then seen as a process of becoming within nature with its own unique dynamics, irreducible to any other processes, involving both intentional and unintentional processes. It is then shown how on the basis of this conception of humanity it is possible to develop an ethical theory and a critical social science and in this way to transcend the disjunction between science and ethics.

CONTENTS

VOLUME I

CONTENTS

VOLUME II

Without wishing in any way to associate her with the shortcomings of this thesis I would like to thank my supervisor, Dr. Patsy Hallen for her encouragement and help in undertaking the ambitious project of developing a metaphysical system.

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In order to speak, then, of man's being we must first elaborate a non-Euclidean concept of being, as others have elaborated a non-Euclidean geometry. The time has come for the seed sown by Heraclitus to bring forth its mighty harvest.

Jose Ortegay Gasset
HISTORY AS A SYSTEM

PREFACE

The central aim of this thesis is to confront the world-view of positivistic materialism with its nihilistic implications and to develop an alternative world-view based on process philosophy in the tradition of Heraclitus, Bergson and Whitehead in terms of which the dignity of humanity can be justified and ethics and science reconciled. While the positivists hold that science is concerned with laws by which predictions can be made and argue for an absolute disjunction between facts and values, I will argue that science is concerned with developing analogies to facilitate understanding and that understanding is implicitly evaluative. While materialists hold that the world consists of nothing but configurations of matter governed by immutable laws, I will argue that the universe is a process of creative becoming, continually giving rise to new self-ordering patterns of activity, each of which makes its own unique contribution to the becoming of the universe as a whole. While the positivistic materialists see nature as having no significance other than as something to be subjugated for human ends and then project an image of man as a law-governed entity responding mechanically to stimuli for whom all ends are without rational foundation, I will argue for a conception of humans as participants in the process of becoming of nature who are able to understand their own and nature's intrinsic significance and on the basis of this understanding to make rational choices about ultimate ends.

In modern society the ultimate arbiter in matters of belief is science, and the authority of positivism and materialism derives from their identification with science. While positivism and materialism are not identical they support each other to form a total world-view. They both imply that everything should be ultimately explained in terms of the universal laws of physics, and while materialism supports positivism by implying that all anyone can know is the product of the effects of the environment on the brain, positivism supports materialism by ruling out the validity of metaphysics and thus condemning any attempt to develop an alternative conception of being. It is extremely difficult to question this world-view or to develop an alternative since to begin any such enterprise one must make assumptions which have already been rejected as invalid. To overcome this problem I will justify my assumptions by the system of thought developed from them. In this way the coherence of this system of thought will be demonstrated.

I will begin the thesis with an account of the rise of materialism and positivism to dominant positions in the culture of Western civilization, concentrating in particular on the development of the scientific image of man and the nihilistic implications of this. In this account it will be assumed that humans are beings who struggle to orient themselves in the world, and that it is possible for there to be rational progress in this struggle, and that individuals attempting to advance in understanding must first acknowledge the authority of their cultural heritage, taking this as their point of departure. Since this conception of humans is incompatible with the image of man implied by positivistic materialism, the invalidity of this world-view will be presupposed from the beginning. I will then try to show the incoherency and problems of the positivistic materialist world-view and indicate ways of tackling these problems.

In my second chapter I will show the inadequacy of the positivist account of scientific knowledge and through an examination of the developments which have taken place in science I will try to justify an epistemological doctrine in which the goal of disciplined inquiry is taken to be understanding rather than the discovery of laws or the accumulation of knowledge. As opposed to the rejection of metaphysics by positivism, this doctrine will be seen to imply that science and metaphysics are mutually dependent. Understanding implies that it is just as important to get an overview of the world as to investigate any particular aspect of it, and that particular studies always presuppose a general conception of the nature of being through which the object of investigation can be understood in relation to the totality. This suggests that materialism is only a particular ontology and not the whole of science, and that as such it is open to challenge through the development of an alternative metaphysics based on a different conception of being.

I will then go on to examine the nature of metaphysics. A successful metaphysical system must fulfil three conditions. It must be all encompassing, providing a total perspective on the world and all that is in it, it must be without implicit assumptions and be able to justify its own first principles, and it must provide a basic conception of being arrived at through the articulation of one or more analogies. It will be argued that the best way to deal with the problem of basic assumptions is to develop the system in a circle beginning with an historical analysis of the problems of one's cultural heritage and concluding with a justification of the assumptions made in this analysis. This will justify the introduction and the way the thesis will have been developed. To satisfy the first requirement of a successful metaphysical system the circle of such a system must be such as to encompass all aspects of experience and of the world. In opposition to the materialist ontology I will elaborate a form of process philosophy based on an auditory analogy.

Following this I will examine developments in the physical and the biological sciences to show how in the last analysis materialism has proved to be inadequate as a foundation for these, and how process philosophy indicates directions in which the problems within these sciences can be overcome. In relation to the physical sciences I will be particularly concerned to show how process philosophy offers hope for resolving the problems of quantum theory and reconciling quantum theory and relativity theory, while in relation to the biological sciences I will show how in terms of process philosophy, it is possible to conceive of living entities as subjects which act purposefully. This will pave the way for the development of a more adequate conception of humans and their place in nature than it has been possible to develop in terms of positivistic materialism.

The subsequent chapters will be concerned to develop a conception of humans, showing the relationship between individuals and the dynamics of society and the relationship between humanity in general and the dynamics of the physical and biological world. This will justify and develop the basic conception of humans assumed in the introduction, that is beings, who in association and communication with each other struggle to understand and orient themselves in the world. This conception will also resolve those problems engendered by the positivistic materialist conception of humans such as how the mind is related to the body, how it is possible to be conscious of the external world and of other minds, and how it is possible to be both a complex of chemical and physiological processes and a responsible agent capable of enacting decisions. Also it will be shown how it is possible for there to be a science in which there is a rational progress. This will indicate the harmony between the epistemology emphasising understanding and the ontology of process philosophy the development of which will have been justified by the epistemology.

The conclusion will then be seen to be a return to the starting point, but at a higher level, from which the problems described in the introduction will be seen from a perspective in terms of which they can be resolved. In particular a belief in the intrinsic significance of life and the dignity of man will have been justified and all those views which would in any way reduce the stature of man in the name of science and objectivity will have been dealt with. The conception of man based on process philosophy will be seen to justify a rationalist ethics and indicate an indissociable relationship between ethics and science. With the goal of science being understanding, and assuming the process view of the world, of life and of humans, science will be seen to be implicitly evaluative showing what goals are worth pursuing and how to pursue them. Since the values implicit in such judgements will be seen to derive from the concept of man and his place in nature assumed by the sciences, and since this concept must be always open to development and revision, values will be brought into the arena of rational disputation. Finally, by developing and justifying the concepts in terms of which people define themselves, their relationships with others, their situation within the world and their ideals and goals, this science must be seen as not just an attempt to understand the world but at the same time as part of the creative activity by which we form ourselves, constitute the society within which we live, and contribute to the process of becoming of nature.

CHAPTER 1

SCIENCE AND NIHILISM

> It is not contrary to reason to prefer the destruction of the whole world to the scratching of my little finger. It is not contrary to reason for me to choose my total ruin, to prevent the least uneasiness of an Indian, or person wholly unknown to me. It is as little contrary to reason to prefer even my own acknowledged lesser good to my greater, and have a more ardent affection for the former than the latter.
>
> David Hume
> A TREATISE OF HUMAN NATURE

> Nietzsche defines nihilism as the situation which obtains when "everything is permitted". If everything is permitted, then it makes no difference what we do, and so nothing is worth anything.
>
> Stanley Rosen
> NIHILISM

The aim of this chapter is to define the problems which the thesis is designed to overcome. The central problem with which I am concerned and the problem which should be taken as the focus of the whole thesis is that our most reliable body of knowledge, science, appears to justify nihilism. Nihilism has two meanings: that it is impossible to provide rational justification for moral judgements, and that life is meaningless. As Rosen suggested, these two meanings are closely associated. Only where life is meaningless can there be no reason to choose one course of action rather than another. To find that there are no grounds for such choices is to realize that everything is pointless, while to overcome the meaninglessness of existence is to find that there are ideals worth realizing and goals worth striving for.

I will begin this task by analysing the nature of human action. I will try to show how the ultimate ground for the rational justification of decisions is the world-view in terms of which the actor or actors define their place in the world. In doing this I will try to show how world-views of the past, particularly the medieval world-view, provided people with rationales for action. Against this background it will be shown how the rise of the new science based on positivistic materialism in which the world was conceived as totally independent of and indifferent to the subject, and the subject was conceived to be outside the physical world or non-existent, undermined such rationales for action. I will then try to show how the ideas of positivistic materialism have come to pervade the culture of Western civilization and how nihilistic the influence of these ideas has been. In particular I will focus attention on the way positivistic materialism has influenced the human sciences, both in prescribing the methods of investigation and in determining the conception of humans on which they have been based. To illustrate this I will describe the changing assumptions underlying economic theory and the effects this has had on the implicit values of this science. Finally, it will be seen how the nihilistic influences of positivistic materialism have culminated in a 'value free' social science embodying a technicist rationality in which people are conceived of as nothing but things to be manipulated.

In the attempt to overcome the nihilisitc implications of positivistic materialsim two basic strategies have been adopted. One of these is to delimit the realm of validity of natural science, giving it a secondary or derivative status. This is the approach of Berkeley, Kant, the phenomenologists and the linguistic analysts. This strategy will be criticised and rejected. The other approach has been the attempt to develop an alternative ontology to materialism. Outstanding figures in this field are Leibniz, Schelling, Hegel, Engels, Bergson and Whitehead. It will be argued that this is the correct approach and in support of the attempt to develop a new metaphysics I will indicate the weaknesses in positivistic materialism. It will be shown how positivism and materialism are each internally inconsistent and also ultimately inconsistent with each other. Also the problems which have arisen with materialism such as the mind-body problem will be shown to be insoluble. In doing this I will not only be indicating the need for a new metaphysics but will also set the tasks to be achieved by any new metaphysics if it is to be regarded as superior to positivistic materialism.

RATIONAL ACTION AND WORLD-VIEWS

To understand nihilism, that is, to understand what it means to have no reasons to choose a course of action and to have no grounds to justify one's actions or projected actions, it is necessary to understand how rationality is related to action. Rationality is usually associated with the justification of beliefs about the world and only derivatively about action. However, from the point of view of both the genesis of the human species and the development of the individual, practical reason precedes theoretical reason. In practical reasoning, the conclusion drawn from deliberation is not a proposition but an action. In this, the actual inference is unanalysable and unproblematic. Where rationality can be analysed is in the deliberation which precedes the action.

This deliberation has been carefully analysed by a number of philosophers, from Aristotle to Husserl and his followers. However, for my purposes W. I. Thomas's concept of the 'definition of the situation' suffices to characterize what is involved. He writes:

> Preliminary to any self-determined act of behaviour there is always a stage of examination and deliberation which we may call the <u>definition of the situation</u>. And actually not only concrete acts are dependent on the definition of the situation, but gradually a whole life-policy and the personality of the individual himself follow from a series of such definitions. (1)

(1) William I. Thomas "The Definition of the Situation" printed in SYMBOLIC INTERACTION. 2nd ed. Jerome G. Manis and Bernard N. Meltzer eds, Allyn & Bacon, Boston, 1975 p. 331.

To define a situation is to conceptualize it so as to relate it to broader contexts. It is to see its relevance for the realization of one's projects or for deciding on which project to realize. It is to relate it to one's life as a whole and to the beliefs and intentions of others, to institutions, to society in general. Ultimately, to define a situation is to define one's place in the world.

Defining a situation is not simply the act of an isolated individual. Individuals, even when they are alone, define each situation from the standpoint of what G. H. Mead calls the 'generalized other' so that the situation is seen as objectively real and capable of being seen in the same way by anyone else who is in the same situation. This means that people always act before an implicit audience and it is because of this that individuals can co-ordinate their activities. Each individual has a general idea of what others expect of him or her and correspondingly, what s/he can expect of others.

However, it is not people as such who constitute the generalized other but the perspective on the world shared with them. It is through acquiring this perspective that the individual is able to define a succession of situations in a consistent manner so that the world can be experienced as coherent. As Tamotsu Shibutani wrote of perspectives:

> A perspective is an organized view of one's world, what is taken for granted about the attributes of objects, of events, and of human nature. The environment in which men live is an order of things remembered and expected as well as things actually perceived. It includes assumptions of what is plausible and what is possible. Without such an order life would be chaotic; even doubts become possible only within an unquestioned frame of reference. Having such perspectives enables men to conceive of their ever changing world as being relatively stable, orderly, and predictable. (1)

It is from the point of view of this perspective that the individual defines him or herself and achieves an identity. It is the attainment and maintenance of this identity which constrains individuals to conform to the values or norms implicit within the perspective of the generalized other. The universality of this has been argued for by the anthropologist, Irving Hallowell, who has shown how the concept of the self plays a central role in the maintenance of social order through promoting self-orientation. He writes:

> In so far as the needs and goals of the individual are at the level of self-awareness, they are structured with reference to the kind of self-image that is consonant with other basic orientations that prepare the self for action in a culturally constituted world. (2)

Having outlined the relationships between situations, perspectives and self-concepts and how these function to

(1) Tamotsu Shibutani, "Reference Groups and Social Control" in HUMAN BEHAVIOUR AND SOCIAL PROCESSES, Arnold M. Rose ed. Houghton Mifflin, Boston, 1962, p. 130.

(2) A. Irving Hallowell, CULTURE AND EXPERIENCE, Uni. of Pennsylvania Press, Philadelphia, 1955 p. 76.

constrain people to conform to societal norms, I will now examine the nature of these norms. The norms and values of society are implicit in the moral notions in terms of which situations are defined. For instance, to describe the killing of a person as murder is to imply that it is morally unacceptable and associated with this, that human life has some intrinsic significance. The concepts 'stealing' and 'cheating' have similar normative connotations. However, it can be open to question whether a concept should be applied in a given situation. Is it really stealing if property is taken without permission of the owner in order to save someone's life? Also the validity of some concepts can be questioned. Thus, the concept of fornication with its implicit moral condemnation has been virtually dropped from the language. This leads to the problem of how moral notions are to be justified.

In traditional societies, theultimate grounds for the justification of moral notions and their application is the society's cosmology. As Mary Douglas wrote:

> The cosmological scheme connects up the bits of experience and invests the whole with meaning; the people who accept it will only be able to justify their treatment of one another in terms of these ultimate categories. (1)

The cosmology of a society is their general world-view. However, this is not something that is simply constructed to interpret the world. As Douglas emphasised in a later work:

(1) Mary Douglas, NATURAL SYMBOLS: EXPLORATIONS IN COSMOLOGY, Penguin Books, 1973, p. 10.

> It is a mistake to think of people as being set somewhere below and apart from their cosmological ideas. People are living in the middle of their cosmology down in amongst it; they are energetically manipulating it, evading its implications in their own lives if they can, but using it for hitting each other and forcing one another to conform to something they have in mind. (1)

What gives coherence to a world-view or cosmology is an underlying analogy or thematic motif. Roy Willis has made a comparative study of three tribes: the Nuer, the Lele and the Fipa showing how their different perceptions of the structure of the universe correlate with differences in ideas of time, historical consciousness or the lack of it and with ideas of the self, and how these perceptions are ultimately based on different dominant analogies. From this he concluded that:

> The cohesion and vitality of human cultures appears to rest on a kind of cognitive and affective reductionism by which a wide range of disparate concerns are subsumed under a single thematic motif. (2)

What this means is that traditionally the possibility of people being able to act in a rational way, and being able to justify their actions to others, has been dependent on a cosmology dominated by a thematic motif which could provide the ultimate grounds for ethical judgements. If it can be shown that the only cosmological beliefs which can be rationally held are those which provide no such grounds, then unless some alternative ultimate grounds can

(1) Mary Douglas, IMPLICIT MEANINGS: ESSAYS IN ANTHROPOLOGY, Routledge & Kegan Paul. London, 1975, pp.60-61.
(2) Roy Willis, MAN AND BEAST, Paladin, Frogmore, 1974, p. 86.

be found, we are left in a state of nihilism. I will now try to show how the destruction of the medieval world-view following the rise of science in the seventeenth century led to this nihilistic state of affairs.

THE MEDIEVAL WORLD-VIEW

In this section I will try to describe the medieval world-view and show how it provided people with an orientation to the world and grounds for action. There are a number of difficulties in the way of this task. One problem is that at any one time different people hold different views of the world. Only a small proportion of the population is likely to have acquired their entire cultural heritage, and this heritage could not at any stage be thought to form an entirely consistent world-view. Also different groups are likely to have widely diverging outlooks on the world. The Middle Ages is even more problematic in this respect because while the educated classes uniformly spoke Latin, the rest of the population spoke a variety of tongues. This gave rise to the sort of situation described by William Brandt. Through a study of the aristocratic and clerical chronicles of the Middle Ages, he revealed that these two groups of people maintained very different ways of looking at the world for several hundred years. (1) Marc Bloch also showed that Catholicism only incompletely penetrated among the common people during the Middle Ages, and since these people were still largely dominated by pagan beliefs, it can be surmised that they must have had outlooks on the world quite different from both the clerisy and the aristocracy and from similar groups of people in different regions. (2)

(1) William J. Brandt, THE SHAPE OF MEDIEVAL HISTORY: STUDIES IN MODES OF PERCEPTION (1966) Schocken Books, N.Y. 1973.
(2) Marc Bloch, FEUDAL SOCIETY tr. L. A. Manyon, 2nd ed. 1962, Routledge & Kegan Paul, London 1965, Vol. 1, p.82f.

Furthermore, ideas themselves are constantly changing and it is difficult to delimit the era in which sets of ideas can be said to dominate. At best one can only speak of a common way of thinking consisting of a more or less cohering set of relatively unchanging ideas which have dominated the most powerful groups within a society over a period of time.

To overcome these problems I will begin by outlining the original ideas which went to make up the medieval world-view which dominated the Middle Ages and, as E. M. W. Tillyard has argued, the Renaissance as well (1) and show how these were synthesized. By adopting this approach I will be able to indicate the conflicts which account for the dynamics of the intellectual life of the Middle Ages and which were in the long run largely responsible for the collapse of these ideas. I will then attempt to show how these ideas were articulated into the way people understood themselves, other people and actions in everyday life, and in this way became so basic to life that they were unconsciously presupposed by everyone.

Only by giving a detailed account of the development of these ideas into what came to be taken as the common-sense view of things is it possible to attain an understanding of what a world-view is in the sense that it has been described by E. E. Evans-Pritchard in relation to the Azande:

(1) E. M. W. Tillyard, THE ELIZABETHAN WORLD PICTURE (1943) Penguin Books, Harmondsworth, 1972, pp.12-16.

> In this web of belief every strand depends upon every other strand, and a Zande cannot get out of its meshes because it is the only world he knows. The web is not an external structure in which he is enclosed. It is the texture of his thought and he cannot think that his thought is wrong. (1)

Despite the diversity of views in the Middle Ages, I will try to show that all these were based on an entirely different way of thinking than dominates thought in the present age. In doing this my concern will be to show that the world as it is experienced in the present age is not reality itself but is only a particular world-view. To reveal the ideas of the present as only features of one world-view among others is required in order to enable people to see that they can be replaced. As Robin Horton remarked in relation to traditional societies in Africa: "absence of any awareness of alternatives makes for an absolute acceptance of the established theoretical tenets, and removes any possibility of questioning them". (2)

The first source of the medieval world-view was the Hebraic vision as expressed in the Bible. The essence of this is that God intended man to live in paradise, but man sinned and so was expelled from paradise and in this fallen state, suffered the consequences of his sin. But God promised to restore him and sent his Son to earth to make that restoration possible, at least for a few, or, according to more sanguine interpreters, for everyone.

(1) E. E. Evans-Pritchard, WITCHCRAFT, ORACLES AND MAGIC AMONG THE AZANDE, Clarendon, Oxford, 1936, p. 194.
(2) Robin Horton, "African Traditional Thought and Western Science" Part II, in AFRICA, Vol. XXXVII, 1967, pp. 155-187, p. 156.

The most striking features of this vision are the conception of God as a person and the historical character of man's situation in the world.

The second source was the philosophy of Plato, more especially as it had been interpreted by the Neo-Platonists. Plato was strongly influenced by the Pythagoreans according to whom the world was seen as number or mathematical relations. Plato generalized this so that the ideas of things were taken to be the true reality transcending the flux of the sensible world while particular things were seen as only real to the extent to which they participated in these universal forms. For instance, a particular shoe was taken to be real only insofar as it approximated or imitated the idea of what a shoe is. Nothing of the diversity of nature was to be left out of this realm of ideas. It included simple sensible qualities, the non-temporal relations between objects, the complex groupings of such qualities and relations which make up the 'what' of things experienced, and all the moral and aesthetic qualities: justice, temperance and beauty. All value in the sensible world was thought to derive from this super-sensible realm. For instance, there was thought to be beauty in the perceived world only by virtue of the form of beauty, and associated with this, Plato believed that if one attains satisfaction from observing beauty in the world, then one should attain far greater satisfaction from contemplating the Idea of beauty itself. (1) In the REPUBLIC Plato introduced the concept of the Good as the Idea of Ideas from which all the others are in some

(1) THE REPUBLIC OF PLATO tr. Francis MacDonald Cornford, Oxford Uni. Press, London 1941, V.476, p.183.

sense derivative. This Idea is the most indubitable of all realities, and as the Idea of all Ideas, it has the properties common to all of them. In particular, it is eternal and immutable. It is the polar opposite of the sensible world so that "The entire soul must be turned away from this changing world, until its eye can bear to contemplate reality and that supreme splendour which we have called the Good". (1) As the source of all forms, it cannot be described by the concepts of ordinary speech and transcends all other things in dignity and potency. Finally, it is the universal object of desire and draws all souls towards itself. The highest good for man is nothing but the contemplation of this absolute Good. The Idea of the Good has been interpreted by Christians to be identical with Plato's Demiurgus of the TIMAEUS, the artificer of the world. This Demiurgus was seen by Plato as of necessity making the world to include replicas of all the Ideas, from the most exalted to that which is paltry, ridiculous or disgusting. This was not a creation of the world out of nothing, but a creation out of pre-existing matter, the receptacle of the forms. This composite of the Good and the Demiurgus was then identified by Christian interpreters as God.

The Christian world-view was based on a fusion of these two outlooks. The synthesis has been described by Morse Peckham:

(1) THE REPUBLIC OF PLATO tr. Francis MacDonald Cornford, Oxford Uni. Press, London 1941, V I 518, p.232.

> The result though superficially incredibly elaborate, was fundamentally very simple. The unreal world of the Platonists was identified with the fallen world of the Judeo-Christian tradition, and the restored world of the latter was identified with the radiant world of the ideas of the former. Time was contained in eternity. To go to heaven was to leave time and enter eternity. Man's soul originated in heaven, it emanated from God, a spark of the divine fire, it descended to earth, it suffered temporal unreality, and then, having achieved salvation, it returned to heaven and was re-absorbed in God. (1)

Augustine completed this synthesis, subordinating Plato to Christ. In this scheme, God wills the fall to take place, and chooses which men will be redeemed to enter heaven and live in the City of God. In the meantime, people must live their lives in an imperfect, disordered world of deteriorated, half destroyed value. In this world the duty of Satan is to tempt us into believing that the full value is structured within it. Our duty is to resist this temptation, to fight the temporal world, the flesh and the devil, and use it in order to win salvation. As Augustine wrote:

> ... among all these things only those are to be enjoyed which we have described as being eternal and immutable; others are to be used so that we may be able to enjoy those. (2)

The mark of a good Christian was the manner in which he endured suffering and frustration, and his or her ability to make a good death. To accept the suffering and randomness

(1) Morse Peckham, BEYOND THE TRAGIC VISION, George Braziller, N.Y., 1962, p.57f.
(2) Saint Augustine, ON CHRISTIAN DOCTRINE, tr. D. W. Robertson, Bobbs-Merrill, Indianapolis, N.Y., 1958, Bk I, XXII, 20, p.18.

of this world was to accept the will of God, and this was the mark of grace and proof that one would achieve salvation. This conception of man's place in the world, though it was developed in different ways by different thinkers and was largely reformulated by Thomas Aquinas in his attempt to assimilate to it the philosophy of Aristotle in the thirteenth century, formed the basis of the medieval world-view.

However, there were conflicts arising from this synthesis. While Platonism and Judeo-Christianity complemented each other to a large extent, the Palestinian tradition was essentially historical with the pattern paradise-exile-restoration all taking place on this earth, while the Platonic view was a simple contrast between a perfect eternity and a shadowy temporality. One of the conflicts arising from this was that between conservatives who believed restoration to be outside time and the revolutionary view that restoration would take place here on earth by totally correcting all that is wrong in the world. Another conflict arose out of the different conceptions of God. The Good for Plato was an intellectual concept and was understood by a long process of intellectual endeavour, while the Hebraic God is a personal God and knowable by revelation. While all Christians of the Middle Ages acknowledged the primacy of revelation over intellect, there were those who wanted to reject all intellectualizing. This conflict reached its highest pitch when Bernard of Clairvaux launched a powerful attack against the dialecticians of his time, achieving his end by having Abelard condemned.

The significance of these conflicts, together with the achievements of medieval culture, has been summed up by Ernst Cassirer:

> Medieval culture has often, and justly, been admired for its deep unity and homogeneity. It seems to lack all those conflicts, all those contradictions and dissonances that are the stigma of our modern civilization. In the Middle Ages all forms of human life - science, religion, moral and political life - were pervaded and saturated with the same spirit. Yet all this cannot make us forget that medieval life was the outgrowth of two conflicting intellectual and moral forces. It needed the heroic effort of all the great scholastic thinkers to bridge this gulf and bind together the opposing elements of thought and feeling. (1)

Apart from the conflict between the Judeo-Christian elements of Christianity and its Platonist elements, there was also a conflict between the two concepts of God: that of the REPUBLIC and that of the TIMAEUS. The God of the REPUBLIC, the Good, was an apotheosis of unity, self-sufficiency and quietude, while the God of the TIMAEUS, the Demiurgus, was the apotheosis of diversity, self-transcendence and fecundity. As Arthur Lovejoy has written of this conflict:

> There was no way in which the flight from the Many to the One, the quest of a perfection defined wholly in terms of contrast with the created world, could be effectually harmonized with the imitation of a Goodness that delights in diversity and manifests itself in the emanation of the Many out of the One. The one program demanded a withdrawal from all "attachment to creatures" and culminated in the ecstatic contemplation of the indivisible Divine Essence; the other, if it had been formulated, would have summoned men to participate in some finite measure, in the creative passion of God, to collaborate consciously

(1) Ernst Cassirer, THE MYTH OF THE STATE, Yale Uni. Press, New Haven, 1946 p. 87f.

> in the processes by which the diversity of things, the fullness of the universe, is achieved. (1)

The Christian theologians were constrained to choose between the two and chose the first. But while the second trend only attained full expression in the poetry of Pope and the philosophy of Leibniz in the eighteenth century, (2) most people in the Middle Ages were far more oriented to this world than would be suggested by the writings of the theologians. As Tillyard wrote:

> Those who know most about the Middle Ages now assure us that humanism and a belief in the present life, were powerful by the twelfth century, and that exhortations to contemn the world were themselves powerful at that time for that very reason. The two principles co-existed in a state of high tension. (3)

So while the contemplative life was acknowledged to be superior to the life of worldly involvement, most people chose to be actively engaged in the world. Therefore, it is necessary to focus on how the sensible world was conceived not only as a fallen state to be transcended, but also as a world to be lived in.

Along with the pre-occupation with sin and salvation engendered by these notions of the creation, the temptation and the fall of man, the incarnation, the atonement and the possibility of regeneration through Christ, people in the Middle Ages were dominated by an intense concern for world order and its maintenance, for, as Tillyard put it:

(1) Arthur O. Lovejoy, THE GREAT CHAIN OF BEING, Harvard Uni. Press, Cambridge, Mass. 1936, p.83f.
(2) ibid. p.85.
(3) Tillyard (1943) op.cit. p.12f.

"what use to educate the magistrate without the assurance of a coherent universe in which he can do his proper work?" (1) A clear exposition of the nature and importance of order was given by Elyot in the first chapter of the GOVERNOR:

> Take away order from all things, what should then remain? Certes nothing finally, except some man would imagine eftsoons chaos. Also where there is any lack of order needs must be perpetual conflict. And in things subject to nature nothing of himself only may be nourished; but, when he hath destroyed that wherewith he doth participate by the order of his creation, he himself of necessity must then perish: whereof ensueth universal dissolution.
>
> Hath not God set degrees and estates in all his glorious works? First in his heavenly ministers, whom he hath constituted in diverse degrees called hierarchies. Behold the four elements, whereof the body of man is compact, how they be set in their places called spheres, higher or lower according to the sovereignty of their natures. Behold also the order that God hath put generally in all his creatures, beginning at the most inferior or base and ascending upward. He made not only herbs to garnish the earth but also trees of a more eminent stature than herbs. Semblably in birds beasts and fishes some be good for the sustenance of man, some bear things profitably to sundry uses, other be apt to occupation and labour. Every kind of trees, herbs, birds, beasts and fishes have a peculiar disposition appropered unto them by God their creator; so that in everything is order, and without order may be nothing stable or permanent. And it may not be called order except it do contain in it degrees, high and base, according to the merit or estimation of the thing that is ordered. (2)

Universal order was conceived under three main forms: the great chain of being, a series of corresponding planes and a cosmic dance. The chain of being was thought to be composed of an immense or infinite number of links

(1) Tillyard (1943) op.cit. p.19.
(2) Cited by Tillyard (1943) op.cit. p.19f.

ranging in heirarchical order from the meagerest kind of existents, through every possible grade up to the most perfect or highest possible kind of creature. Each link in this chain differed from that immediately above and that immediately below it by the least possible degree. Deriving from Plato's TIMAEUS this metaphor survived largely unchanged into the eighteenth century in the philosophy of Leibniz and the poetry of Pope, expressing the unimaginable plenitude of God's creation, its unfaltering order, and its ultimate unity. As Pope wrote in his ESSAY ON MAN:

> Vast chain of being, which from God began,
> Natures aethereal, human, angel, man,
> Beast, bird fish, insect! what no eye can see,
> No glass can reach! from infinite to thee, (1)

At the top of this chain, at the foot of God's throne, were the orders of angels, conceived to be purely rational or spiritual. Below these was man who sums up in himself all the faculties of earthly phenomena. Below him were higher animals with touch, movement, memory and hearing, but without understanding. Lesser animals were ranked according to which faculties they have, and below animals were plants, and at the bottom of the list inanimate bodies. Each group, however, was also conceived to be in hierarchical order. Thus water was nobler than earth, and there were noble metals such as gold and base metals such as brass, there was a hierarchy of fishes, of birds, of

(1) Alexander Pope "An Essay on Man" (1733-34) in THE POEMS OF ALEXANDER POPE. John Butt ed., Methuen, London, 1970, pp.501-547, Epistle I, 237-240, p.513.

animals, of men and of angels. This chain was not single or consistent. For instance, there were problems in placing the four elements earth, fire, air and water out of which being was constituted. Apart from sentience and rationality, the order was conceived in terms of closeness to heaven, with the earth being conceived of as "the cesspool of the universe, the repository of its grossest dregs". (1) This ranking was also associated with mutability, with the higher realms being characterised by an unchanging and immutable order and earthly beings by susceptability to corruption. Lower animals than man had shorter lives. Finally, the higher orders had control over the lower. It is for this reason that the stars, being immutable and closer to heaven, were thought to control the fortunes of men. This is why astrology was so important in the Middle Ages.

Each class in this chain was thought to excel in some particular. For instance, stones excel plants in their strength and durability, plants excel in assimilating nourishment, beasts are stronger than man in physical energy and desire, while man surpasses angels in his ability to learn. And every link within the chain was understood to have some significance. However, man's place was of paramount importance. As Tillyard put it:

> He was the nodal point, and his double nature, though the source of internal conflict, had the unique function of binding together <u>all</u> creation, of bridging the great cosmic chasm, that between matter and spirit. (2)

(1) Tillyard (1943) op.cit. p.47.
(2) ibid. p.73.

It was for this reason that man was referred to as the microcosm of the universe. Man was seen to possess the faculties of all the other beings in the universe, but in each case in deficient form. He is weaker than the beasts and less rational than the angels. But by virtue of having all these faculties man has the freedom to live which way he wills: he can become like a plant or a beast; or he can strive to become like an angel. By virtue of this, man is for ever struggling to overcome base passions through understanding and reason.

The second form of order conceived was that of the corresponding planes. Each plane in the hierarchy of being was seen as having a corresponding order. The different planes were the divine and the angelic, the universe or macrocosmos, the commonwealth or body politic, man or the microcosmos, and the lower creation. The detailed way in which these correspondences were understood is illustrated by the way in which Raleigh compared the macrocosmos to the microcosmos in his HISTORY OF THE WORLD and the way in which John of Salisbury described the commonwealth in terms of the body. Raleigh wrote:

> His blood, which dispertheth itself by the branches of veins through the body, may be resembled to those waters which are carried by brooks and rivers over all the earth, his breath to the air, his natural heat to the inclosed warmth which the earth has in itself ... the hairs of man's body which adorns or over-shadows it, to the grass which covereth the upper face and skin of the earth ... Our determinations to the light wandering and unstable cloude, carried everywhere with uncertain winds, our eyes to the light of the sun and the moon, and the beauty of our youth to the flowers of the spring which in a very short time or with the sun's heat dry up and wither away, or the fierce puffs of wind blow them from the stalks. (1)

(1) Cited ibid. p.99.

And John of Salisbury:

> The place of the head in the body of the commonwealth is filled by the prince, who is subject only to God and to those who exercise His office and represent Him on earth, even as in the human body the head is quickened and governed by the soul. The place of the heart is filled by the senate, from which proceeds the initiation of good works and ill. The duties of eyes, ears, and tongue are claimed by the judges and the governors of provinces. Officials and soldiers correspond to the hands. Those who always attend upon the prince are likened to the sides. Financial officers and keepers ... may be compared with the stomach and intestines ... The husbandmen correspond to the feet, which always cleave to the soul. (1)

Other commonly referred to correspondences were those between the animal kingdom and the human kingdom, the macrocosm and the body politic and the commotion in the mind of man and the debate of king and council.

Finally, we come to the conception of order as a cosmic dance. The idea that the order of the universe is a form of musical harmony derives from Pythagoras. (2) The seven known planets were thought to be carried round their orbits spaced according to the intervals of a musical scale, the celestial harmonia, and the sound given off by these was thought to be inaudible only because it is so constantly in our ears. It was believed that the harmony of heaven is perfect, while that of human souls is marred by imperfection and discord. Virtue consists in the soul achieving moral order by harmonising with the cosmos.

(1) John of Salisbury "Policraticus" extract in THE PORTABLE MEDIEVAL READER eds James Bruce Ross and Mary Martin McLaughlin, Viking Press, N.Y. 1949, p.47f.
(2) F. M. Cornford "The Harmony of the Spheres" in THE UNWRITTEN PHILOSOPHY AND OTHER ESSAYS C.U.P., Cambridge, 1967.

While the details of Pythagoras's doctrine were not adhered to, the idea of the created universe ordered by music was a commonplace in the Middle Ages. Thus, Isodore of Seville who was the most popular of all medieval encyclopaedists wrote:

> Nothing exists without music; for the universe is said to have been framed by a kind of harmony of sounds, and the heaven itself revolves under the tones of that harmony. (1)

All earthly, celestial and divine hierarchies were conceived of as being sped on a varied but controlled dance to the accompaniment of music. While the paths of each are different, through harmonising with the music they make up a perfect whole. The importance of the harmony of the universe was acknowledged as late as the sixteenth century by Shakespeare in Ulysses' speech on 'degree' in TROILUS AND CRESSIDA:

> Take but degree away, untune the string,
> And hark, what discord follows, Each thing meets
> In mere oppugnancy. (2)

From this outline of the way in which the order in the universe was understood it is possible to get some idea of how it oriented people in their lives. The chain of being indicated the place of man in the cosmos which was educative both in the marvels of itself and its implications for what was higher and what lower. It clearly indicated that man, being at the intersection between matter and spirit, should strive to overcome his baser nature. The

(1) Cited by Tillyard op.cit. p.109.
(2) William Shakespeare "Troilus and Cressida" in THE COMPLETE WORKS OF WILLIAM SHAKESPEARE, Hamlyn, Feltham, Middlesex, 1958 I,iii, p.633.

highest life that anyone could attain was the ascetic life of contemplation of the monk or nun. However, for those who did not aspire to such heights, the concept of correspondences offered an orientation in the socio-political realm. This legitimated social differentiation and an hierarchical social order. Romei's COURTIER's ACADEMY typified the conception of social order:

> Now a city being nothing less but a body of men united together, sufficient of itself to live, it is necessary that like to a human body it be compounded of unlike members, the which, in goodness and dignity among themselves unequal, all notwithstanding concur to the good establishment of a city. Whereupon as it would be a thing monstrous and incommodius to see a human body wholly compounded of heads arms legs or of other members uniform in themselves, so would it be altogether as disproprionable and a thing of itself insufficient if all men in a city were artificers husbandmen soldiers judges or of one self condition and quality. (1)

John of Salisbury used this idea to argue for more concern with the lot of the poorer classes:

> The husbandmen correspond to the feet, which always cleave to the soil, and need the more especially the care and foresight of the head, since while they walk upon the earth doing service with their bodies, they meet the more often with stones of stumbling, and therefore deserve aid and protection all the more justly since it is they who raise, sustain, and move forward the weight of the entire body ... (2)

While Raleigh, using the notion of correspondences in the full spirit of medieval thinking, tried to justify the value of honour and riches in the same way:

(1) Cited Tillyard, op.cit. p.103.
(2) Extract from THE PORTABLE MEDIEVAL READER op.cit. p.48.

> Shall we therefore value honour and riches as nothing and neglect them as unnecessary and vain? Certainly no. For that infinite wisdom of God, which hath distinguished his angels by degrees, which hath given greater and less light and beauty to heavenly bodies, which hath made differences between beasts and birds, created the eagle and the fly, the cedar and the shrub, and among stones given the fairest tincture to the ruby and the quickest light to the diamond, hath also ordained kings, dukes or leaders of people, magistrates, judges, and other degrees among men. (1)

Further, inclining people to accept and to fill their role in society was the belief in the cosmic dance, the belief that in doing so one was harmonising with the music of the cosmos while to aspire beyond one's station was to create discord in the universe and to threaten the existence of order in the world. Finally, supplementing all this was the belief that the ultimate aim in life was not success in this world but to achieve salvation of the soul in the life hereafter.

The medieval world-view provided a general orientation to life. But it was also articulated to deal with particular situations in the world. For those who were not prepared to devote their lives to meditation, the Church developed the Court of Conscience whose authority extended throughout Christendom. This functioned to develop the implications of the Christian world-view for the here and now. The activity of determining the morality of concrete situations came to be known as casuistry, and although the major part of this was exercised by word of mouth, in private correspondence or under the seal of the confessional, treatises

(1) Cited by Tillyard op.cit. p.19

were written to spell out how people should act in every situation that they might encounter. As Benjamin Nelson described the situation:

> Solutions for the conduct and regulation of man's life and all his relations in the market place, in the battlefield, the court, the home and elsewhere, were, therefore, developed in innumberable treatises on the cases of conscience. All the urgencies of life and the aims of men as they moved about in the daily round were indeed grist for the mills of the casuists. (1)

After 1215, annual confessions became an obligation for all Christians and the Court of Conscience became the guide to Christian souls everywhere. (2) Everyone supposed that the principles of conscience could become - and needed to become - meaningful at every turn in everyday life.

However, casuistry was not simply the application of moral generalizations to particular problems. It was interpretation based on the Christian conception of the world and man's place within it. As Benjamin Nelson noted, con-scienta had embedded within it a dual reference, one to moral rules of conduct and the other to philosophical knowledge. (3) This suggests the indissociable relationship

(1) Benjamin Nelson "Conscience and the Making of Early Modern Cultures" in SOCIAL RESEARCH, Vol.36, 1969, pp.4-21, p.13.
(2) Benjamin Nelson "Self-Images and Systems of Spiritual Direction in the History of European Civilization" in Samuel Z. Klausner THE QUEST FOR SELF-CONTROL Free Press, N.Y. 1965 pp.49-103.
(3) Benjamin Nelson "Scholatic Rationales of 'Conscience', Early Modern Crises of Credibility and the Scientific-Technocultural Revolutions of the 17th and 20th Centuries" in JOURNAL FOR THE SCIENTIFIC STUDY OF RELIGION, 1968, Vol.7, pp.157-177, p.164.

between knowledge of the world and knowledge of how to act within the medieval framework. As G. B. Bentley has written:

> Casuistry cannot attain its end, thus conceived, simply by taking over 'conclusions' - moral generalizations and axioms - from general moral theology and relating them to circumstances. Often the right resolution of a case requires direct reference to the fundamental mysteries of the Christian faith or fresh consideration of the God-given natures and ends of created beings. (1)

Thus, the medieval world-view itself provided people with reasons for their actions.

The way in which the medieval world-view came to pervade the lives of unreflective individuals to determine how they perceived the world, each other and themselves and how they acted accordingly is illustrated by the case of chivalry. Throughout the Dark Ages, Europe was ravaged by Vikings, Moslems and Hungarians. (2) For this reason, the society which emerged from this turmoil was one dominated by an extremely warlike caste imbued with military ideals. However, despite their power, privilege and social position, they still regarded themselves as subservient to the Christian Church. When the tide had turned and Europe became an expansionist society, the expansion was undertaken in the name of the Church with the invasion of Palestine being conceived of as an effort to recover the Holy Land and the invasion of the Baltic countries by the Teutonic knights being conceived of as missionary work

(1) G. B. Bentley "Casuistry" in ENCYCLOPAEDIA BRITANNICA (1961) Vol.5, p.13.
(2) Marc Bloch FEUDAL SOCIETY tr. L. A. Manyon, 2nd ed. Routledge & Kegan Paul, London, 1965, Vol.1, Chs 1 and 2.

characterized by their slogan 'Convert or kill'. The knights who participated in these crusades believed that through their activities they could achieve salvation. The close connection between the secular and the sacred is evident in a letter written by Pope Gregory VII in the Eleventh Century:

> ... if they persist in their disobedience and remain at variance, we shall exclude the offender from the protection of St. Peter, ... so that he shall enjoy no victory in battle and no prosperity in this world. (1)

It is also evident in the behaviour of individuals as described by David Douglas:

> Duke Robert I ... the father of William the Conqueror was a young, lustful and ruthless prince who was successfully reducing his turbulent duchy to order when he suddenly determined to mend his soul by departing to Palestine on the pilgrimage from which in fact he was never to return. Again, Simon de Crepi, count of the Vexin, consolidated his power by winning in profitable marriage Judith the daughter of the count of Auvergne. But he chose the occasion of his wedding night in 1078 to vow himself and his wife to perpetual continence and departed forthwith to become a monk in the abbey of Saint Claude in the Jura. To men such as these a pilgrimage might be as important as a war, or a monastic vow as compelling as the establishment of order, and it may be recalled how many of the warrior lords of this age retired after their strenuous lives to spend the evening of their days in monastries. (2)

The institution of chivalry then emerged out of this association of Christianity and warcraft in the beginning of the twelfth century as a crystallization of the attempt

(1) Quoted by R. W. Southern THE MAKING OF THE MIDDLE AGES, Hutchinson, London, 1972, p.123.
(2) David C. Douglas THE NORMAN ACHIEVEMENT 1050-1100, Collins/Fontana, London, 1972, p.19.

to Christianize military behaviour by laying down codes of conduct for the members of the ruling military caste.

The most distinctive feature of the world-view of the military aristocracy in terms of which chivalry was formulated was its Platonism. Thus, universals or forms were taken to be real and particulars or individuals to have reality only insofar as they imitated or participated in these forms. Thus people were only considered in terms of the immutable values and goals which defined proper human behaviour and which constituted the only meaningful definition of man. This was manifest in the way people were perceived. They were always described by means of six or eight adjectives and their contradictories, and no other possibilities were allowed for. Men were valiant, courteous, prudent and so on or they were cowardly, discourteous and reckless. Women were beautiful, charming and discreet or the reverse. In describing people in this way it was the universal forms, not the individual characteristics which were important. And it was only by virtue of individuals being able to be described in these terms that they could be considered 'real'. People who stood outside the circle of values defining human meaning and significance had only a shadowy existence in the eyes of the aristocracy, as is evident from the treatment of noncombatants in battles. These people were generally slaughtered, not for any real reason, but simply because they were considered so insignificant. An example based on the CHRONICLES of Froissart which illustrates this is typical:

> ... a body of knights left the main army in search of adventure. They came across "a handsome and strong castle" which looked like just the adventure they had in mind. After some gallant deeds, in which an English knight was killed, the castle was taken prisoner, "and the remainder they put entirely to the sword". Thereupon, the English destroyed the castle as much as they could (they didn't wish to keep it) and returned to the main army; "they reported to the king and his barons how they had behaved". The prisoners put to the sword constitute the most minor detail in the whole engagement, of no more consequence than the coat of arms of one of the defending knights described in the same passage: both were stage properties. (1)

The contrast between the way people were perceived when they participated in the forms as opposed to those who did not is evident in the reactions of the Black Prince at the massacre of Limoges where 3 000 men, women and children were slaughtered. During the battle three French knights especially distinguished themselves in individual action and were seen by the Prince who "looked on them with pleasure, and he repressed and softened his ill-will". (2) These knights were allowed to surrender and were presumably spared. In relation to this Brandt notes:

> In the midst of incredible carnage to which the Black Prince was apparently totally indifferent, three knights by their honourable stance touched the Prince where mere suffering never could. (3)

The Platonist conception of the world provided people with prescriptions for how to act and with goals to live by. Feudal chivalry demanded prowess, loyalty, largesse and courtesy of the knight. (4)

(1) William J. Brandt THE SHAPE OF MEDIEVAL HISTORY: STUDIES IN MODES OF PERCEPTION (1966) Yale Uni. Press, New Haven, 1966, p.108.
(2) From Froissart's LIFE OF THE BLACK PRINCE, cited ibid. p.13
(3) loc. cit.
(4) ibid. p.108.

The chivalrous knight was supposed to be vigorous in his assaults on other knights and generous to others of his own class, behaving to a well defined schedule of responses to particular situations. He was expected to be loyal to superiors, and to manifest largesse towards some inferiors. Courtesy was required in the knight's relationship to his equals, to his distinguished enemies, and to aristocratic women. It is evident from this that the ideals of behaviour were always to be found in specified status relationships. People were not expected to behave with respect to each other but with respect to the situation whose proper behaviour was prescribed. Thus loyalty was to be displayed not to a particular person but by virtue of positions fulfilled by each. This was also true of kinship relationships. And this was required only so long as the other lived up to his position; the knight was only expected to be loyal to his feudal suzerain only so long as the suzerain displayed the appropriate behaviour towards him.

The feudal code was not directed towards the fostering of personal relationships but to the achievement of honour. This was not something simply to be preserved, but was also to be pursued positively and aggressively. For the feudal aristocrat there could be no such thing as a good, peace loving individual. To be good was to achieve military glory in the prescribed manner. As the French writer, Philippe de Naverre asserted: "he who passes his youth without exploit may have cause for great shame and grief". (1) Honour achieved resulted in fame, but the real end at which the medieval knight aimed was 'stance' or 'posture'. This was the form of the highest good to which all other forms were subservient. William Brandt has argued that it is essential to understand this in order to make sense of the behaviour of people in the Middle Ages:

> The aristocrat found his summum bonum in a kind of public posture taken with regard to his own class; he was an actor inventing a script which he hoped would turn out to be heroic ... To understand the Middle Ages, we must realize that a great many activities - the most important - were pursued for their own sake, with no other end in view beyond the public posture they permitted. (2)

The military caste remained the dominant force in Europe up until the fifteenth century. The formism deriving from the Platonistic element of Christianity which underlay their understanding of the world meant that the medieval aristocrat lived in a world of values which prescribed how to act on every occasion and defined what goals to pursue. The individual was thus able to define him or herself in relation to the world and to other people in a way which implied that there were ends which are intrinsically significant and which gave him or her reasons for choosing what to do. Thus it can be seen that the medieval world-view was able to orient people in a way which made nihilism inconceivable.

(1) Cited ibid. p.111.
(2) ibid. p.114.

THE DISSOLUTION OF THE MEDIEVAL WORLD-VIEW AND THE RISE OF POSITIVISTIC MATERIALISM

The dissolution of the medieval world-view was largely brought about by the development of science. This new science was characterized by three features: the belief that the world must be understood mathematically, that everything must ultimately be understood as the product of the interaction between bits of inert matter, and that the only true knowledge is that gained by science through the experimental method. It is this conception of the world which I have characterized as positivistic materialism. However, positivistic materialism did not simply replace the medieval world-view. The science which was so spectactularly successful in the seventeeth century had its roots in the growth of rationality and the reappropriation of the heritage of Greek thought which began with the rise of medieval society from the Dark Ages.

To begin with the rationalists generally regarded their efforts as being in the service of the Christian religion and saw themselves as providing a rigorously rational foundation for it. This process culminated with the rediscovery and attempt to come to terms with the philosophy of Aristotle in the thirteenth century by such thinkers as Robert Grosseteste (1168-1253), Albertus Magnus (1193-1280) and Albertus' student Thomas Aquinas (1225-1274). Aquinas developed a world-view which unified the religious and intellectual world conceptions, thus making scientific investigation a religious enterprise. This synthesis not only directed people's attention towards the world, but also provided a point of departure for new ideas, the development of which eventually undermined the medieval world-view. As Herschel Baker wrote: "the Thomistic synthesis not only brought Scholastic thought to its highest expression: it also contained the seeds of the scientific rationalism that was to undermine the authority of the Holy Catholic Church whose saint Aquinas has become".(1)

From the thirteenth century to the fifteenth century all those thinkers whose work was important for the development of science were basically Aristotelians, while those who opposed these trends, for example Bonaventura and Duns Scotus (1265-1308), were Augustinian Neo-Platonists. While Aquinas himself made no direct contribution to science, Grosseteste developed ideas on experimental method and hypothesised that the rainbow was caused by the refraction of light rays by clouds. His ideas were developed further by his student, Roger Bacon (1214-1292), who also championed the use of mathematics in natural philosophy. However, the most important achievements in natural philosophy during this period were made in the field of kinetics. These studies were mainly carried out by the nominalists or terminists, that is, followers of William of Occam (d.c.1350). Occam rejected the Aristotelian idea that a vacuum is impossible and that an inanimate body can only be in motion if propelled by some extrinsic mover. (2) This involved the revival of the notion of impetus according to which a projectile could be understood as its own motor. These ideas were developed by Jean Buridan (d.c.1360) into concepts which to some extent anticipated the concepts

(1) Herschel Baker THE IMAGE OF MAN (1947) Harper Torchbooks, N.Y. 1961, p.200.
(2) A. Rupert Hall & Marie Boas Hall A BRIEF HISTORY OF SCIENCE, Signet, N.Y., 1964, p.85.

of momentum and inertia. (1) Since a body was regarded by him as capable of continuing in a state of motion until encountering a resistance, the motion of celestial bodies could be explained. Acceleration was also explained by Buridan as following from the accumulation of impetus. These ideas were developed mathematically by Nicole Oresme, (1323-1382), Buridan's colleague at Paris and by Thomas Bradwardine and his colleagues at Merton College, Oxford.

All these ideas were developed within the framework of Aristotelian metaphysics, with impetus being regarded as a cause of motion rather than as a symptom of motion or as a quantity characterizing it as in classical mechanics. (2) However, the problems associated with this weakened the Aristotelian position and opened the way for its replacement. But the materialism of Leucipus and Democritus had been severely criticised by Aristotle, and scientific materialism cannot be understood as simply a revival of their ideas. The reaction to Aristotelianism which began with the Renaissance and which eventually led to a new conception of the world took the form of a Pythagorian Neo-Platonist revival which only later and derivatively developed as a form of atomistic materialism. These Platonists conceived of the world as consisting of mathematical forms.

The philosopher who began the Neo-Platonic revival which led to the new conception of the universe was Nicolaus

(1) E. J. Dijksterhuis THE MECHANIZATION OF THE WORLD PICTURE (1950) tr. C. Dikshoorn, Oxford Uni. Press, London, 1961, p.182 (II 113).
(2) ibid. p.183 (II 113).

Cusanus (1401-1464). Cusanus provided the philosophical justification for the conception of the universe as mathematical structure. He reasoned that to study something unknown is to observe its resemblance to and difference from something known and these relationships he found in the framing of a mathematical ratio. From this premise he argued that cognition consists in the determination of ratios by means of numbers. (1) From this he concluded that it was necessary to conduct experiments based on exact measurement, many of which he suggested and some of which he carried out. In one of these experiments he managed to prove that plants absorb something from the air. Such ideas have been basic to science ever since, the role of mathematics in science being encapsulated in the famous proclamation of Galileo two centuries later:

> Philosophy is written in this great book which continually stands before our eyes (I mean the universe), but we do not understand it if we do not first learn the language, and know the characters, in which it is written. It is written in the mathematical language, and the characters are triangles, circles, and other geometrical figures, without which it would be humanly impossible to understand a word of it; without which one wanders vainly through an obscure labyrinth. (2)

With these arguments Casanus began the transition described by Koyré from the ancient and medieval idea of a hierarchically ordered 'closed world' with the earth featuring as its centre, to that of an infinite universe in which no part is privileged. On the basis of his idea that we can only know ratios, Cusanus concluded that the universe

(1) Dijksterhuis (1950) op.cit. p.226.
(2) Cited from Galileo Galilei's IL SAGGIATORE by Ivor Leclerc in THE NATURE OF PHYSICAL EXISTENCE, George Allen & Unwin, London, 1972, p.82.

is an indeterminate, unbounded extension withouta centre in which the earth moves. Thus he wrote:

> It is already clear to us that this earth actually moves although it does not seem to, for we only apprehend movement by means of comparison with a fixed point ... And for this reason if someone finds himself on earth, in the sun, or another star, it will always seem to him that he is at the immobile centre and that all the other things are in motion; ... Hence the machine of the universe has so to speak, its centre everywhere - its circumference nowhere ... (1)

This not only anticipated the ideas of Copernicus in whose system of astonomy the sun was seen as the fixed point about which the earth revolves, but also the general theory of relativity and modern gauge field theories. Cusanus's ideas were further developed by his champion in the sixteenth century, Giordano Bruno (1548-1600) who argued for the conception of an infinite universe consisting of a plurality of inhabited worlds.

The development of materialism out of the Platonist conception of the world took place with the evolution of the concept of matter from its subsidiary status in relation to forms to that of a self-subsistent substance, devoid of any potentiality, or any internal process of change and capable only of change of position. It was pointed out in the last section that Plato's forms were correlated with a receptacle. This was referred to as 'hyle' by Aristotle which was translated into Latin as 'materia'.

(1) From Nicholas of Cusa DE DOCTA IGNORATIA, extract in THE PORTABLE RENAISSANCE READER, eds and trs James Bruce Ross and Mary Martin McLaughlin, 2nd ed., Penguin, Harmondsworth, 1977, p.586f.

Since in Plato this receptacle was conceived to be eternal and so was inconsistent with the complete transcendental eminence of God, Augustine accepted Plotinus' conception of matter as the indefinite. As such this was seen as the opposite pole from the highest form which was conceived to be the source of all being. So matter as the indefinite was understood as 'not-being', and only forms were thought to have an active principle. Thus the concept of matter was given the lowest possible status in Augustine's philosophy.

Succeeding thought was characterized by a complete reversal of the relative status of form and matter. Matter began to take a more prominent position with the revival of interest in Aristotle for whom "the capacity of each thing to be or not to be indicates their material nature". (1) Thus in Aquinas' philosophy, matter is that by which individuation into separate bodies takes place and is conceived of as extensive stuff. The three decisive developments which put matter in a dominant position and then freed it entirely from the concept of form were the development of the concept of matter as the source of activity on the basis of Cusanus's ideas, the theory of elements in chemical combination whereby the elements came to be conceived of as changeless, and the development of the analogy of mechanism as a means of understanding the world.

Cusanus accepted the conception of matter and form as correlatives but developed a conception of the deity which included matter along with form as the world-soul which is

(1) Aristotle METAPHYSICS 1032a 21-23 tr. Richard Hope, Uni. of Michigan Press, 1975, p.142.

the source of all individual existents, each of which was conceived of as being ensouled. This conception of a world soul with all existents being ensouled became a prominent feature of sixteenth century thought and was accepted by Paracelsus, Telesio, and to begin with, Kepler. But the idea was developed most fully by Bruno. For Bruno the universe was a composite of universal matter and universal form, but the matter in this scheme was conceived of as containing the forms and as the source of activity or motion, and thus of being. Bruno then identified matter with nature, effecting a complete reversal of the relative status given to matter and form in medieval thought.

The theory of elements was developed by the medical men of the sixteenth century. (1) The point of departure for these thinkers was Aristotle who had argued for the necessity of seeing the bodies we encounter as complex by virtue of their changeability. This led to the problem of the nature of the elements out of which bodies are composed. Aristotle argued that since change involves change into contrary characteristics, the elements cannot be identified with the substratum or hyle but must themselves involve contrary characteristics and to account for the coming into being of new characteristics contrary tothose in existence, the elements themselves must be changing. On this basis he rejected the atomism of Leucippus and Democritus and maintained that the contraries hot and cold, wet and dry, are the basis out of which are formed the four

(1) Leclerc (1972) op.cit. Ch.11.

elements air, fire, earth and water, and all physical existents were then understood to be constituted out of these elements. In opposition to this Paracelsus argued that the real elements are sulphur, mercury and salt and in line with the conception of the world predominating in the sixteenth century, these were conceived of as ensouled matter and thus as self-subsistent substances. As ensouled, these were thought to have an active power, and it is this spirit or power of the elements which was seen to ultimately constitute the powers whereby bodies come into being with their particular characteristics. These elements are generally different from each other, and unlike the Aristotlian elements, do not change into each other. In combinations, they are not changed but have their effect through their powers. They are devoid of any internal process of becoming. Further developments of the theory of elements along these lines were made by Daniel Sennert and Sebastian Basso in the first quarter of the seventeenth century. These thinkers suggested that matter as such is substance, that is, a self-subsistent existent, the instances of this being the elementary constituents of all compounds. These were referred to as atoms, and this was effectively a revival of atomism. A wealth of empirical evidence was brought forward, especially by Basso to prove that the world could only be explained on the supposition that the constituents of chemical combinations had an unchanged existence. The implication drawn from this was that all perceptible bodies are simply aggregates of changeless elements or atoms, with all change being a change or place or locomotion of these atoms.

However, what really established the primacy matter over substantial forms was the increasing tendency to view the world as a mechanism. This began when Nicole Oresme in 1370 drew attention to the similarities between the ordered movements of a clock and those of the heavens. (1) But it was Kepler (1571-1630) who carried through this conception of the universe after having begun by accepting the sixteenth century view of the world as ensouled matter. He wrote to a friend in 1605 describing his new point of view:

> I am now much engaged in investigating physical causes; my goal is to show that the celestial machine is not the likeness of the divine being, but is the likeness of a clock (he who believes that the clock is animate ascribes the glory of the maker to the thing made). In this machine nearly all the variety of movements flows from one very simple magnetic force just as in a clock, all the motions flow from a simple weight. Moreover I show how this physical conception is to be presented through calculation and geometry. (2)

On this basis Kepler broke with the tradition whereby the earth and the heavens were regarded as separate realms and looked "for a universal physical law based on terrestrial mechanics to comprehend the whole universe in its quantitative detail". (3) This involved the rejection of Kepler's earlier conception of the order and harmony of the universe in terms of forms in favour of a conception of order and harmony based on the laws governing bodies. This enabled him to reject the assumption that the account of heavenly bodies must be in terms of circles. In 1607

(1) Richard Olson, ed. SCIENCE AS METAPHOR Wadsworth, Belmont, Calif. (1971) p.59.
(2) Cited ibid. p.60.
(3) Gerald Holton THEMATIC ORIGINS OF SCIENTIFIC THOUGHT: KEPLER TO EINSTEIN, Harvard Uni. Press, Cambridge, Mass. 1973, p.77.

he wrote to D. Fabricius:

> The difference consists only in this, that you use circles, I use bodily forces. (1)

Kepler's new conception of order has been described by Hedwig Zaiser in KEPLER ALS PHILOSOPH:

> Harmony resides no longer in numbers which can be gained from arithmetic without observation. Harmony is also no longer the property of the circle in higher measure than the ellipse. Harmony is present when a multitude of phenomena is regulated by the unity of the mathematical law which expresses a cosmic idea. (2)

With the physical laws of bodily forces the basis of his conception of order, Kepler could then conceive of planets moving in elliptical orbits. The whole universe could then be understood in terms of the laws of motion of bodies, and in relation to this, Kepler proposed that in physics the word 'anima' should be replaced by the word 'vis', meaning that the concept of vital energy producing qualitative changes should be replaced by quantitative mechanical energy producing quantitative changes. (3)

With the advance of the seventeenth century the mechanistic analogy permeated all branches of natural philosophy. This helped bring about a revival of Greek atomism which was foreshadowed by Galileo, but was developed and defended most explicitly by Pierre Gassendi (1592-1655). This atomism was in some ways opposed to mechanism but generally complemented and blended with it. Descartes (1596-1650) developed a fully mechanistic account of the

(1) Cited ibid. p.77
(2) Cited ibid. p.83f.
(3) R. G. Collingwood THE IDEA OF NATURE (1945) Oxford Uni. Press, London, 1960, p.101f.

universe in which, apart from minds, all change was conceived of as mechanical action through contact. His greatest supporter, the Dutch physicist Christian Huygens (1629-1695) wrote:

> ... in the true Philosophy ... one conceives the causes of all natural effects in terms of mechanical motions. This ... we must necessarily do, or else renounce all hopes of ever comprehending anything in Physics. (1)

Thomas Hobbes (1588-1679) developed an even more extreme version of materialism in which the mind itself was conceived of as nothing but the motions of inert matter. Robert Boyle (1626-1691) made an impressive contribution to materialism by extending mechanistic theories to chemistry while William Harvey had applied mechanistic analogies to biology, conceiving the heart as "a piece of machinery in which though one wheel gives motion to another, yet all the wheels seem to move simultaneously". (2) Finally, the grand synthesis was achieved by Newton (1642-1727). Newton developed the ideas on mechanics of Galileo, Descartes and Huygens to fulfil Kepler's ambitions of a mechanics which could account for both terrestrial and heavenly phenomena, and to provide proof for Kepler's laws. He advanced an almost perfectly satisfactory theory of the complex motion of the Moon, accounted for tidal action in terms of lunar and solar gravitational forces and accounted for the need to reduce the length of a clock's pendulum near the equator. This whole system was

(1) Cited by Hall and Hall (1964) op.cit. p.153.
(2) Cited by Herbert Butterfield in THE ORIGINS OF MODERN SCIENCE 1300-1800, 2nd ed. Bell, London, 1957, p.50.

built on the conception of the world as composed of inert matter moving in space through time, and active principles were conceived "not as occult Qualities, supposed to result from the specifick Forms of Things, but as general Laws of Nature, by which the Things themselves are form'd..." (1) and Newton suggested "that God in the Beginning form'd Matter in solid, massy, hard, impenetrable, moveable Particles". (2)

Newton's physics was so successful that it established science as the ultimate reference point for all knowledge and established physics as the paramount science. The conception of nature this implied involved a complete exclusion of soul or mind from the world, and complexity was thought to be capable to being entirely understood in terms of the laws governing the parts. The integral wholeness of the forms on which the Aristotelian ontology was based had completely dissolved into the calculability of the forces operating in a given configuration of matter.

Along with the development of the conception of the world as a mathematical structure composed of inert matter, there arose a positivistic attitude towards knowledge. Positivism is essentially an attempt to delimit the criteria by which we can accept beliefs as knowledge and to distinguish between the philosophical and scientific disputes which may be profitably pursued and those which cannot. It takes itself to be the description of the correct procedure of

(1) Isaac Newton OPTICKS 4th ed. (1730) G. Bell & Sons, London, 1931, p.401.
(2) ibid. p.400.

science and attempts to defend science as the source of true knowledge. As a corollary to this it is assumed that the methods for acquiring knowledge can be formulated independently of any investigation and are the same for all spheres of investigation. Since what is thought to be accessible to investigation is that which can be empirically examined, positivism generally rejects reference to entities which are not examinable in this way. The important views which have been developed on this basis are that metaphysics is nonsense, that knowledge is useful only in so far as it enables us to make predictions and gain control over the world, that reference to minds, spirits and purposes are unacceptable and that value judgements and normative statements cannot be regarded as knowledge.

This set of ideas has evolved over a long period and has been closely related to empiricism. Empiricism means 'reliance on experience' and the original empirics were one of three main schools of medicine in Greco-Roman times. They were distinguished from the other schools by their scepticism about theoretical explanations, their emphasis on observation and their reliance on remedies which were proved to work. (1) During the Middle Ages, as interest in nature increased, such attitudes were revived. In the thirteenth century Roger Bacon claimed that knowledge could only be obtained through experiment and geometric deduction and called for controlled experiments guided by theory.[2] He believed that knowledge gained

(1) P. H. Nowell-Smith "Empiricism" in ENCYCLOPAEDIA BRITANNICA (1961) op.cit. Vol. 8, p.410.
(2) Leszek Kolakowski POSITIVIST PHILOSOPHY (1966) tr. Norbert Guterman, Penguin, Harmondsworth, 1972, p.21.

in this way would lead to technical control over nature. Then in the fourteenth century Jean de Mirecourt and Nicolas d'Autrecourt argued that all infallible knowledge could be reduced to the principle of contradiction or identity on the one hand and records of experience on the other. (1) However, these scholastic proto-positivists had little influence.

Positivistic ideas became influential when the rise of Protestantism and of radical ideas such as those of Copernicus had created a crisis in beliefs. The most important consequence of this crisis was the re-discovery and development of the ideas of scepticism according to which we have no grounds to accept any beliefs, and Pyrrhonism according to which we have no reason to accept any beliefs as certain. (2) These doctrines were used by such philosophers as Montaigne to justify reliance on the traditional beliefs of the Roman Catholic Church. This challenged the proponents of the new science to defend its claim to knowledge and at the same time to justify the questioning of accepted beliefs.

The most influential of the apologists for the new science was Francis Bacon. Bacon tried to develop an approach to acquiring knowledge involving both experimental investigation of nature and speculation. (3) He compared empirics

(1) ibid. p.24.
(2) Richard H. Popkin THE HISTORY OF SCEPTICISM: FROM ERASMUS TO DESCARTES, 2nd ed. Harper & Row, N.Y., 1968.
(3) Francis Bacon "Novum Organum" in THE PHYSICAL AND METAPHYSICAL WORKS OF LORD BACON, tr. Joseph Devey Henry G. Bohn, London, 1953, Bk 1, XCV, p.427.

who merely observe and heap up collections of data to ants and dogmatists to spiders who spin their webs from their own interior. He argued that an intermediate position should be taken comparable to that of bees who extract matter from flowers and then refashion it by their own efforts. He argued that knowledge should be built on a broad base ofexperiment and that all existing claims to knowledge should be put to experimental test. At the same time he argued that the experimental technique should be developed and that it should be much more systematic and careful than it had been. This should involve intervention in nature rather than simple observation.

The attempt to develop a methodology for science was combined with an hostility towards scholasticism and especially to explanations in terms of final causes, a belief that science would lead to a control over nature and an acceptance of a mechanistic world-view. It can be seen that this combination was not accidental since Bacon's recipe for investigation of nature made it impossible to acknowledge the existence of purposeful behaviour but revealed those features of the world open to control by people. The conception of being which accorded with this methodology was then one in which nature was seen as intrinsically inert and open to intervention, that is, a materialist or mechanistic conception.

The influence of Bacon in Britain was immense and is evident in the motto adopted by the Royal Society, that is 'Nullius in Verba' (On the word of no man). He was looked back to with veneration by such notable scientists as Hooke and Boyle, and his influence is clearly apparent in the methodology adopted by Newton which he outlined in his OPTICKS:

> Analysis consists in making Experiments and Observations, and in drawing general Conclusions from them by induction, and admitting of no Objections against the Conclusions, but such as are taken from Experiments, or other certain Truths. For Hypotheses are not to be regarded in Experimental Philosophy. And although the arguing from Experiments and Observations by Induction be no Demonstration of general Conclusions; yet it is the best way of arguing which the Nature of Things admits of and may be looked upon as so much the stronger, by how much the Induction is more general. (1)

Similar positivistic ideas were developed in France. Mersenne and Gassendi tried to develop an epistemology between absolute scepticism and dogmatism, that is, a constructive scepticism. (2) They accepted the sceptical arguments against the possibility of metaphysical certainty but then argued that scientific knowledge did not need such absolutely certain grounds. Mersenne, and following him, Gassendi, argued that conceptions of the world are simply ways of ordering the knowledge of the world that we are aware of, and that the aim of science is to find the most convincing and effective way of doing this. Mersenne then argued for a mechanistic conception of the world on this basis while Gassendi argued for a traditional form of atomism. Such knowledge should be developed by first

(1) Isaac Newton OPTICKS (1730) op.cit. p.404.
(2) Popkin (1968) op.cit. ch.vii.

carefully scrutinizing our experience and then constructing a theory able to account for this experience. This was an early version of the hypothetico-deductive model of scientific theories.

However, these positivistic ideas were soon eclipsed by those of Descartes who attempted to arrive at absolutely certain knowledge by taking scepticism as far as possible and then building his system on that which had been found to be indubitably given as 'clear and distinct' ideas. On this basis Descartes believed that he had proved the existence of God, and this provided him with grounds for believing that knowledge of the world is possible. In his philosophy, as with his intellectual descendents Malebranche, Spinoza and Leibniz, reason provided access to the realm of eternal verities, those truths held in common by the human and the divine mind, and every act of reason meant participation in the divine mind. (1) But while Descartes and the rationalists who followed in his footsteps dominated French thought in their own lifetimes, the champions of science eventually rejected rationalism in favour of English empiricism.

While it was seen that Bacon's positivist theory of knowledge and experimental methodology largely implied the validity of materialism, the implications of materialism were shown by Hobbes and Locke to support positivism. Working out the implications of an entirely mechanistic conception of humans, Hobbes had revealed the problem of how an

(1) Ernst Cassirer THE PHILOSOPHY OF THE ENLIGHTENMENT (1932) tr. Fritz C. A. Keolln and James P. Pettegrove, Princeton Uni. Press, Princeton, N.J. 1951, p.13.

individual's mind, enclosed spatially in the brain, could attain knowledge of the world. It was John Locke, a one time assistant of Robert Boyle and a supporter of the physics of Newton and Huygens, who attempted to develop a form of empiricism in the light of this problem.

Locke began by arguing against innate ideas in support of the idea that the mind is a tabula rasa. All the contents of the mind must then be seen to be based on experiences produced by the effect of the outside world on the body. Thus he wrote:

> Let us then suppose the mind to be, as we say, white paper void of all characters, without any ideas. How comes it to be furnished? Whence comes it by that vast store which the busy and boundless fancy of man has painted on it with an almost endless variety? Whence has it all the materials of reason and knowledge? To this I answer, in one word, from experience; in that all our knowledge is founded, and from that it ultimately derives itself. (1)

From this starting point Locke attempted to show how knowledge is built up and what is the nature of reason and in this way to define the limits of understanding so that "we may content ourselves with what is attainable".(2) The central concept used by him in this analysis was that of 'ideas' which were taken to be entities 'in the mind'. An idea was then defined as "whatsoever is the object of the understanding when a man thinks ... or whatever it is which the mind can be employed about in thinking". (3)

(1) John Locke AN ESSAY CONCERNING HUMAN UNDERSTANDING (5th ed. 1706) Dent, London, 1965 Vol. 1, Bk II, Ch.1, sec. 2, p.77.
(2) ibid. Bk I, ch. 1, sec. 4, p.7.
(3) ibid. Bk I, ch. 1, sec. 8, p.9.

Sensations were regarded as ideas produced in us by bodies, with those of primary qualities, that is, shape, size, mass, etc., resembling the qualities of bodies in the world and those of secondary qualities, that is, colour, odour, sound, etc., not resembling anything though they are produced in us by the powers of bodies. (1) This is essentially a representational theory of perception, and derivatively, of knowledge. Knowledge was thus regarded as "real only so far as there is a conformity between our ideas and the reality of things". (2) That is, truth was understood as a correspondence between ideas which represent reality and the reality itself. Since only ideas of primary qualities were thought to represent the real world, this meant that knowledge could pertain only to such primary qualities. This epistemology thus implied that the only true knowledge was that of the motion of bodies of inert matter, in this way implying the validity of materialism as had Bacon's epistemology previously. This meant that Locke's epistemology which was based on the acceptance of materialism, in turn implied its validity.

In this way the three basic ideas: that the world is a mathematical structure, that it is composed of inert matter, and that knowledge is built up out of certain kinds of experience crystallized to form the world-view of positivistic materialism which was then identified with

(1) ibid. Bk II, Ch. 8, sec. 15, p.106.
(2) ibid. Vol. 2, Bk IV, Ch. 4, sec. 3, p.167.

the achievements of science. Thus, while in the Middle Ages it had been believed that the ultimate test of any idea was whether it accorded with religion, the test now became whether it accorded with science, and this involved a rejection of the assumption that the nature of the world is contained in a privileged and unimpugnable communication vouchsafed by the Church and the rejection of anything outside the laws governing particles of matter as an acceptable explanation of phenomena.

However, these changes were all to some extent simply a manifestation of an even more basic change in the way the world was understood. In the Middle Ages, the world had been understood in terms of the forms which beings in the world were seen to be trying to imitate or actualize. This was so basic that people were not aware of what they were assuming. The rise of the new scientific world-view involved a rejection of this assumption and its replacement by the belief that the correct way to understand anything is by analysing it into its constituents. That which is to be understood must then be accounted for in terms of the interactions between these constituents.

The development of this idea preceded its explicit formulation and was manifest in Galileo's approach to the world. Descartes then argued that the world could be understood in these terms, writing to his friend Mersenne: "If anyone could know perfectly what are the small parts composing all bodies, he would know perfectly the whole of nature". (1) This analytical way of thinking completely

(1) Cited by Brian Easlea in LIBERATION AND THE AIMS OF SCIENCE Chatto & Windus, London, 1973, p.255.

dominated Hobbes' philosophy and underlay his vision of the world. For instance, in his LEVIATHAN he mentally dissolved the bonds of civil society, considering individuals in their natural state as the ultimate constituents in terms of which the social order had to be understood. The principle was explicitly formulated by Newton in the OPTICKS:

> As in Mathematics, so in Natural Philosophy, the Investigation of difficult things by the Method of Analysis, ought ever to precede the method of Composition... By this way of analysis we may proceed from Compounds to Ingredients, from Motions to the Forces producing them... (1)

It can be seen from this that the adoption of the analytical mode of investigation virtually implies the reductionist materialist view of the world. Newton developed a coherent conception of the world to accord with this approach, and his achievement in this task firmly established it as the foundation of the new world-view. Locke's analysis of human understanding was then simply an application of the approach to psychology with sensations and reflections being taken as the elementary constituents of mental phenomena. Locke argued that all ideas, no matter how complex, are composed of elementary sensations and reflections and then tried to show how these are put together to produce the various psychological phenomena. His political philosophy with its emphasis on individuals manifested the same underlying presupposition.

(1) Newton OPTICKS op.cit. p.404.

With the Enlightenment the world-view of positivistic materialism based on the reductionist assumption came to completely dominate the intellectual climate through such thinkers as Voltaire, d'Holbach, d'Alembert, La Mettrie, Fontanelle and Condillac. Voltaire, who in 1738 had published his ELEMENTS OF NEWTON'S PHILOSOPHY most fully grasped and took over the spirit of Newton's analytical approach and emphasised the harmony between the ideas of Newton and Locke. (1) Locke's analytical approach to psychology was extended with the dualism between sensation and reflection being dissolved into the concept of 'perception'. Also Condillac criticised Locke for still accepting the existence of innate faculties of the soul and attempted to show that mental operations themselves derive from sensations. This made it easier to account for all mental phenomena as the effects of the physical world on the body. But more importantly the analytical approach was developed into a dogma. Voltaire regarded Locke's greatest achievement as the setting of bounds to the pretensions of the human intellect. The principle: 'Nothing is in the intellect which was not first in sense' became an axiom for the philosophers of the Enlightenment and with the atomistic view of sensations, this justified the view that knowledge must be accumulated through piecemeal scientific investigation rather than through metaphysics. (2) Metaphysics came to be rejected as synonymous with spurious arguments for unsubstantiable beliefs, while science was exalted in opposition to it.

(1) Henry Guerlac "Three Eighteenth-Century Social Philosophers: Scientific Influences on Their Thought" in SCIENCE AND THE MODERN MIND ed. Gerald Holton, (1958) Books for Libraries Press, Freeport, N.Y., 1971, p.8.
(2) Ernst Cassirer THE PHILOSOPHY OF THE ENLIGHTENMENT (1932) tr. Fritz C. A. Koelln and James P. Pettegrove, Princeton Uni. Press, Princeton, N.J. 1951, p.99.

By counterposing positivistic materialism to metaphysics and demanding that knowledge be accumulated piecemeal, the Enlightenment philosophers presupposed positivistic materialism's absolute validity and ruled out any form of enquiry or intellectual speculation which could question this presupposition. All the various strands of Enlightenment thought were then systematized and brought to their logical conclusions in d'Holbach's LE SYSTEME DE LA NATURE where it was asserted:

> It is to physics and to experience that man must have recourse in all his investigations: he must consult them in matters of religion, ethics, legislation, political government, the sciences and the arts, even in his pleasures and sufferings. Nature acts by simple, uniform and invariable laws which experience enables us to know. (1)

(1) Cited by Henry Guerlac (1958) op.cit. p.12, from d'Holbach SYSTEME DE LA NATURE OU DES LOIS DU MINDE PHYSIQUE & DU MONDE MORAL. Nouvelle edition, augmentee par l'Auteur, London, 1774, Vol. 1, p.5.

THE TRIUMPH OF POSITIVISTIC MATERIALISM OVER ITS OPPONENTS

While with the exception of evolutionary theory the basic position of positivistic materialism was fully formulated in the Enlightenment and ascendency was gained over the framework of ideas inherited from the Middle Ages, it has never been fully successful against ideas which developed in reaction to it. It has sometimes been held in a secondary position both by ideas developed in philosophy and ideas developed in science itself. The degree of its success has been different in Germany, in France and in the English speaking world. I will now examine the reactions to positivistic materialism and show how in spite of their occasional successes they have failed in the long run to displace positivistic materialism.

Positivistic materialism has traditionally been least successful in Germany and this lack of success has at least partly been due to the influence of Leibniz. Leibniz criticised materialism on a number of grounds. He argued that it is necessary to conceive of being as active rather than inert to adequately account for change in the world and that the Cartesian discontinuity between mind and matter is unacceptable. (1) To overcome these problems, Leibniz argued that the elementary constituents of the universe must be conceived of as active minds rather than as inert atoms, and that space and time must be seen as purely relational.

(1) G. W. Leibniz "Discourse on Metaphysics" (1686) and "The Monadology" (1714) in GOTTFRIED WILHELM LEIBNIZ: PHILOSOPHICAL PAPERS AND LETTERS ed. Leroy E. Loemker 2nd ed. Reidel, Dordrecht, 1976, 35 and 67, pp.303-330 and 643-653.

These entities he referred to as monads. Each monad was thought to be unextended and to reflect from its own unique perspective and with different degrees of dimness or clarity the rest of the universe. Furthermore Leibniz adopted Spinoza's emphasis on the totality though without Spinoza's associated mechanistic materialism. Leibniz argued for the existence of a deity as the Monad of monads which created all the other monads and as the sufficient reason for the pre-established harmony between the changes in the monads. The unity of this one harmony he expressed by comparing the universe to an ocean: "In the universe all things are closely knit together, they are in one piece, like an ocean: the slightest movement transmits its influence far and wide all around". (1) Leibniz argued that everything happens for a reason, and that the sufficient reason should be found to explain all happenings. The appearance of contingency was then seen as nothing but evidence of ignorance or of having too narrow a perspective. Ultimately, everything should be understood from thepoint of view of the totality.

Leibniz also argued that we live in the best of all possible worlds. This would seem to imply a static world since if the world is perfect and is to remain perfect, then it cannot change. However, this doctrine, reviving ideas from the Middle Ages, was transcended by Leibniz who began to conceive the universe as developing towards

(1) Cited from Leibniz: Essais de Theodicee, Amsterdam, 1747, T.I.P.I. s 9, pp. 85, 86, in HEGEL'S LECTURES ON THE HISTORY OF PHILOSOPHY tr. E. S. Haldane and Frances H. Simson (1896) The Humanities Press, Atlantic Heights, N.J., 1974, Vol. 3, p.344.

perfection rather than as being perfect. In PROTOGAEA (1693) Leibniz pointed out that species which existed in earlier times are now extinct and that many now known to us did not then exist and on this basis suggested the hypothesis that the species of animals have been many times transformed. (1) He also suggested that different animals such as the cat family may have all descended from one species. In 1710 he suggested that it is probable that all animals are descended from marine forms of life. (2) In effect, what Leibniz did was to temporalize the great chain of being, which led him to the following conclusion:

> A cumulative increase of the beauty and universal perfection of the works of God, a perpetual and unrestricted progress of the universe as a whole must be recognized such that it advances to a higher state of cultivation, just as a great part of our earth is already subject to cultivation and will hereafter be so more and more. (3)

The net effect of all these ideas was to produce a conception of the universe composed of active rather than inert elements in which the focus was not so much on the constituents as on the totality conceived of as a dynamic process of becoming. This conception of the universe has featured strongly in the German speaking world and has been a strong counterweight to materialism. Developed by Kant and Boscovich as dynamism, these ideas formed the basis of field theory as developed by Faraday, Maxwell and Einstein. Taken over by the Romantic movement, ideas deriving from Leibniz formed the basis of the Naturphilosophen movement which culminated in the work of Schelling in the early nineteenth century. This movement influenced

(1) Arthur O. Lovejoy THE GREAT CHAIN OF BEING, Harvard Uni. Press, Cambridge, Mass. 1936, p.256.
(2) loc. cit.
(3) Cited ibid. p.257 from GESPRACH ÜBER DIE POSIE, 1800.

even those who rejected it. Thomas Kuhn has presented considerable evidence to show that the principle of the conservation of energy formulated between 1842 and 1847 was arrived at in Germany by Helmholz under the influence of the Naturphilosophen doctrine deriving from Leibniz's metaphysical principle that there exists an indestructible force, a 'vis viva' at the root of all natural phenomena, and that there must be a single unifying principle for all natural phenomena. (1) This notion of the conservation of energy then formed thebasis of the phenomenology or energetics movement developed by Wilhelm Ostwald and Georg Helm in the 1970' and 1880's which took energy as the basic principle of explanation rather than the atomism of materialism.

Corresponding to this more dynamic conception of nature, Leibniz's ideas led German philosophers to adopt a conception of mind emphasising activity. This began with the development of a rational and empirical psychology by Leibniz's follower, Christian Wolff. Wolff's concept of mind was based on the doctrine of the independence, self-sufficiency and spontaneity of the monad. (2) In opposition to Locke's psychology based on the passive reception of impressions, Wolff developed a functional psychology according to which the ego does not simply receive ideas but produces them. This means that psychology

(1) Thomas S. Kuhn "Energy Conservation as an Example of Simultaneous Discovery" in CRITICAL PROBLEMS IN THE HISTORY OF SCIENCE Marshall Clagett ed. Uni. of Wisconsin Press, Madison, 1959, p.337ff.
(2) Cassirer (1951) p.120.

must aim at understanding the formative forces behind this production and the relationships between them. In 1777 Tetens published his major work in psychology which differed from the followers of Locke in its concern to understand the highest achievements of the mind such as the development of science and art. He made a distinction between sense perception expressing the state of an object and feelings which were described as subjective relations. (1) These subjective relations were then taken to be the province of art, and Tetens' emphasis on this has led to a concern with aesthetics in German psychology largely lacking in the English speaking world.

Leibniz also had a strong influence on logic in Germany. Lambert suggested on the basis of the conception of the mind as active that while science owes its materials to experience, the concepts in terms of which these materials are understood have relations which are not empirical but are a priori. (2) This idea culminated in Kant's critical philosophy where the forms of intuition and the categories through which the world is experienced as intelligible were seen to derive from the subject of experience.

In France where scientific materialism received its most extreme formulation, a reaction developed based on biology. This began with Buffon's NATURAL HISTORY published in 1749 in which the ideal of a monistic science was rejected and

(1) ibid. p.125.
(2) ibid. p.131ff.

the independent structure of biological knowledge was asserted against theoretical physics for the first time.(1) Buffon rejected the emphasis placed on mathematics and emphasised the importance of the description of the individual and he rejected analytical differentiation in favour of understanding species in relation to their kinship, their transformations and their evolution. Rather than deriving becoming from being, being was derived from becoming.

This new ideal of science was enthusiastically taken up by Diderot who in 1754 suggested that a revolution in science was underway and that mathematics would lose its significance. (2) In place of measurement and number and the systematizing and calculating spirit, Diderot argued for the primacy of the individual over the universal and for aesthetic rather than logical meaning. System should be kept subservient to the facts to be understood and one should always be ready to adapt concepts for the specific subject matter being investigated.

These ideas gained force and eventually culminated in the French revolution. C. C. Gillispie has argued that the hostility to the mechanistic world-view accounts for the dissolution of the Academie des Sciences which had been centred on physical science, and the transformation of the Jardin des Plantes into the Museum National D'Histoire

(1) ibid. p.77ff.
(2) ibid. p.73ff.

Naturelle in which were established twelve chairs of biology. (1) He also argued that it was more due to Lavoisier's materialist views than to his being a financier that he was executed. (2) The effect of these attacks on materialist physics and the support of biology was to make France in the nineteenth century extremely strong in comparative anatomy and experimental biology, but rather weak in physics and chemistry.

In the English speaking world the analytical approach to the world was all pervasive. Unlike France where positivistic materialism was generally associated with atheism, in England the physical sciences and religion did not clash. The argument from design in the spirit of empiricism enabled people to believe in God on what were thought to be scientific grounds, and a real conflict between religion and science didnot occur until the Darwinian theory of evolution provided an alternative explanation for the order existing in the world. Largely for this reason science did not provoke a reaction in English speaking countries as it did in France. However, even in Britain, Priestly, Faraday and Maxwell developed the field theory as an alternative to atomism, suggesting that all phenomena might ultimately be explained in terms of fields. At the same time the development of field theory involved a transcendence of the empiricist constraints on speculative,

(1) Charles Coulston Gillispie "The ENCYCLOPEDIE and the Jacobin Philosophy of Science: A Study in Ideas and Consequences" in Marshall Clagett ed. (1959) op.cit. Paper nine. pp. 255-289.
(2) Charles Coulston Gillispie "Science in the French Revolution" in Proc. N.A.S., Vol.45, 1959, pp.677-684, p.678.

non-testable metaphysical hypotheses. This anti-empiricist approach was implicitly accepted by Faraday and explicitly defended by Maxwell. (1)

However, positivistic materialism has generally gained ground to become increasingly the dominant force in our culture. In mid-nineteenth century Germany a strong movement against the vitalism of the Naturphilosophen developed with the advance of physiology. Schwann, Schleiden, Liebig, Virchow, DuBois-Reymond and Helmholz developed a reductionist approach and defended a materialist ontology. Their position is exemplified in Virchow's statement of 1845:

> The new medicine has a mechanistic approach and its object is the establishment of a physics of the organism. It has shown that life is nothing more than the sum of the phenomena which proceed from general physical and chemical (that is to say mechanical) laws. It denies the existence of an autocratic Life or Healing Force. (2)

Such ideas were further supported by philosophers such as Buchner, and the materialists, generally associated with left wing politics, were so aggressively successful in their efforts to understand biological phenomena and in propogating their ideas, that they succeeded in almost completely eliminating their opponents from the field.

(1) Yehuda Elkana "Boltzmann's Scientific Research Program and its Alternatives" in THE INTERACTION BETWEEN SCIENCE AND PHILOSOPHY ed. Y. Elkana, Humanities Press, Atlantic Highlands, N.J. 1974, pp. 243-279 , p.273n.
(2) Cited by Everett Mendelsohn "Revolution and Reduction" in THE INTERACTION BETWEEN SCIENCE AND PHILOSOPHY ed. Y. Elkana, op.cit. p.415.

In the 1850's three notable ideas were published which formed the basis of modern reductionist biology. In 1858 Pasteur published his experiments proving that there is no spontaneous generation of bacteria, and in the same year Virchow published his conclusions that all cells come from preceding cells. Then in 1859 Darwin published his ORIGIN OF SPECIES which showed without resort to teleological principles how all species are derived from pre-existing species. Together with Darwin's theory of evolution and Pasteur's rejection of spontaneous generation, Virchow's theory implies that there is a continuous line of living protoplasm extending back from each cell in the body to the earliest life which appeared on earth, thus explaining the higher in terms of the lower and leaving only the origin of life itself unaccounted for in terms of reductionist materialism. Later Mendel's work on genetics was discovered which explained the inheritance of characteristics and differentiation of progeny as required by Darwin's theory of evolution in analytical reductionist terms. In this genes came to function as the elementary units.

This complex of ideas was a considerable advance over the simple temporalization of the great chain of being suggested by Leibniz and championed by the Naturphilosophen. The temporalization of the old 'Scala Naturae' still involved a divine creator acting purposefully, whereas the new theory of evolution required no higher forces than those of physics and chemistry. The implications of this position were drawn by Benjamin Disraeli who, in his novel LOTHAIR, has Monsignor claim that "instead of Adam our ancestry is traced to the most grotesque of creatures, thought is phosphorus, the soul complex nerves, and our moral senses a secretion of sugar". (1)

Non-materialist concepts continued to play a part in biology, particularly in France. Thus Claude Bernard (1813-1878) wrote:

> In every living germ is a creative idea which unfolds and exhibits itself through organization. As long as a living being persists, it remains under the influence of this same creative vital force, and death comes when it can no longer express itself. (2)

However, Bernard wrote elsewhere that while life is understood in terms of physical, chemical and vital principles, the use of vital principles to explain phenomena should be regarded as indicative of ignorance and all life should eventually be explained in terms of physics and chemistry. Those who opposed the mechanistic account of life then argued that these vital principles would never be reduced to physical and chemical principles, while the mechnists argued that they would. Notable among these vitalists was Driesch (1867-1941) who argued for vitalism on the basis of his discovery that if the blastula of the sea urchin is cut up, each part will develop into a complete embryo. However, such notions as 'vital force' slowly

(1) Cited by Everett Mendelsohn (1974) op.cit. p.417.
(2) Cited from Claude Bernard INTRODUCTION TO THE STUDY OF EXPERIMENTAL MEDICINE by Stephen Toulmin & June Goodfield in THE ARCHITECTURE OF MATTER, Hutchinson, London, 1962, p.335.

lost ground to mechanistic concepts as biology advanced. Then in place of vital forces the anti-mechanists argued for the irreducibility of wholes to parts. J. B. S. Haldane in Britain was a typical exponent of this position. The idea was then developed in terms of systems theory, the foremost exponents of which have been Ludwig von Bertalanffy and Paul Weiss. However, since 1945 with the success of new efforts to understand living processes in terms of chemistry, the culmination of which was the explanation of genetics in terms of DNA molecules, molecular biology has come to be generally accepted as the most important field of biology and the reductionist approach implied by this has largely supplanted approaches emphasising the integrity of the whole. As Francis Crick, the co-discoverer of the way in which DNA replicates itself to enable organisms to reproduce themselves wrote:

> The ultimate aim of the modern movement in biology is in fact to explain all biology in terms of physics and chemistry. (1)

and a later Nobel laureate, J. Lederberg commented:

> A few eccentrics aside, the whole community of contemporary science shares the view that the same laws of nature apply to nonliving and living matter alike. All of us who investigate the chemistry and physics of living organisms pursue our work as if organisms were complex machines, and we find man to exhibit no tissues or functions that would except him from this way of analysing human nature. (2)

The surviving element of Naturphilosophie in physics in the form of the energism of Ostwald and Helm was challenged by Loschmidt's and Bolzmann's explanations of continuous

(1) Francis Crick of MOLECULES AND MEN, Uni. of Washington Press, Seattle, 1966, p.10.
(2) J. Lederberg "The Perfection of Man" in NOBEL SYMPOSIUM 14: THE PLACE OF VALUE IN A WORLD OF FACTS, Almquist and Wiksell, Stockholm, 1970, p.55. Cited in Brian Easlea LIBERATION AND THE AIMS OF SCIENCE Sussex Uni. Press by Chatto & Windus, 1973, p.259n.

phenomena in terms of atomism. (1) In particular these thinkers tried to explain thermodynamic phenomena in this way, and Boltzmann provided a proof for the second law of thermodynamics on a molecular basis by using mechanics and statistical laws. He also argued for an extension of atomism to time and electricity. (2) His success can be gauged from his influence on Max Planck who in accordance with the phenomenological approach, had wanted to reduce all physics to the two laws of thermodynamics. (3) On the basis of Boltzmann's arguments, Planck came to accept that the principles of thermodynamics and classical electrodynamics were not adequate to account for the process of emission and absorption of radiation, and that the probability principle had to be accepted as fundamental to physics. Planck also accepted that there must be a fundamental division between reversible and irreversible processes and that this division could only be comprehended on the basis of atomistics. (4)

Einstein's quantum theory of radiation in which radiation itself was seen to have a particle-like character decisively undermined both Planck's original goal of reducing everything to phenomenological thermodynamics and Maxwell's attempt to see the world in terms of continuous fields rather than in terms of atoms. Thus quantum theory, when combined with Rutherford's model of the atom by Niels Bohr, provided the beginning of a new era in physics in which it came to be believed that all chemical phenomena could be understood in terms of quantum theory with electrons, protons and

(1) Yehuda Elkana "Boltzmann's Scientific Research Program and its Alternatives" in Y. Elkana ed. (1974) op.cit. pp.243-279, p.257ff.
(2) ibid. p.262.
(3) ibid. p.276.
(4) ibid. p.277-278.

neutrons being taken as the ultimate building blocks of the universe.

The multiplicity of subatomic particles discovered along with electrons, protons and neutrons has called into question the elementary nature of the strongly interacting particles - the protons and the neutrons, and this has given rise to a new field: elementary particle physics, which is at present trying to develop a conception of the world based on quarks and leptons as the most basic building blocks. It is now generally accepted that there are four basic forces of interaction between particles: gravitational, electromagnetic, strong and weak, and this has given rise to major field of physics which studies these forces and their relationships which involves an attempt to develop a unified field theory. However, many physicists, emphasising the quantised nature of these fields, conceive of attraction and repulsion as simply a matter of exchange of particles. Thus, Steven Weinberg who won the Nobel prize for physics in 1979 for his work in developing a unified field theory wrote in an article in 1977:

> When two electrons repel each other electrically, we think of this, from the viewpoint of modern quantum field theory, not as a force exerted between the two electrons at a distance, but rather as the exchange of a particle - the quantum of electro-magnetic force, the photon - which actually runs from one electron to the other. (1)

All forces are understood in the same manner and if this interpretation is accepted, then a unified field theory

(1) Steven Weinberg "The Forces of Nature" in AMERICAN SCIENTIST, Vol. 65, 1977, pp.171-176, p.173.

combined with a successful account of all entities in terms of quarks and leptons interacting by the exchange of such particles could be regarded as providing the ultimate explanation of the universe in terms of elementary particles.

Corresponding to the articulation of materialism through the various branches of science, positivism has been continually refined and developed. In the eighteenth century David Hume carried the premises of empiricism to their ultimate conclusions. He called anything which presents itself to consciousness a perception and divided these into two groups: impressions which were taken to be paradigmatic and ideas which were regarded as faded copies of impressions or composites of such copies. (1) Thought was seen as the mechanical association of such perceptions so that rationality was seen as nothing but a subjective faculty for revealing relations between subjective ideas, while inference about nature itself was taken to have no rational foundation. On this basis Hume also rejected the concept of substance, regarding not only objects as aggregates of individual qualities but also taking the self to be nothing but a sequence of perceptions. All attempts to arrive at a more profound knowledge of the world than suggested by this account of mental processes Hume rejected as sophistry, in particular condemning metaphysics as nonsense. (2)

(1) David Hume AN INQUIRY CONCERNING HUMAN UNDERSTANDING (1748) Bobbs-Merrill, Indianapolis, 1955, p.26ff.
(2) ibid. p.173.

In Germany where the emphasis was on the active role of the subject in perception, Kant developed an alternative epistemology which overcame some of Hume's scepticism. However, this was achieved by assuming that the concepts of Newtonian physics must necessarily be the vehicles for ordering experience if the world is to be experienced as intelligible. This implied a dogmatic acceptance of the materialist view of the world even if this was regarded as concerned only with the world of appearances and not the real world. Kant's ideas have dominated and been the main reference point for epistemology in Germany up till the present.

In nineteenth century France epistemological thought was dominated by Comte (1878-1857) who coined the term 'positivism'. He argued that the history of man had passed through three stages: the first in which thought was dominated by religion, the second in which thought was dominated by metaphysics, and the final stage, the present, in which science was becoming dominant. (1) The task then was to make science prevail. Developing ideas of Hume and Kant, he then argued that science should aim to explain things by laws, and should aim to reduce everything to the most general laws. He thus saw science developing from the subject dealing with the most general, that is mathematics, to the most complex and least general, that is sociology, with each subject being dependent upon and a special case of the preceding subject.

(1) Auguste Comte THE POSITIVE PHILOSOPHY (1832-40) tr. Harriet Martineau (1955) A.M.S. Press, N.Y., 1974, p.25ff.

In Britain John Stuart Mill (1806-1873) also developed an epistemology in which the emphasis was on laws and reduction. According to Mill's doctrine, the laws of nature are simply descriptions of behaviour and the aim of science is to reduce the laws describing complex entities and their interactions to the laws describing their constituents, and then in turn to reduce these laws to the laws describing their constituents. Success is achieved if the way entities behave can be predicted by the laws formulated to describe their constituents. Mill also extended empiricism to the so-called deductive sciences such as mathematics, arguing that the necessity attributed to these is really nothing but the result of experience, while syllogisms do not bring new knowledge since the conclusion is contained in the premisses and we must already know this conclusion to formulate the premisses. Despite the opposition to Mill's views, especially by Whewell under the influence of Kant, and by the rejection of thepositivist methodology generally in favour of an approach which allowed for the adoption of non-testable speculative theories by two of the foremost British scientists of the nineteenth century, Faraday and Maxwell, (1) Mill's empiricism prevailed in Great Britain.

The psychologistic approach to necessary truths prevailed until it was attacked by Frege. But far from dampening positivism, this criticism of the reduction of necessary truths to empiricist psychology inspired its greatest development. The first person involved in this was Russell

(1) Yehuda Elkana (1974) op.cit. p.273n.

who attempted to reduce mathematics to logic and then to reduce all knowledge to knowledge of elementary propositions corresponding to simple facts in the world. This doctrine came to be known as logical atomism. Russell also tried to develop a philosophical system which would reconcile empiricism and materialism. His logical atomism was taken over by Wittgenstein, and in this form it largely inspired the development of logical positivism in Vienna. The central notion of logical positivism is that the only epistemologically significant statements are those which are verifiable through observation or are tautologies, with mathematics being seen as a system of tautologies. The logical positivists developed the hypothetico-deductive model of scientific explanation according to which a phenomena is explained by deducing it as a necessary consequence of an hypothesis. The hypotheses are then regarded as means for ordering experience which are verified by their ability to make correct predictions about what will be observed. Scientific advance is made by reducing tested hypotheses or theories to more general hypotheses in terms of which the reduced theory can be seen as only a special case. The most important exponents of these ideas were Carnap and Hempel, and the ideas of these thinkers dominated the philosophy of science in the English speaking world up until the early 1960's and dominated the human sciences for even longer.

The domination of science and epistemology by the analytical approach has also had the effect of re-organizing enquiry.

This has involved increasing specialisation and fragmentation of knowledge into isolated domains held to be the preserve of small groups of hyper-specialists. Throughout the twentieth century, the intellectual community has come to be organized in such a way that success requires opting for a small specialised field. This specialization does not simply sever the humanities from the sciences and divide up science into a large number of fields, but it also divides applied science from pure science and experimental science from theoretical science. Both the physical and the human sciences have themselves been broken down into a multiplicity of sub-fields and attempts to bridge the gaps between fields have simply produced new specialised fields. Finally, in the English speaking world, philosophy itself has been broken up into specialities divorced both from each other and from concern with anything outside academic philosophy.

This short history of the development of scientific thought shows how the reductionist analytic approach according to which it is assumed that anything can be understood by identifying the constituents from which it is composed or constructed and then studying their interactions, has become increasingly predominant. Opposing attitudes in science have been defeated in the long run despite outside support. And since the stature of science has continued to grow, the world-view first fully articulated by the philosophers of the Enlightenment on the basis of this reductionist view of science has come to increasingly dominate Western society, and particularly the English speaking world. It could be argued that this is not the case on the basis of the ignorance by the general public of science and their adherence to ideas inconsistent with it such as astrology. But this is to fail to understand what is meant by dominant. Dominant in this context does not mean the beliefs which are held by most people in society, but what beliefs are held by most people who are socially recognized as the ultimate arbiters in disputes about beliefs, and whose ideas consequently permeate the society's most powerful institutions. In the Middle Ages the clerisy was the dominant group in this respect. In our society it is the scientists who have taken over the position of ultimate arbiters in matters of belief and the whole orientation of society to the world and the relationships between people in the organizations mediating society's interaction with the world are largely constituted by the world-view of positivistic materialism.

Since all members in society must live through such organizations, they must come to assume the ideas which constitute them in the conduct of their everyday lives. Ideas which accord with these assumptions then constitute the individual's reality, while other ideas are simply froth on the surface which come and go according to fashion. And all those ideas opposed to the world-view of positivistic materialism must be defined in relation to the dominant beliefs. As Ernest Gellner wrote:

> The claim that the Enlightenment forged and first formulated the modern outlook as it manifests itself both in shared presuppositions and in formal philosophies does not ...call for qualification on the

> grounds that religion has survived its attack. If the characteristic eighteenth century outlook fails to excite or stimulate today, it is partly because its exponents have done their work so well and successfully. What they preached has become common ground, shared even by the successors of their erstwhile opponents. (1)

The extent to which individuals do ignore the scientific conception of the world is the measure of their social irrelevance.

(1) Ernest Gellner "French Eighteenth-Century Materialism" in THE DEVIL IN MODERN PHILOSOPHY Ernest Gellner, ed. I. C. Jarvie and Joseph Agassi, Routledge & Kegan Paul, London, 1974, pp.113-148, p.119.

THE DISSOLUTION OF THE FEUDAL ORDER AND THE ATTEMPT TO DEVELOP A PURELY RATIONAL ETHICS

The growth of rationality which took place during the Middle Ages and the Renaissance was predominantly aimed at justifying a world-view which gave a place to man and provided an orientation in life. This achievement was most fully realized in the Renaissance where the medieval principle of order which was codified in the natural theology of Aquinas was further buttressed by the rich tradition of pagan humanism, all of which pointed to the ideal of conduct in which man was to use his gift of reason to discipline his sensuous appetites to arrive ultimately at the high truth of spirit or of conceptual knowledge. As Herschel Baker wrote:

> The Renaissance man was one of many legacies, but of them all perhaps the strongest was his optimism. Its strength was reinforced, for it came to him both from the rational theology of the late Middle Ages and from the massive humanistic tradition of pagan antiquity which the learned were rediscovering. In both these traditions man was construed as the glory of the universe. Renaissance optimism was predicated upon a sense of security, the felt existence of order, pattern, and sequence; ...by which man could view his world as the manifestation of an omnipotent God and himself as that God's special creation. (1)

As the social order constituted by these ideas began to dissolve with the rise of commercial capitalism and the rise of the national state, the ideas themselves were undermined. While in the Middle Ages, social, economic

(1) Herschel Baker THE IMAGE OF MAN: A STUDY OF THE IDEA OF HUMAN DIGNITY IN CLASSICAL ANTIQUITY, THE MIDDLE AGES, AND THE RENAISSANCE (1947) Harper & Row, N.Y., 1961, p.223.

and political ties formed a unity which bound the individual in a web of relations, defining his status, rights and obligations to sets of individuals, associations and guilds, the economic and political spheres now began to take on an independent status, leaving individuals in isolation to confront an absolute state and related to the economy only by the legal power to make contracts. The first person to develop a political philosophy to give expression to and to legitimate this new form of social relationships was Machiavelli (1469-1527). Machiavelli focussed his attention upon the rise of the new principalities and the problems of maintaining power in these without the traditional forms of legitimacy. That is, he was the first political thinker to identify the new political order dominated by the secular state, and correspondingly to take a political standpoint outside traditional morality and its associated hierarchical social order. As Cassirer wrote:

> The sharp knife of Machiavelli's thought cut off all the threads by which in former generations the state was fastened to the organic whole of human existence. The political world has lost its connection not only with religion or metaphysics but also with all the other forms of man's ethical and cultural life. It stands alone - in an empty space. (1)

Consequently, Machiavelli was solely concerned with how to attain and hold down power and recommended cruelty, perfidy and deception to achieve this. Thus he wrote in THE PRINCE: "a prince should not worry if he incurs

(1) Cassirer (1946) op.cit. p.140.

reproach for his cruelty so long as he keeps his subjects united and loyal", (1) and

> ... contemporary experience shows that princes who have achieved great things have been those who have given their word lightly, who have known how to trick men with their cunning, and who, in the end, have overcome those abiding by honest principles... because men are wretched creatures who would not keep their word to you, you need not keep your word to them. And a prince will never lack good excuses to colour his bad faith. (2)

The only morality is that of success at attaining and holding power and Machiavelli speaks highly only of those who succeeded and condemned only those who failed. Of the right use of power Machiavelli said nothing.

Corresponding to the political philosophy of Machiavelli, Luther and Calvin developed a theology appropriate for a social order in which the economy was emancipated from the rest of society. For Luther (1483-1546) the true moral rules are the divine commandments, and these are in no need of a rationale or justification other than that they are the injunctions of God. Since we are inherently sinful, it is inevitable that our inclinations, our reason and our will, will be opposed to these commandments and we can do what God commands only be grace. Luther restated the doctrine of predestination, implying that efforts on our part are pointless. All we can do

(1) Niccolo Machiavelli THE PRINCE tr. George Bull, Penguin Books, Harmondsworth, 1961, p.95.
(2) ibid. pp.99-100.

is "hope for grace that we may be justified and forgiven for our inability to obey the arbitrary fiats of a cosmic despot". (1) Thus people's attention was turned away from concern with the consequences of their actions and the morality of social institutions to a concern with faith and subjective religious experience. As Charles Trinkaus put it:

> The sensuous world could have little spiritual importance for men. Otherwise men would trust objective reality and lose the only truly valuable inner experience... In recognizing only subjective religious experience as valid, Luther rejected the medieval effort to establish an objective structure linking God and man, eternity and time, the other world and this world, spirit and flesh. (2)

This left the individual to pursue economic gain without considering his or her obligations to others, and freed the political rulers from religious judgements. Calvin (1509-1564) developed these ideas in a more extreme form, and while unlike Luther he wanted to establish a theocracy making clergy sovereign over princes, he sanctioned the autonomy of secular activity at every level where morals and religious practice were not in direct conflict with such activity.

The medieval world-view was unable to come to terms with this new situation. This failure was manifest most clearly by the ideas of the Jesuits, that order within

(1) Alisdaire MacIntyre A SHORT HISTORY OF ETHICS, Routledge & Kegan Paul, London, 1967, p.123.
(2) Charles Trinkaus "The Religious Foundations of Luther's Social Views" in ESSAYS IN MEDIEVAL LIFE AND THOUGHT ed. John H. Mundy et.al. Biblo and Tanden, N.Y., 1965, p.73.

the Catholic Church devoted to the task of orienting the church to the modern world. In their efforts to come to terms with the new social order their ideas lost all coherence and their casuists simply told people what they wanted to hear. Thus Pascal declared of them:

> Their object is not to corrupt morals...that is not their design. But neither is it their sole purpose to reform them: this would be bad policy. Their intention is this: ...that they should govern all consciences. And as the severe maxims of the Gospel are apt to govern some people, they make use of them whenever the occasion favours it. But as these maxims do not accord with the views of the great majority of the people, they waive them in regard to such persons, for the sake of affording universal satisfaction. On this account, having dealt with persons of every condition in life and of all different nations it is necessary to have casuists assorted to match this whole diversity... They have a few for the select few, while the multitude of lax casuists offer their services for the multitude that prefer laxity. (1)

Similarly, the order of Europe disintegrated into a state of almost permanent war in the seventeenth century. The major war during this period, the 'Thirty Year War' fought mainly in Germany, but really involving almost the whole of Europe, lasted from 1618-1648. Its principle protagonists were the Catholic Spanish empire being essentially a feudal order and the protestant United Netherlands in which the new form of commercial capitalism was flourishing, and for the most part the war was a battle between Catholics and Protestants, or in the case of France which fought with the Protestants, a battle between a society

(1) Cited from PROVINCIAL LETTERS V. English tr. (N.Y., J. Leavitt; Boston, Crocker & Brewster, 1828) pp.69-71, by E. Cassirer (1946) op.cit. p.171.

within which commercial capitalism was rapidly developing(1) and the dominant feudal power. The medieval world-view provided no superordinate grounds for resolving such conflicts which were therefore fought until a state of mutual exhaustion had been reached.

While these developments themselves weakened the medieval world-view, it was the advance of science which provided the rational foundation for its dissolution. This initially produced some disorientation as the scientific conception of the world was a world in which there was no place given to humans and which provided no grounds for justifying or legitimating any moral order. This sense of dislocation found expression in the poetry of John Donne (1572-1631) who in his ANATOMY OF THE WORLD wrote:

> The new philosophy calls all in doubt,
> The Element of fire is quite put out;
> The Sun is lost, and th' earth, and no man's wit
> Can well direct him where to looke for it.
> And freely man confesse that this world's spent,
> When in the Planets, and the Firmament
> They seeke so many new; then see that this
> Is crumbled out againe to his Atomies.
> 'Tis all in Peeces, all coherence gone;
> All just supply, and all Relation:
> Prince, Subject, Father, Sonne, are things forgot,
> For every man alone thinkes he hath got
> To be a Phoenix, and that then can bee
> None of that kinde, of which he is, but hee.
> This is the world's condition now.(2)

The philosophical implications of the new science were spelled out by Blaise Pascal (1623-1662) in order to justify Jansenism, a French form of portestantism which arose

(1) Maurice Ashley THE GOLDEN CENTURY: EUROPE 1598-1715, Cardinal, London, 1975, p.105ff.
(2) Cited by Karl Löwith in "Man Between Infinities" in MEASURE: A CRITICAL JOURNAL, Chicago, Vol. 1, 1950, pp.297-310, on p.297.

within the Catholic Church. The situation of a person in the world as understood by science was described as follows:

> I see the terrifying immensity of the universe which surrounds me, and find myself limited to one corner of this vast expanse, without knowing why I am set down here rather than elsewhere, nor why the brief period appointed for my life is assigned to me at this moment rather than another in all the eternity that has gone before and will come after me. On all sides I behold nothing but infinity, in which I am a mere atom, a mere passing shadow that returns no more. All I know is that I must soon die, but what I understand least of all is this very death which cannot escape me. (1)

Thus the philosophers from the seventeenth century onwards were confronted with the problem of orienting themselves in a world which was totally indifferent to humans. However, the original emphasis of the new science was on the rationality of the universe and the capacity of humans to comprehend this rationality. The Pythagorean or Platonist aspects of this world-view were taken to be more significant than its materialist aspect. Newton himself can only be understood as one of the Cambridge Platonists. So while science undermined the conception of the world as a hierarchical chain of being which gave to everything its unquestionable place in the general order of things, and so left humans exiled in an infinite universe, this achievement was based on a belief in the power of reason to comprehend the world. This justified an exaltation of consciousness and a revival of the Stoic

(1) Blaise Pascal PENSÉES ed. Louis Lafuma, tr. John Warrington, Dent, London, 1973, fr.11, p.6.

principle of the 'autarky', that is, the autonomy and self-dependence of human reason. On this basis the philosophers tried to justify a belief in their own significance and to found a new ethics. Thus Pascal wrote:

> Man is a mere reed, the weakest thing in nature; but he is a thinking reed. The entire universe need not arm itself to crush him; a vapour, a drop of water, is sufficient to cause his death. But if the universe were to crush him, man would still be nobler than his destroyer, because he knows that he dies, and also the advantage that the universe has over him; but the universe knows nothing of this.
>
> Our whole dignity, therefore, consists in thought. From this we must rise, not from space and time which we cannot fill. Let us endeavour then to think aright, this is the principle of morality. (1)

The first important philosopher to attempt to justify rules of conduct in this way was Hugo Grotius (1583-1645). Confronted with the religious wars and the absence of any ethical order in terms of which they could be resolved, Grotius looked to the science of Galileo as a model for knowledge and began the task of finding a 'mathematics of politics'.(2) He argued that social life is not simply a mass of incoherent facts but is based on judgements which have the same objective validity and are capable of the same firm demonstration as mathematical propositions. These then have the character of universal and eternal truths. On this basis Grotius set out to revive the Stoic

(1) ibid. fr.391, p.110.
(2) Cassirer (1946) op.cit. p.165.

ideas of natural law to provide a universal system of ethics or principles that could be admitted by every nation, creed and sect. It was argued that natural law antedates all human and divine power and is valid independently of such power since it is founded in the sphere of pure reason. As Grotius put it, "Just as even God, then, cannot cause that two times two should not equal four, so He cannot cause that which is intrinsically evil be not evil".(1) The term 'natural' in this context meant that the laws were derived from nature. However, 'nature' was not taken to refer to the existence of things but to the origin and foundation of truth. (2) So to nature belongs all truths capable of a purely immanent justification. And as Galileo had defended the autonomy of mathematical physics, Grotius had done the same for the intellectual and moral world. The physical and the moral world together were then seen to constitute the real world, the cosmos itself.

This notion of natural law is quite different from that of the Middle Ages as contained in the writings of Aquinas where natural law was always subordinated to divine law. Not only did Grotius secularize the conception of natural law, he was also one of the first theorists to deduce natural laws from the assumption that civil society is a

(1) Quoted from LAW OF WAR AND PEACE Bk I, ch.1, sec. x., par. 5, by John Hallowell, in MAIN CURRENTS IN MODERN POLITICAL THOUGHT, Holt, Rinehart & Winston, N.Y., 1950, p.95.
(2) See "Some Meanings of 'Nature' " in Arthur O. Lovejoy and George Boas PRIMITIVISM AND RELATED IDEAS IN ANTIQUITY (1935) Octagon Books, N.Y., 1973, pp.457-456, pars 13, 26, 40 and 60.

social contract and that therefore individuals must be seen to have natural rights. The natural laws of the Middle Ages justified the status quo, while this new notion of natural law justified the right of the individual against arbitrary rule and to do and possess things. Thus Grotius defined a right as "a moral quality of a person making it possible to have or to do something lawfully".(1)

The idea that political and moral ideals could be rigorously demonstrated in a way analogous to mathematical physics dominated thought through the seventeenth and eighteenth centuries. It was accepted by both Leibniz and by Locke who despite his adherence to empiricism and materialism, argued that "morality is capable of demonstration, as well as mathematics".(2) This conjunction of ideas was characteristic of many of the Enlightenment philosophers of the eighteenth century. The idea of natural law thus formed the basis of Montesquieu's empirical investigations. In THE SPIRIT OF LAWS he analysed legal and political institutions by attempting to trace the variety of laws back to a few definite principles, and it was this systematic relationship between the various legal forms which Montesquieu meant when he referred to the 'spirit of laws'. Thus Montesquieu declared in THE SPIRIT OF LAWS that "Laws in their broadest sense are the necessary relations which are derived from the nature of things."(3) and in

(1) Quoted from LAW OF WAR AND PEACE, Bk I, ch.1, sec. iv, by Hallowell (1950) op.cit. p.97.
(2) Cited by MacIntyre (1967) op.cit. p.160.
(3) Cited by Cassirer (1932) op.cit. p.243.

accordance with this, justice was seen as a basic relation which remains the same no matter what the subject it embraces or who conceives it or whether justice is realized in practice. He went on to write:

> Before there were any enacted laws, just relations were possible. To say that there is nothing just or unjust excepting that which positive laws command or forbid is like saying that before one has drawn a circle, all of its radii were not equal. (1)

Voltaire also adhered to these ideas opposing his leader and master Locke by arguing that while there are no innate ideas, there is still a universal principle of morality which can be found by each individual on his own at a certain stage of his development. Consequently, as there is the law of gravity which extends throughout the universe, there is a fundamental law of morality which extends throughout humanity.

This rationalist movement culminated with the American Declaration of Independence, the American Bill of Rights and the French Declaration of the Rights of Man and the Citizen. The heritage of natural law theory on which these were based is most clearly evident in the Declaration of Independence written by Thomas Jefferson in 1776 in which occur the famous words:

> We hold these Truths to be self-evident, that all Men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty, and the Pursuit of Happiness - That to secure these Rights, Governments are instituted among Men, deriving their just Powers from the consent of the Governed, that whenever any Form of Government becomes destructive of these Ends, it is the Right of the People to alter or to abolish it... (2)

(1) loc. cit.
(2) "The American Declaration of Independence" in THE PORTABLE AGE OF REASON READER ed. Crane Brinton, Viking Press, N.Y. 1956, pp. 194-199. p. 195.

Thus it was believed that an objective standard had been attained in terms of which the social order could be judged.

While Rousseau rejected natural law, his views were strongly influenced by it, and the political philosophy and ethics which he developed were just as committed to the primacy of reason. Thus in his arguments against slavery he wrote: "These principles were not invented by Grotius, nor are they founded on the authority of the poets; they are derived from the nature of things; they are based on reason." (1) and in "On Law" he wrote: "There is undoubtedly a universal justice which springs from reason alone..." (2) Rousseau's ideas were developed by Kant who rejected the reality of the social contract, and rejected the idea of morality being based on natural law. (3) However, he recognized the importance of the idea of a contract for a rational construction of law and saw ethics as involving the development of laws of nature through reason. Thus in the METAPHYSICAL BASIS OF THE THEORY OF LAW he stated that a contract is "by no means to be necessarily assumed to be a fact - indeed it is not even possible as such"; it is:

> a mere idea of reason which has, however, its undoubted (practical) reality: that is, it obliges every lawgiver to promulgate his laws in such a way that they could have arisen from the united will of an entire people, and to regard every subject, in so far as he decides to be a citizen, as though he had joined in assenting to such a will. For that is the touchstone of the legitimacy of every public enactment. (4)

(1) Jean-Jacques Rouseau THE SOCIAL CONTRACT tr. Maurice Cranston, Penguin Books, Harmondsworth, 1968, p.57.
(2) ibid. p.80.
(3) Ernst Cassirer ROUSSEAU, KANT, GOETHE: TWO ESSAYS tr. James Gutmann, Paul Oskar Kristeller and John Herman Randall, Princeton Uni. Press, Princeton, 1945, p.15.
(4) Quoted ibid. from Kant WERKE, VI, p.380f.

Correspondingly, Kant argued that the morality of an act should be judged by its form, the categorical imperative which he formulated as: "Act only according to that maxim by which you can at the same time will that it should become a universal law."(1) Kant held that such rationally based laws could then become a law of nature, and also formulated the categorical imperative as "Act as though the maxim of your action were by your will to become a universal law of nature." (2) In this way, pure reason which Kant had shown to have justified itself as the necessary condition of science could serve as the foundation for morality and political action and in this way create laws of nature in the relationships between people.

(1) Immanuel Kant FOUNDATIONS OF THE METAPHYSICS OF MORALS (1785) tr. Lewis White Beck, Bobbs-Merrill, Indianapolis, 1959 (422) p.39.
(2) loc.cit.

POSITIVISTIC MATERIALISM AND THE RISE OF NIHILISM

As the emphasis in science shifted away from its Neo-Platonic origins to its associated reductionist materialism, a quite different orientation to ethics developed. The meaning of 'nature' changed from 'the origin and foundation of truth' to 'all that exists', and for the materialist what exists is "a dull affair; soundless, scentless, colourless; merely the hurrying of material endlessly, meaninglessly."(1) The status of the subject in the world changed from that of an inexplicable intrusion into the world capable of manipulating and controlling it, to a passive spectator standing outside the world but somehow capable of understanding its workings, and was finally dissolved altogether, leaving either a mechanical association of ideas or simply the behaviour of a complex mechanism determined by mechanical laws and incapable of being held responsible for his or her actions. Rationality lost its objective status and came to be understood as a subjective faculty in the service of the passions, or was simply denied. Under these circumstances, the possibility of developing a purely rationalist ethics to replace moral theory based on an understanding of man's place in the cosmos was excluded. The full force of the idea that we are living in a world consisting of nothing but the meaningless movement of matter in which there is a total disjunction between knowledge and the motivation for action, had to be faced.

The development of this way of thinking was a slow process and did not simply follow the development of the ideas

(1) Alfred North Whitehead SCIENCE AND THE MODERN WORLD (1925) Mentor, N.Y. 1948, p.55.

stressing man's rationality. The stage was set for it by ideas which had developed prior to the emergence of the new science. Thus Machiavelli was taken as a model for the physical sciences by Francis Bacon who wrote:

> "...we are beholden to Machiavel, and writers of that kind, who openly and unmasked declare what men do in fact, and not what they ought to do..." (1)

The emphasis on subjectivity and inner experiences by Luther and Calvin divided the subject from the world and left the world to be understood in a way which excluded subjectivity, while their notions of predestination gave support to the determinism of the mechanistic conception of the world. And then the essential features of positivistic materialism were articulated by Bacon and Hobbes in the early seventeenth century without having any immediate effect on people's confidence in their ability to establish an ethics through pure reason. It was only gradually that the implications of positivistic materialism were worked out to their nihilistic conclusions.

The first development of science which undermined ethics was the exclusion of values as real properties of the world. The attack on this began with the attack on teleology. Where the world is understood as permeated by purpose, then being is constitutive of meaning and understanding of the world must lead to an awareness of what is valuable. But the conception of the world as activated by soul which justified ascribing purpose to

(1) Francis Bacon "Advancement of Learning" (1605) in THE PHYSICAL AND METAPHYSICAL WORKS OF LORD BACON tr. Joseph Devey, Henry G. Bohn, London, 1853, Bk III, ch. 2, p. 281.

things in nature was attacked by the proponents of the new science such as Bacon, Mersenne and Gassendi. Teleology, Bacon wrote, "is a barren thing, or as a virgin consecrated to God". (1) All understanding of nature had to be framed in terms of the causes which produce the effects, while final causes were rejected as saying nothing. This exclusion of teleology from the world has been so closely indentified with science that the importance of Nicholas Cusanus and Giordano Bruno in developing the new science has been virtually ignored because they conceived of beings in the world as ensouled.

Having excluded purpose from the world, science also excluded all but the so called primary qualities from the real world. Galileo insisted that "tastes, odours and colours and so on are no more than mere names so far as the object in which we place them is concerned, and that they reside only in the consciousness." and "To excite in us tastes, odours and sounds I believe that nothing is required in external bodies except shapes, numbers and slow or rapid movements."(2) This view was consolidated with the development of science, and as E. A. Burtt has argued, despite Newton's Neo-Platonist metaphysics emphasising the role of the deity, he

> was squarely behind that view of the cosmos which saw in man a puny irrelevant spectator (so far as a being wholly imprisoned in a dark room can be called such) of the vast mathematical system whose regular motions according to mechanical principles constituted the world of nature... The world that people had thought themselves living in - a world rich with colour

(1) ibid. Bk III, ch.5, p.144.
(2) Quoted by Brian Easlea from LIBERATION AND THE AIMS OF SCIENCE. Chatto and Windus, London, 1973, p.255 from Galileo Galilei "The Assayer" in DISCOVERIES AND OPINIONS OF GALILEO, S. Drake ed. Doubleday Anchor, 1957, p.274.

> and sound, redolent with fragrance, filled with gladness, love and beauty, speaking everywhere of purposive harmony and creative ideals - was crowded now into minute corners in the brains of scattered organic beings. The really important world outside was a world hard, cold, colourless, silent and dead... (1)

The orientation of science which conceived the world in these terms was not towards understanding the meaning or intrinsic value of beings in the world but solely towards its control. Bacon called upon men to "direct their united forces against nature herself; and by taking her high towers and dismantling her fortified holds, enlarge as far as God will permit the borders of man's dominion." (2) Descartes also understood the world as just something to be controlled, and compared the new science with the old conception of the world as follows:

> But when once I had arrived at some general notions in physics, and begun to test them in various special problems... I thus saw that one may reach conclusions of great usefulness in life, and discover a practical philosophy in the place of the speculative philosophy taught by the Schoolmen; one which would show us the energy and action of fire, air, and stars, the heavens, and all other bodies in our environment, as distinctly as we know the various crafts of our artisans, and could apply them in the same way to all appropriate uses and thus make ourselves masters and owners of nature... (3)

Thus Descartes defined animals as mere machines to be controlled and used while in the eyes of people in the

(1) Edwin Arthur Burtt THE METAPHYSICAL FOUNDATIONS OF MODERN PHYSICAL SCIENCE, 2nd ed. Routledge & Kegan Paul, London, 1932, p.236f.
(2) Francis Bacon "The Advancement of Learning" op. cit. Bk 4, ch.1, p.150.
(3) René Descartes DISCOURSE ON THE METHOD (1637) in DESCARTES: PHILOSOPHICAL WRITINGS tr. Elizabeth Anscombe and Peter Thomas Geach, Nelson,London, 1964,part 6, p.46.

Middle Ages, animals were assistants to man. With this view of nature knowledge must be seen as enabling us to manipulate the world more effectively, but for ends which cannot be arrived at or justified by this knowledge.

The application of the reductionist methodology to the understanding of society was first carried out by Hobbes. As already noted this involved a resolving of a complex entity into its simple elements and then using these simple elements to show how the complex element could be reconstructed. Society dissolved into its simple elements is a collection of individuals, and it is in terms of these that Hobbes attempted to understand society. These individuals were then conceived of as egoists. Hobbes writes: "Men from their very birth, and naturally, scramble for everything they covet, and would have all the world, if they could, to fear and obey them."(1) In terms of these selfish interests Hobbes tries to explain all human behaviour. This assumption of the selfishness of individuals is not arbitrary but simply follows from the approach adopted by Hobbes, since the simple elements had to be understood independently of their social context. Having taken this as the starting point it was simply assumed that individuals know what they want, though they might not know how to get it, and so ends were not subject to rational inquiry.

Hobbes in his reductionist account of thought also began the process by which consciousness generally was degraded.

(1) Thomas Hobbes THE ENGLISH WORKS OF THOMAS HOBBES Sir William Molesworth ed. 11 Vols. John Bohn, London, 1839-45, Vol. VII, p.73.

This reduction was fully developed in the eighteenth century by Helvetius (1715-1771) in ON THE MIND. (1) This work assumed that all psychological reality is a transformation and metamorphosis of simple sense perception. The analysis took the form of a reduction of all phenomena of consciousness to one level so that all moral qualities such as unselfishness, magnanimity, and self sacrifice were seen as really no different from the elementary impulses, appetites and passions. No moral greatness could rise above this plane of egotism, vanity and ambition since consciousness was seen as nothing but an undifferentiated mass of sensations, and all action was seen to be inspired either by the love of pleasure or the fear of pain. This idea formed the basis of utilitarianism in which the normal relationship between subjective feelings and the world was reversed. Instead of seeing happiness or unhappiness as the response to things in the world or aspects of life which are objectively good or bad, the utilitarians assumed that the only significance the world can have is its ability to produce happiness or unhappiness in the individual. What is taken to be good is then contingent on the subjective experience of individuals.

At the same time and also based on the levelling of consciousness, the status of rationality was severely questioned. If the contents of consciousness are simply the results of actions on the body of external forces

(1) Cassirer (1932) op.cit. p.25-27.

then perception is nothing but pictures somehow produced inside people's heads, and it is impossible to say anything about the world itself. This means that the apparent laws of nature are nothing but the means of making predictions from one sensation to another, and reason is nothing but a subjective faculty for comparing, contrasting and ordering of ideas in order to enable one to change the course of events. This scepticism and its implications for ethics were most fully worked out by Hume. Attacking the rationalist ethics of the Cambridge Neo-Platonists exemplified by Clarke and Wollaston, Hume argued on the basis of his reductionist and subjectivist conception of reason that "Reason is, and ought only to be, the slave of the passions, and can never pretend to any other office than to serve and obey them."(1) On this basis he concluded that "It is not contrary to reason to prefer the destruction of the whole world to the scratching of my little finger."(2) Reason was thought by Hume to be only capable of arriving at mathematical truths and truths of fact and existence, and Hume argued that it is impossible to derive an 'ought' or an 'ought not' from such matters of fact or existence,(3) or as it has since been formulated, it is impossible to derive an 'ought' from an 'is'.

As society is reducible to individuals, and thought reducible to sensations or ideas, the organism is reducible to matter so man, like other animals, can be thought of as a machine. This conception of man as nothing but a machine

(1) David Hume A TREATISE OF HUMAN NATURE (1738) 2 vols. Dent, London, Vol. II, Part III, sec.iii, p.127.
(2) ibid. p.128.
(3) ibid. p.177f.

first put forward by Hobbes was echoed in the eighteenth century by Holbach and La Mettrie. Thus La Mettrie wrote in L'HOMME MACHINE:

> Let us then conclude boldly that man is a machine, and that in the whole universe there is but a single substance differently modified... Against so strong and solid an oak, what could the weak reeds of theology, of metaphysics, and of the schools avail... (1)

This involved a complete reduction of man to the meaningless order of matter in motion and the final development of thought from the animistic conception of the world where spirit was primary to a world completely devoid of any subjectivity whatsoever.

The conclusion drawn from this reduction of man to a machine was that all his actions are completely determined. This made all ethical ideas meaningless as Frederick the Great pointed out in reply to Holbach's SYSTEM OF NATURE:

> After the author has exhausted all evidence to show that men are guided by a fatalistic necessity in all their actions, he had to draw the conclusion that we are only a sort of machine, only marionettes moved by the hand of a blind power. And yet he flies into a passion against priests, governments, and against our whole educational system; he believes indeed that the men who exercise these functions are free, even while he proves to them that they are slaves. What foolishness and what nonsense! If everything is moved by necessary causes, then all counsel, all instruction, all rewards and punishments are superfluous as inexplicable; for one might just as well preach to an oak and try to persuade it to turn into an orange tree. (2)

If this form of determinism is correct, then it is absurd to hold people responsible for their actions and

(1) Julien Offray de la Mettrie MAN A MACHINE (1747) Open Court, La Salle, 1961, p.148f.
(2) Quoted by Cassirer (1932) op.cit. p.71.

there is no reason to take responsibility for one's own actions.

The mechanistic conception of man was finally consolidated with the development of the Darwinian theory of evolution. This is generally understood to have explained away the appearance of order in the universe as simply the arrangement of matter which has survived in competition with other arrangements of matter. The individual is the product of this mechanical process and all that s/he is or does simply reflects the characteristics which have led his or her progenitors to survive. An individual's behaviour is thus determined, and whether s/he is vicious or sacrifices him or herself for others, s/he cannot be held responsible for his or her actions. The implications of this have been eloquently expressed by George Bernard Shaw:

> ... the Darwinian process may be described as a chapter of accidents... There is a hideous fatalism about it, a ghastly and damnable reduction of beauty and intelligence, of strength and purpose, of honour and aspiration, to such casually picturesque changes as an avalanche may make in a mountain landscape, or a railway accident in a human figure... If it be... a truth of science, then the stars of heaven, the showers of dew, and winter and summer, the fire and heat, the mountains and hills, may no longer be called to exalt the Lord with us by praise: their work is to modify all things by blindly starving and murdering everything that is not lucky enough to survive the universal struggle for hogwash. (1)

Since such a mechanistic conception of evolution implies that what there is in the world is that which has survived,

(1) Quoted by Richard Olson in Olson ed. (1971) op.cit. p.110, from BACK TO METHUSELAH: A METABIOLOGICAL PENTATEUCH, Brentano, N.Y., 1921, pp.xlv-xlvi.

there are no grounds within it for saying that what survives is any better than what has not, or that evolution should lead in one direction rather than another. Despite this, evolutionary theory has been used to justify almost everything. But its most enduring influence on ethical thought has been to focus attention on survival, and concern with dignity, rights, principles, justices, beauty, sympathy, the arts, the humanities and philosophy, and all other forms of life not utilizable by humans in their struggle for survival is rejected as of no importance or as an obstruction to what is really important: power and survival. Social Darwinism which gives expression to this point of view has taken two main forms, one stressing the relationship between individuals, the other the relationship between groups. The Darwinian attitude in relation to individuals is used to justify lack of principles or concern with others except as means to one's own ends, and to justify a social order which does nothing to protect the less powerful members of society or to provide for those in need. In relation to groups it is used to justify the oppression by one society or race of another and the unbridled use of force and fraud in international relations wherever this is likely to prove successful.

All these nihilistic ideas have coalesced in the twentieth century. The reduction of humans to the laws of nature means that people can be thought of things to be controlled in the same way as physical objects, and as the empiricist critique of reason implies that the only rationality associated with nature is the technological rationality by which it is brought under control, this attitude has come to be taken towards people. This must be seen as the end result of the permeation of the mechanistic conception of the world through all fields of culture. As Ludwig von Bertalanffy wrote in the Finale of his book PROBLEMS OF LIFE:

> The acceptance of living beings as machines, the domination of the modern world by technology, and the mechanization of mankind are but the extension and practical application of the mechanistic conception of physics. (1)

This technocratic control of humans is then further justified in terms of the struggle for survival between individuals or nations.

The positivistic/materialist world-view has been most fully accepted by the philosophers of the English speaking world, either explicitly as a metaphysical system as in the case of Bertrand Russell, or implicitly as these ideas have become sedimented into common sense as in the case of G. E. Moore and most of the analytical philosophers. Consequently, Russell accepted that ends are ultimately unjustifiable, G. E. Moore revived the idea that an 'ought' cannot be derived from an 'is', and referred to such attempts as 'naturalistic fallacies', while A. J. Ayer argued that ethical concepts are pseudo-concepts which simply express feelings in a way that is calculated to arouse similar feelings in others. As he put it:

> We can now see why it is impossible to find a criterion for determining the validity of ethical judgements... If a sentence makes no

(1) Ludwig von Beralanffy PROBLEMS OF LIFE Watts & Co. London, 1952, p.202.

> statement at all, there is obviously no sense in asking whether what it says is true or false. And we have seen that sentences which simply express moral judgements do not say anything. They are pure expressions of feeling... (1)

Such ideas have become widely accepted and the fact/value dichotomy has come to be taken as virtually common sense. All of the major schools of ethics in Britain this century: intuitionism, emotivism and prescriptivism have worked within the framework of this assumption, and the description of twentieth century moral philosophy in Britain given by R. G. Collingwood in his autobiography of 1939 still largely holds:

> The pupils , whether or not they expected a philosophy that would give them...ideals to live for and principles to live by, did not get it; and were told that no philosopher (except of course a bogus philosopher) would even try to give it. The inference which any pupil could draw for himself was that for guidance in the problems of life, since one must not seek it from thinkers or thinking... one must look to people who are not thinkers (but fools), to processes that were not thinking (but passion), to ideals that were not ideals (but caprice). (2)

(1) Alfred Jules Ayer LANGUAGE, TRUTH AND LOGIC (1936) Penguin, Harmondsworth, 1971, p.144.
(2) R. G. Collingwood AN AUTOBIOGRAPHY Oxford Uni. Press, London, 1939, p.48.

THE ROMANTIC REACTION AND ITS EFFECTS

The most important opposition to the rise of the mechanistic conception of humans and its implicit nihilism came from the Romantic movement. The increasing exclusion of the subjective realm from the materialist's conception of the world produced a reaction the main concern of which was to do justice to subjectivity and all its manifestations. This Romantic movement is generally understood to be simply counterposed to science, with science being held to be essentially rational and Romanticism being held to be essentially emotional and irrational. Science is seen to be concerned with the way the world really is and Romanticism with subjective feelings. However, this is Romanticism as understood from within a culture in which positivistic materialism has prevailed and the real challenge of Romanticism has been negated. Romanticism is then only considered insofar as it does not conflict with science. The original Romantic movement should be understood as an attempt to completely replace the world-view of positivistic materialism with a conception of the world within which the subjective realm could be adequately understood.

The most important idea underlying the Romantic movement is not so much the importance of feeling but the creative potential of humans. The first thinker to emphasize this was Giambattista Vico (1668-1744), but he was ignored by his contemporaries and his work was not taken seriously until his main ideas had been worked out independently by

Herder. The thinkers who did most to inspire the movement based on the assumption of man's creativity were Rousseau (1712-1778) and Herder (1744-1803).

Rousseau exalted childhood and primitive life rather than civilization, and nature as it was experienced immediately rather than as it was conceived by materialist physics, and achieved notoriety by arguing in an essay that the revival of the arts and the sciences had corrupted morals. In opposition to the philosophes of the Enlightenment with their faith in progress through science, he argued that happiness belonged to men in a state of nature and that virtue was possible in simple societies where men lived austere, frugal lives. His hostility to civilization was expressed in all his major works. The first chapter of THE SOCIAL CONTRACT begins: "Man was born free, and he is everywhere in chains."(1) and ÉMILE begins: "God makes all things good; man meddles with them and they become evil."(2) The aim of Rousseau's educational prescription was to preserve natural feeling for nature and for others. Rousseau redefined the meaning of nature so that for him it was not the source of truth or the sum of all that exists, but the world as it is before it is adulterated.

However, while Rousseau's exaltation of nature and the 'natural' was important, the most significant of his ideas were those concerned with how to produce a reconciliation between society and nature such that human groups might live in accordance with both the principles of nature and

(1) Rousseau (1968) op.cit., p.49.
(2) Jean Jacques Rousseau ÉMILE tr. Barbara Foxley, Dent, London, 1966, p.1.

of justice. The NOUVELLE HELOISE described a society functioning as a family unit with such harmony while THE SOCIAL CONTRACT was a political theory in the language of law aimed at the same end. The idea underlying these works is that individuals are able to attain a higher state of freedom than they could have in the state of nature by willingly submitting themselves to principles deriving from the interests of the society as a whole. This involved a new conception of freedom, that is, as the freedom to be able to do what one ought to do rather than as the freedom from restraint to act arbitrarily. Thus in THE SOCIAL CONTRACT, individuals do not surrender their liberty but convert their liberty from simple independence into political and moral freedom, and in doing this they transform themselves from creatures living according to their passions and impulses into men living humanly according to reason, conscience and the general good. The laws and principles through which such freedom is to be attained must be an expression of the general will which, as distinct from the will of all which is simply the sum of all actual wills, is the ideal will of the group as a whole. In this way Rousseau transcended the egoistic individualism of Hobbes and the other philosophes and found a source of right in the concrete world rather than in the realm of abstractions of the natural law theorists. In doing this Rousseau introduced a holistic conception of society through which individuals attain freedom, and he developed a conception of individuals as self-determining rather than as mechanisms.

While Romanticism developed in France, Britain and Germany, it was in Germany that it was most successful. This was partly for social reasons, but also because the intellectual climate was prepared by Leibniz and his followers. The thinker who accomplished the task of articulating Romanticism into a general world-view was J. G. Herder and virtually all anti-reductionist or anti-mechanist conceptions of man developed since Herder have been influenced by ideas which he originally espoused. (1)

In opposition to the philosophes' belief that reality is ordered by universal, timeless, objective laws which can be discovered by rational enquiry, Herder emphasised the particular and the concrete. He argued that each activity, individual, historical period and civilization possesses a unique character of its own which would only be obliterated by any attempt to reduce it to its constituents. In opposition to such reductionism, Herder argued that divisions are artificial abstractions which obscure the unity of the phenomena, particularly where humans are concerned. He adopted an evolutionary view of the world and tried to understand all phenomena in an evolutionary context, and in place of materialism he argued for a dynamic conception of being in which individuals were seen as creative processes of becoming.

Herder was one of the first of the Naturphilosophen who

(1) Isaiah Berlin "Herder and the Enlightenment" in ASPECTS OF THE EIGHTEENTH CENTURY ed. Earl R. Wasserman, John Hopkins Press, Baltimore, 1965, pp.47-104 and Charles Taylor HEGEL, Cambridge Uni. Press, Cambridge, 1975, pp.13-27.

reacted against the conception of the world as mechanical and dead from which man as a subject is exiled. However, rather than returning to a medieval conception of the world as embodying a set of ideal meanings discoverable through the contemplation of ideas, Herder argued that nature is a great stream of life of which we are part and with which we have contact by our sympathetic insertion into this stream. Spinoza influenced Herder, but was understood by him not as the philosopher of the anti-subject, but as having conceived the world pantheistically as a unified totality unfolding itself in such a way that the subject could be seen to fit into a universal current of life. Leibniz's concept of 'vis viva' was developed into the concept of a great creative force Herder called 'Kraft' which he described thus: "what is alive in creation is, in all forms, shapes, channels, one spirit, one flame." (1) This was seen to consist of different 'Krafte' or dynamic, purpose seeking forces. These forces were not mechanical as in Descartes, nor insulated from each other as in the Monadology of Leibniz but were thought to clash, combine and coalesce to constitute all movement and growth. Reality was then seen as a symbiosis of these vital forces and a somewhat static environment. While the dynamism of beings is provided by these vital forces, these forces require the right environment. This is evident from the way plants or people wilt if transplanted to a radically new environment. This dynamic world was then seen to be evolving to produce higher and higher levels of beings, with man seen as a special creation at the top of nature's scale of being.

(1) Cited by Berlin (1965) op.cit. p.77, from J.G. Herder, SAMLTCHE WERKE,ed. B. SUPHAN, Berlin; 1877-1913,Vol.VIII,p.178.

With this conception of nature as a starting point, human life was explained by reference to its physical environment and its origins and following Montesquieu, Herder argued that the variety of civilizations is largely determined by differences of physical and geographical factors which collectively he referred to as 'climate'. In his account of human life he adopted an evolutionary approach, beginning with the links which connect humanity to organic life, then considered the primitive or prehistoric phases of human society, and concluded with an examination of recorded history up to the sixteenth century. In this he adopted a teleological and progressivist notion of historical development in common with the Enlightenment philosophes, but his conception of societies and their dynamics involved a departure from the ideas of these thinkers.

Herder compared societies to organisms, and emphasised the uniqueness of each society, regarding each society as having its own dynamic principle of development. The notion of society as organic was a revival of the medieval conception, while the emphasis on the particular rather than the universal in societies reflects the influence of one of Herder's teachers, Hamann. However, the idea of each society having a unique dynamic principle was original to Herder and can only be understood in terms of the Leibnizian concepts on which it was based. (1) As already pointed out, Leibniz developed a new conception of substance. By conceiving of the universe as composed of

(1) Cassirer (1932) op.cit. p.228f.

a multiplicity of substances, or as he referred to them, of monads, he gave a central place to individuality. But more importantly, rather than substance being conceived of as the unchanging aspect of the world with changeability pertaining only to accidents, the enduring and the mutable were seen to be mutually dependent. Mutability was no longer subordinated to the changeless as the stability of the monad was seen to involve the constant rule of its progression. Thus substance is dynamic, being directly active and revealing its nature in the sequence of its activities. Its stability lies in this capacity to emanate what is preformed within it without cessation. In the totality of the monad, identity and continuity are combined, and its perfection is only revealed in the completeness of its development. It is this concept which Herder applied to organisms, individuals, societies and civilizations.

Thus while Rousseau's understanding of virtue as the submitting of oneself to principles implies a conception of the subject as self-defining, it was Herder on the basis of Leibniz's concept of the self-unfolding monad who was able to fully develop this idea. According to Herder, human activity is the expression of the personality or spirit of an individual or group and it was in terms of the categories of expression that he developed his conception of man. (1) Each individual and group was seen to be realizing itself through the expression of its inner nature.

(1) Charles Taylor (1975) op.cit. pp.13-18.

This is a teleological conception of beings, but this purposefulness was not understood in terms of independently fixed goals or plans. Rather, the life of the individual or group was seen to unfold from within, imposing itself against obstacles on external reality, and each individual and group was seen to have its own way of being human. The inner nature which is realized is not transparent to the individual or group, but is only clarified and made determinate through its expression.

From this basis, Herder argued that each society must be understood in its uniqueness, having its own character and value, rather than in terms of universal laws or principles. He insisted that each culture must be grasped as a whole from within, in terms of its own stage of development, purposes and outlooks. Only within the context of a whole culture is it possible to understand the ends people strive for. Consequently, "One must enter the time, the place, the entire history [of a people]" and "feel oneself (sich Einfuhlen) into everything."(1) (the word 'Einfuhlen' was coined by him). Thus a reader of Hebrew scriptures must be "a shepherd with shepherds, a peasant in the midst of an agricultural people, an oriental with the primitive dwellers in the East."(2) The ideals and behaviour of individuals or groups must not be judged against a common measure, and Herder railed against those who tried to interpret and judge people of other cultures against the standards of their own. Herder valued everything authentic, and while he had his preferences, he was

(1) Cited by Berlin (1965) op.cit. p.79, from Herder (op.cit.) Vol.V, p.502.
(2) Cited loc.cit. from ibid. Vol.X, p.14.

prepared to defend and penetrate or feel himself into the essence of every culture, trying to grasp what it must have been like to live, contemplate goals, think and imagine in the unique ways of each particular society, and so to grasp the patterns of life in terms of which alone such groups must be defined. Thus Herder wrote: "Every nation has its own inner centre of happiness, as every sphere has its own centre of gravity."(1) Then through a study of other cultures we may succeed in grasping what we, in our turn may be and what we may create. This is not to be achieved by learning the lessons of the past, since each age is unique. Rather, the vision of past cultures which have successfully realized their potential should inspire us to find our own centre of gravity or that of the group, the nation, region or community to which we belong, and thereby to realize our own unique potential.

While Herder conveyed the notion that all aspects of a particular people, the way they speak, move, eat, drink, their laws, architecture, theology and social outlook, their music and dance forms, are pervaded by patterns and qualities unique to themselves, he believed that it is in language that these patterns and qualities are contained and manifest themselves most fully. Language was understood by Herder in evolutionary terms. The Enlightenment notion of language as having been invented at a particular time was rejected as absurd, as was the nominalist idea of language according to which words are designed to name

(1) Cited loc.cit. from Vol.V., p. 509.

things. In its place Herder argued for the primacy of expression and stressed the relationship between emotion, action and language. He argued that the earliest language was in the form of cries and expressive gestures to indicate passions and emotions, and that this gradually gave way to an era in which communication occurred through the use of metaphors and the sensuous imagery of poetry. Herder maintained that poetry should not be seen as a cool description of nature or of anything else but as a spur to action. It stimulates and directs the actions of heroes, hunters and lovers and can be understood by feeling oneself into the situation in which such words sprang into existence. Along with poetry, Herder exalted folk music, mythology and religion for the vision of the world they produce and the actions they inspire. It is only in later, more sophisticated stages of development that the more prosaic and didactic forms of language characteristic of scientific discourse develop, and Herder implied that at this stage the vitality of a culture is on the wane, with uncreative reflection replacing spontaneous and imaginative invention. He then argued that men are virtually formed through the language they inherit. To think is to use symbols, we do not have thoughts and then clothe them with words, and since to create a language would require thought which only becomes possible through language, to think and to speak is to "swim in an inherited stream of images and words; we must accept these media on trust: we cannot create them."(1) Since words connect passions with things,

(1) Quoted ibid. p.66 from ibid. Vol.XII, p.357.

the present with the past, thus making possible memory and imagination and so creating the family, society, literature and history, the individual is inserted into the social context through his appropriation of language. This means that through language is created the entire network of beliefs and behaviour that binds men together. Therefore social growth and the cycles of infancy, youth, maturity and decay will be manifest in a people's language. Thus Herder wrote: "Language expresses the collective experience of the group."(1) and "Has a nation anything more precious than the language of its fathers? In it dwell its entire world of tradition, history, religion, principles of existence; its whole heart and soul." (2)

Herder rejected the idea of a wholly solitary man as opposed to a self-isolated individual as inconceivable, since individuals were seen as only able to define themselves through their association with others and through language. Individuals require their foundations in the culture through which they have attained their humanity. They need to belong to a group or culture, and to be cut off from the spirit of their people would enfeeble them. Herder emphasized the unity of the historical stream as something which cannot be defined except in terms of tradition, milieu and culture, and saw these as generated by natural forces: the climate, physical structure and biological needs. The interplay of all these was then seen to produce the dynamic, collective process called society. However,

(1) Quoted ibid. p.66, from ibid. Vol. XI, p.225.
(2) Quoted ibid. p.63, from ibid. Vol. XVII, p.58.

the individual was not reduced to a cypher for these forces but was seen to play an active part in this stream. As with Rousseau, the individual through his participation in the social order was seen to be self defining. While dependent upon society, the individual was seen by Herder to play an active part in his or her process of formation. This is especially true of the artist who, creating out of the fullness and experience of his or her whole society, especially out of the memories and antiquities which shape its collective individuality, illuminates the experience of society to his or her fellows. Writes Herder: "A poet is a creator of a people; he gives it a world to contemplate, he holds its soul in his hand."(1) But for Herder all men are in some degree artists as all artists are first and foremost men - fathers, sons, friends, citizens and so on. And so each individual lives in a world of which, in some sense, together with others s/he is the maker, or as Herder put it: "We live in a world we ourselves create."(2)

Herder developed this expressivist conception of man further in his psychology. He not only opposed the atomist, mechanist, utilitarian picture of man of the philosophes, but also the faculty psychology of Wolff. He argued that the human mind is not split into compartments, but reason, will, desire and so forth are all part of an indivisible whole. Thought and feeling were seen as inseparable. Rather the individual must be seen as a self-realizing totality who expresses his or her whole personality in all

(1) Quoted ibid. p.93 from ibid. Vol. II, p.61.
(2) Quoted loc.cit. from ibid. Vol. VIII, p.252.

his or her actions, thoughts and creations. It is only when this process of self-realization is stultified that fractures appear between feeling and thought or action.

Herder was one of the originators of the secular doctrine of the unity of fact and value, theory and practice, 'is' and 'ought', intellectual judgement and emotional commitment, thought and action. His ideas influenced virtually every thinker who has since reacted against scientific materialism. He met and strongly influenced Goethe, setting German literature on new lines. He inspired the Sturm und Drang movement with his doctrine of spontaneity and naturalness, his emphasis on striving and the cult of genius, his notion of the spirit of a people and his interest in folk songs and mythology, and his preference for feeling over abstract reasoning. He was one of the first of the Naturphilosophen whose influence on science has already been described. Hölderlin, Novalis, the brothers Schlegel, Schleiermacher, Fichte, Schelling, Hegel and von Humboldt were all in his debt.

The most important of these thinkers was Hegel. Hegel followed Fichte and Schelling in trying to synthesize Herder's expressivist anthropology with Rousseau's notion of the rational autonomous will as it had been developed by Kant by conceiving of being as a self-developing subject, a single monad.(1) In his metaphysical system Hegel gave a dominant place to this new conception of humanity while trying to take into account the achievement of reductionist

(1) Charles Taylor HEGEL (1975) op.cit. Part I.

materialism. The universe as a cosmic subject was seen to posit nature as its other against which it could struggle and the development of humanity was seen as its process of self-realization and self-explication. If Hegel had been successful in this attempt he might have replaced the positivistic materialist synthesis, but while particular aspects of Hegel's system were taken over by a number of major thinkers, very few people have been prepared to accept the system as a whole. Along with the breakup of the Hegelian synthesis, most of those ideas deriving from the Naturphilosophen have been rejected or forced into a minor role by the scientific community, leaving those ideas deriving from the expressivist anthropology in a marginal position within our culture.

Herder's ideas live on in the work of various existentialist thinkers through such concepts as authenticity and in existentialist psychology in concepts such as self-actualization; in those versions of Marxism which have tried to build on the earlier works of Marx with its emphasis on the self-realization of the human species; in idealist philosophers such as Dilthey, Cassirer and Croce with their emphasis on the expressivist nature of man and the role of symbolic universes in the constitution of man's world; in history where empathising or 'feeling oneself' into the object of study has been developed by people like Dilthey and Collingwood as a method in opposition to the search for universal laws; in the social sciences which have reacted against utilitarianism and emphasised the need to belong to a community in order to attain an identity and an idea of how life should be lived; and in the sociology of knowledge and in philosophical anthropology in which the mechanistic conceptions of man have been challenged. However, all these movements are characterized by a tendency to ignore the relationship between their own conception of humans and the conception of humans and their place in the world which is implied by the dominant ideology of society - positivistic materialism. Science tends to be treated as a cultural product and nature a shadowy background to human activity, and except in the case of a few existentialist psychologists, no attempt is made to confront the fact that the dominant world-view implies that humans are simply mechanisms whose behaviour is determined by the laws of physics. In concentrating almost exclusively on subjective phenomena, these movements tend to reinforce the separation between the objective and subjective realms. By insulating themselves in this way, these ideas fail to confront the positivistic materialist world-view, becoming mere decorations, hiding or obscuring the prevalence of reductionist manipulative ways of conceiving theworld. The ideas of these movements are espoused in the schools of humanities in universities and are a comfort to people in their private lives but the ultimate court of appeal for all knowledge claims remains science, and as soon as the ideals implicit within these ideas conflict with technicist rationality it is accepted by those in power that they have no scientific foundation and so must give way to what is deemed to be really important.

Technicist rationality becomes even more potent when it does not simply displace the ideas of the Romantics but is complemented by them. Such a complementary relationship is evident in those individuals who see the world and others as only means to their own self-actualization. However, such complementarity has been most significant in political movements. The ideas of the Russian Marxists represent a complementary relationship between positivistic materialism with its implicit justification of a technicist rationality and a dissociated but complementary Romantic rationalism. The foundations for this lie in the thought of Plekhanov and Lenin. Thus Lenin wrote:

> If you hold that it is given, a philosophical concept is needed for this objective reality, and this concept has been worked out long, long ago. This concept is matter. Matter is a philosophical category designating the objective reality which is given to man by his sensations, and which is copied, photographed and reflected by our sensations, while existing independently of them.(1)

This materialist view implies a world capable of being controlled and manipulated, and given this, it was inevitable that a social revolution based on this philosophy would be organized along technicist rationalist lines. That these ideas paved the way for Stalinism was argued by Anton Pannekoek in his book LENIN AS PHILOSOPHER published in 1938.(2) But such a development was also facilitated by the idea also accepted by Plekhanov and Lenin that the history of humanity could be understood as humanity's self-realization to be finally achieved by the most dehumanized class, the proletariat. The combination

(1) V. I. Lenin "Materialism and Empirio-Criticism" in V. I. LENIN COLLECTED WORKS, 1908, tr. Abraham Fineberg, Progress Publishers, Moscow, 1962, Vol.14, p.130.
(2) Anton Pannekoek LENIN AS PHILOSOPHER (1938) Merlin Press, London, 1975, Chas 6 & 7.

of these two sets of ideas justified the development of a highly centralized communist party, which as the vehicle of humanity's process of self-realization and the representative of the proletariat could be held to have a monopoly on truth and the justification to act without principles in its struggle to bring about the millenium, and as the active agent in a world of matter it was justified in treating the beings of this world, including humans, as things to be manipulated and controlled. This dualism is generally maintained by the apologists for the Soviet government by following Plekhanov's lead in interpreting Marx through the philosophy of Spinoza in which substance is seen to have two attributes: extension and thought, (1) with extension implying a world of matter to be controlled, and thought understood as dialectical logic implying a logically unfolding history in which the Russian Communist Party is the ultimate manifestation.

A complementary relationship between positivistic materialism and irrationalist Romantic ideas characterized Naziism. While positivistic materialism was identified by the Nazis with rationality, irrationalism was championed, with emotion being given a place above reason, mythological thought raised above science, and Herder's ideas on the importance of a people's cultural heritage developed into a racist, imperialist, chauvanistic nationalism. Such irrationalism did not lead to a downgrading of technicist rationality but complemented it. The ultimate ends which technicist

(1) E. V. Ilyenkov DIALECTICAL LOGIC, Progress Publishers, Moscow, 1977, Essay 2.

rationality could not provide were supplied by appeal to emotion and myth, and the means to realize these ends were provided by technicist rationality. The technicist, manipulative conception of and attitude to people has never been developed so completely as in the Nazi state.

NIHILISM AND THE SCIENCES OF HUMANITY

The way in which the conception of man and his place in the world implied by positivistic materialism has come to permeate and form an integral part of the social order is through the development of human sciences modelled on the positivistic materialist physical sciences. Treating people and societies as objects to be explained in terms of laws separates the scientists as investigating subjects from the object of investigation, denying the personal involvement of scientists in society and denying the effect of scientific ideas on people. Along with this it denies the potential of people to transcend their situation by understanding it, to develop new ideas and on this basis to develop new modes of life, new types of social relationships and new forms of society. It also denies the uniqueness of people and the role of empathy in understanding this uniqueness. Finally, while such sciences generally claim to be value free, the conception of humans and their place in the world assumed by them is always implicitly evaluative. The final result of a conception of people as objects governed by laws is to justify treating them as nothing but things to be manipulated and controlled.

The first of the sciences of humanity to achieve widespread recognition was economics. Economics typifies these sciences in purporting to be a positive, value-free science while being based on an explicit conception of man and nature which implies how people ought to act. As Walter Weisskopf wrote:

> The economic image of man, although referring to actual economic behaviour, has almost always a normative connotation: Man <u>should</u> be such and such in order to be an effective subject of the economy. Assumptions in economics about the nature of man, then, are rarely ever factual statements but value judgements - judgements as to how man ought to be, how the economy wants man to be, what he should want, will, think, and do so that the aims of the economy become his aims.(1)

I will now try to show what images of man and nature have been assumed by mainstream economics and what values these have implied, and how the development of these has led economics to become increasingly nihilistic.

It has been noted by Marx that the foundations for the development of economics were laid with thenew modes of thought and conception of nature which developed with the rise of the new science, most notably in the philosophies of Descartes and Bacon. Thus he wrote:

> That Descartes, like Bacon, anticipated an alteration in the form of production, and the practical subjugation of Nature by Man, as a result of the altered methods of thought, is plain from his "Discours de la Methode"... In the preface to Sir Dudley North's "Discourses upon Trade" (1691) it is stated, that Descartes method had begun to free Political Economy from the old fables and superstitious notions of gold, trade, etc. On the whole, however, the early English economists sided with Bacon and Hobbes as their philosophers; while, at a later period, the philosopher ... of Political Economy in England, France, and Italy was Locke.(2)

This geneology of the philosophers whose ideas led to the establishment of economics suggests how the conception of

(1) Walter A. Weisskopf "The Image of Man in Economics" in SOCIAL RESEARCH, Vol. 40, 1973, pp.547-563, p.547.
(2) Karl Marx CAPITAL: A CRITICAL ANALYSIS OF CAPITALIST PRODUCTION, 3 Vols., tr. Samuel Moore and Edward Aveling, ed. Frederick Engels, (1887) Progress Publishers, Moscow, 1954, Vol. 1, p.368n.

nature as being of no significance or value except as something that can be controlled and used was built into the basic assumptions of economic theory.

The first thinkers to define the domain of economics as a whole were Quesnay and Smith. These thinkers treated the economic system as a totality rather than focussing on particular issues as had previous thinkers, and attempted to emancipate economics from political theory.(1) Smith was of much greater significance in this since he succeeded in working all the achievements of the past into an all encompassing, integrated theory and so bringing economics to maturity. In order to understand the economy in accordance with the modes of thought of the new science, Smith understood human interaction in terms of the exchange of commodities produced by people's labour. The products of people's efforts were thus treated as objects quantifiable in terms of the labour embodied within them to facilitate the explanation of the economic domain of society by means of laws governing elementary and quantifiable objects. The effects of understanding social relationships in these terms has been described by Marx:

> A commodity is therefore a mysterious thing, simply because in it the social character of men's labour appears to them as an objective character stamped upon the product of that labour; because the relation of the producers to the sum total of their own labour is presented to them as a social relation, existing not between themselves, but between the products of their labour... the relations connecting the labour of one individual with that of the rest appear, not as direct social relations between individuals at work, but as what they really are, material

(1) Eduard Heimann HISTORY OF ECONOMIC DOCTRINES (1945) Oxford Press, N.Y., 1964, Ch.3.

> relations between persons and social relations between things. (1)

This means that not only has nature considered to be of no intrinsic value but people themselves are to be only regarded as significant insofar as they possess money and commodities or can sell their labour as a commodity. Only commodities are held to be of real value.

Yet despite this reduction of nature to something to be controlled and the reduction of humans to the means for the production of commodities, the image of man and his place in the world adopted by Smith in the WEALTH OF NATIONS is still implicitly normative. Smith worked within the framework of a natural law philosophy in which 'normative' law and 'positive' law were not sharply separated and science was seen as the study of the laws of nature by which order is maintained in the world. (2) As already pointed out, 'nature' was here not understood to mean the actual physical reality or all that exists but the foundation of truth, and the 'natural' was understood to mean the 'rational'. To understand humans in terms of such natural laws then is to find the rational laws by which order can be maintained between people, and Smith attempted to discover the laws of society according to which individual economic interests would neither be in conflict with each other nor with the common good. Were people to act in accordance with such laws, then individual interests and the common good would

(1) Marx (1887) op.cit. p.77f.
(2) Heimann (1945) op.cit. p.49f.

be reconciled by the 'invisible hand'.(1) The assumption of a natural (rational) harmony of interests was in this way the cornerstone of Smith's economic theory.

In working out how such a harmony of interests could be possible, Smith accepted the validity of the Protestant work ethic. Whereas in the Middle Ages excessive concern with money making was condemned with the statement "the merchant can never, or hardly ever, please God", Calvin and the English puritans regarded economic attitudes such as thrift, diligence, sobreity, frugality and work in accordance with one's calling as Christian virtues.(2) The entire ethical system of Puritanism centred around labour and hard work. This attitude was taken as expressing the real nature of man by Smith:

> The desire of bettering our condition... comes with us from the womb and never leaves us until we go to the grave... Every individual is continuously exerting himself to find out the most advantageous employment for whatever capital he can command... (There is) a certain propensity in human nature... the propensity to truck, barter, and exchange one thing for another... (3)

Smith left it open as to "whether this propensity be one of those original principles in human nature of which no further account can be given; or whether, as seems more probable, it be the necessary consequence of the faculties of reason and speech" but asserted that this propensity to truck and barter "is common to all men".(4)

(1) Adam Smith THE WEALTH OF NATIONS (1776) Modern Library N.Y., 1937, p.423.
(2) Walter A. Weisskopf THE PSYCHOLOGY OF ECONOMICS, Uni. of Chicago Press, Chicago, 1955, p.14.
(3) Adam Smith op.cit. pp.13, 324 and 421.
(4) ibid. p.13.

It is clear in Smith's work that this account of the nature of man was not just a description but also a moral imperative; it is the attitude which is required for the economy to function and for capital to accumulate. (1) Thus industry and thrift were continually praised, while idleness, profligacy and unproductive spending were seen as vices and attributed to the royal courts and their aristocratic retinues. Furthermore, the rewards people get for their economic activities were justified by the labour theory of value according to which the exchange value of an article is seen to be determined by the labour needed to produce it. Following Locke, Smith then justified the institution of private property on the grounds that labour belongs to an individual, so anything that an individual "hath mixed his labour with"(2) must also belong to him. Thus the labour theory of value, while in accordance with the reductionist tradition of science, provided the ultimate, simple, homogeneous, quantifiable units which could be used to explain all other economic phenomena, and at the same time unified individualism, private property and market values into a related system and sanctified labour and work as moral obligations.

This synthesis, embodying the ethics of protestantism and natural law theory was soon to be attacked. Thomas Malthus argued that there is no inherent harmony in the economic order and that Smith's optimism about the future of society could not be justified.(3) He argued that since the growth of productivity could only take place arithmetically while

(1) ibid. passim.
(2) John Locke OF CIVIL GOVERNMENT (1690) Dent, London, Bk II, Ch.v, p.130.
(3) Heimann (1945) op.cit. pp.84-92.

the population would grow geometrically if unrestrained, the raising of the living standards of the working class by increased productivity would immediately lead to an expansion in the population which would again reduce the workers to subsistence level. He concluded from this that:

> A man who is born into a world already possessed, if he cannot get subsistence from his parents on whom he has a just demand, and if the society does not want his labour, has no claim of right to the smallest portion of food, and, in fact, has no business to be where he is. At Nature's mighty feast there is no vacant cover for him. She tells him to be gone.(1)

Furthermore, Malthus argued that there is no inherent tendency for the economic order to harmonize interests. He showed that since there is no inherent reason for savings to find an outlet in investments, it is possible for there to be economic crises or depressions in which people would not have the money to buy what is produced. That this could be possible indicated that there was nothing inherently rational about the laws governing the economic process and undermined the belief in the existence of such a natural harmony.

While Ricardo was not convinced by Malthus' arguments generally, he did acknowledge that there is no inherent tendency for society to improve indefinitely. In fact, he predicted that through diminishing returns to investment, the economy must eventually stagnate.(2) So while Ricardo developed the labour theory of value, extolled the virtues of hard work, insisted that work effort was the only morally

(1) Cited ibid. p.86f.
(2) ibid. p.105f.

valid source of rewards, and tried to show that this is in fact how income is really distributed in the economic system if it is free from outside interference, his ethical views were no longer founded on the conviction of the natural law theorists that there exists a rational harmony in the universe.

With the disintegration of the philosophy of natural law there arose an alternative economic theory based on the assumptions of utilitarianism. This is referred to as the neo-classical school. The neo-classicists revived the utility theory of value in opposition to the labour theory of value, arguing that the value of a unit will be equal to its marginal utility so that the marginal units of money spent on different goods will bring the individual equal satisfaction. While this marginalist doctrine was first put forward by Gossen in 1854(1), it was only in the 1870's that a large number of thinkers began to argue for this position. Its relation to utilitarianism is most clearly evident in one of its major exponents of this time, Stanley Jevons who developed the position on a utilitarian psychology in terms of a calculus of pleasures and pains. (2) However, it was Alfred Marshall (1842-1924) who developed the ideas of this school most fully in his PRINCIPLES OF ECONOMICS first published in 1890.

The classical conception of economic man was based on a concern with the objective goals of production, while in neo-classical theory the basis shifted to the subjective goals of need satisfaction. However, in Marshall this subjectivism was thoroughly blended with an emphasis on economic rationality.

(1) ibid. p.251f.
(2) ibid. p.185.

This rationality was that associated with the calculation necessary for any individual to maximise his or her advantage, utility and profit. Thus, his ideal of man was that of a deliberative, self-controlled nature which he characterized in terms of:

> ... a certain independence and habit of choosing one's own course for oneself, a self-reliance; a deliberation and yet a promptness of choice and judgement, and a habit of forecasting the future and of shaping one's own course with reference to distant aims.(1)

This ideal of man was adopted by Marshall as the basis of all his economic models and the consumer, the housewife, the entrepreneur, the saver, etc. were all seen to accord with this. It was then shown how such ideal behaviour leads to long-run beneficial results for the whole of society, with the optimum use of resources to maximise welfare. Thus the ideal served both as explanatory and a normative ideal as had the concept of man assumed by Smith.

Despite these value connotations of Marshall's concept of man, his approach brought to the fore the problems of the utilitarianism of the neo-classicists. Conflicting drives and inclinations of a qualitatively different nature were reduced to a quantitative denominator. This meant that incommensurable aspects of life such as dignity and sensuous pleasure were treated as ends that could be traded off against each other. As Marshall wrote: "the economist studies mental states rather through their manifestations than in themselves; and if he finds they afford evenly balanced incentives to action, he treats them prima facie as for his

(1) A. Marshall PRINCIPLES OF ECONOMICS 8th ed. Macmillan, London, 1920, p.5.

purposes equal."(1) And all that cannot be priced was devalued. Since such things as the pleasure obtained from scenery or the discomfort from pollution do not give a monetary return or cost anything, they had to be considered as of no economic significance. To take them into account would have uneconomic consequences which in terms of economics is *ipso facto* bad. Since the whole theory was based on models of individuals exchanging money for goods and services, the community as a whole and its relation to future generations were largely ignored. This meant that such things as preventative medicine, cultural activities of no immediate market value and the rights of future generations to non-renewable resources were simply not taken into consideration, and the significance of each individual as a member of society was even more fully ignored than in the economics of Smith and Ricardo. While Smith's and Ricardo's image of economic man, despite its emphasis on commodities and their exchange, held that there was some intrinsic value in working according to a calling and taking part in the development of man's control over nature, Marshall's economics completely excluded any consideration of the creative nature of work. Work could only be regarded in relation to the individual and as a disutility to be balanced against the utility derived from the income received for it. Finally, while Adam Smith's economics was based on the assumption of the rights of the individual, no such implicit commitment follows from utilitarian foundations. This meant that individual rights had to be considered as just one subjective end among others to be balanced by economic cost, or they had to be counterposed

(1) ibid. p.16.

against what is economic, and as such were open to rejection as being without significance.

The great depression of the 1930's revealed the inadequacy of neo-classical economics with its assumption that perfect competition would lead to the best distribution of resources to maximise happiness. It became evident to economists that the economic system could be in a state of equilibrium with a great deal of unemployment, and attention shifted away from individual decision making or micro-economics to fluctations in the whole economy or macro-economics. The pessimistic views of Malthus were revived and developed, especially by Keynes, into a general theory of the business cycle. Keynes held that the greatest threat to continued economic growth was the inability of society to consume its growing income and that the rising propensity to save was an ever present danger to the economic system. He stated in his conclusion to THE GENERAL THEORY OF EMPLOYMENT, INTEREST AND MONEY:

> Thus our argument leads towards the conclusion that in contemporary conditions the growth of wealth, so far from being dependent on the abstinence of the rich, as is commonly supposed, is more likely to be impeded by it.(1)

While the implications drawn from this were that there should be more government interference in the economy and a more equitable distribution of income, it also meant that the state of the economy as a whole became the end to be considered, and individuals were thoughtof not as rational agents pursuing their best interests through the economic process, but as manikins to be manipulated in the control and management of the economy. This eventually led to a totally irrationalist conception of economic man. While Marshall counselled

(1)John Maynard Keynes THE GENERAL THEORY OF EMPLOYMENT, INTEREST AND MONEY (1936) Macmillan, London, 1964, p.373.

"wholesome enjoyments" and the "subordination of the desire for transient luxuries to the attainment of more solid and lasting resources which will assist industry in its future work, and will in various ways tend to make life larger."(1), modern economic man has his demands directed by advertising and salemanship. The end is to maintain consumer demand, and rather than the real interests of individuals being considered, the sale of the most wasteful, harmful goods and services are economically justified if they keep the economy expanding. With this mass management of demand, consumer sovereignty is lost, and the individual in society ceases to be the end and becomes the means only. Where this is the case Malthus's ideas come to hold sway, and those individuals who cannot find work because of the nature of the market, that is, the structurally unemployed, are held to be a burden on the economy, and as such are held to have no right to exist. The growth of the economy with its increasing consumption of scarce natural resources is taken to be the end irrespective of what effect it has on the quality of people's lives or of its long term effects on the environment on which society depends for its existence.

The situation in sociology and psychology are not as straightforward as in economics. While in economics there were attempts to develop the subject on the assumption of a different conception of humans and with a correspondingly different value orientation than the mainstream, the most notable cases being those of Marx and Weber, it is nevertheless possible to identify the mainstream and to determine the line

(1) Marshall (1920) op.cit. p.66.

of development within it. Sociology and psychology on the other hand have been the battle grounds for competing conceptions of man without any real consensus having been reached. The polar opposites in this battle have been Romanticism and positivism, but there have been a multitude of intermediate positions developed as various thinkers have attempted to accommodate themselves to their opponent's arguments. Nevertheless, there has been a persistent strain in sociology and even more so in psychology which has formulated its position exclusively in positivistic terms and the conception of man associated with this which was first coherently articulated and forcefully presented in the beginning of the nineteenth century has been steadily gaining ground ever since.

The first significant attempt to develop the human sciences on the model of the physical sciences was that of Saint-Simon (1760-1825). Taking science as theonly true source of knowledge, Saint-Simon wrote: "It is necessary that the physiologists chase from their company the philosophers, moralists and metaphysicians just as the astronomers and chemists have chased out the alchemists."(1) He regarded human behaviour as law governed and hoped to base his science of human behaviour in Newtonian fashion on the laws of gravitation. Science was seen as facilitating industrial development and since people themselves were understood in the same terms as the physical world, he argued for an authoritarian government consisting of an elite of scientists to be called the 'Supreme Council of Newton' to educate and rule people according to the dictates of a deterministic science.

(1) Quoted by F. W. Matson in THE BROKEN IMAGE: MAN, SCIENCE AND SOCIETY Braziller, N.Y. 1964, p.29f. from OEVRES DE SAINT SIMON ET D'ENFANTIN.

However, it was August Comte (1798-1857), the foremost member of the Saint Simonian school who fully articulated the positivist position in social science. As pointed out earlier, Comte argued that the scientific or positivistic conception of the world was the final stage in the development of human thought, superseding metaphysics which in its turn had replaced religion. To further this overcoming of metaphysics, the positivistic spirit had to be turned towards the human domain which would then be understood in terms of laws. Comte described his ideal as doing away with reference to ends:

> The fundamental revolution that characterizes the generation of our spirit consists essentially in everywhere replacing the unattainable determination of authentic causes [that is final causes or substantial forms] with the simple investigation of laws, that is of the constant relations existing between observable phenomena.(1)

In these terms Comte laid the foundations not only for positivistic sociology, but also for reductionist and behaviourist psychology. He argued against introspection, declaring that "True observation must necessarily be external to the observer"; and that "the famous internal observation is no more than a vain parody of it," which presents the "ridiculously contradictory situation of our intelligence contemplating the habitual performance of its own activity."(2) Introspective psychology was then characterized as the last transformation of theology and as being of no scientific interest. The correct approach to psychology was therefore

(1) from DISCOURS SUR L'ESPRIT POSITIF, Hamburg, 1956, p.27, quoted by Jurgen Habermas in KNOWLEDGE AND HUMAN INTERESTS TR. Jeremy J. Shapiro, Heinemann, London, 1972, p.78.
(2) Quoted by Matson (1964) op.cit. p.50.

seen to be the study of the organs of sense and the observation of the "more or less immediate and more or less durable results"(1) of action, ie. behaviour.

While Comte's ideas were more a development of empiricism than of materialism, his conception of science was implicitly reductionist. He argued that science should direct its efforts to constructing laws to make predictions rather than simply to accumulating facts, and it should aim to reduce laws to more basic laws. Thus he wrote:

> ...scientific progress essentially consists in gradually diminishing the number of distinct and independent laws, while extending their mutual connection.(2)

This ideal leads to the view that the laws governing human behaviour are nothing but a special case of the laws of physics. In accordance with this ideal of science Comte argued that scientific knowledge must be technically utilizable, writing that "all of our sound theories [are necessarily related] to the continuous improvement of our individual and collective conditions of life - in opposition to the vain gratification of a sterile curiosity."(3) Science must make possible technical control over processes of both nature and society. This Comte clearly spelt out:

> It is important above all...that previously the fundamental relation of science and technology necessarily could not be grasped adequately by even the best minds, owing to the insufficient extension of natural science, which remained foreign to the most important and most difficult areas of inquiry immediately relevant to human society. Indeed, in this way the rational comprehension of the effect of man upon nature was essentially restricted to the inorganic world... once this huge gap is adequately filled - a process that

(1) Quoted ibid. p.51.
(2) Auguste Comte THE POSITIVE PHILOSOPHY (1830-1842) tr. and condensed by Harriet Martineau (1855) A.M.S. Press, N.Y. 1974, p.799.
(3) Quoted from DISCOURS SUR L'ESPRIT POSITIF Hamburg, 1956, p.85f. by Habermas, op.cit. p.76.

> is beginning today - the fundamental significance of this great practical goal (of the sciences) for the continual stimulation and often even the better direction of the highest theories... will be recognized. For technology will then be no longer exclusively geometrical, mechanical, or chemical, etc., but also and primarily political and moral.(1)

What he meant by this was that morality and politics should be thought of in terms of the technical efficiency, and this implies that people are nothing but things to be controlled.

The attempt to reduce the social sciences to the physical sciences received a big impetus with the development of the Darwinian theory of evolution. The sociology developed on the basis of evolutionary theory either focussed on the survival of the individual or on the survival of the group, depending on whether evolution was understood in terms of the struggle between individuals or between groups. But in one most important respect the implications of these approaches are the same, the individual as such disappears into the impersonal mechanisms of evolution. Thus the Darwinian Thomas Huxley focussing on the individual stated to an audience that "the thoughts to which I am now giving utterance, and your thoughts regarding them, are the expression of molecular changes in that matter of life which is the source of our other vital phenomena."(2) and the Darwinian Ludwig Gumplowicz focussing on the group wrote:

> The greatest error of individualist psychology is the suppostion that man thinks... Blind natural law controls the action of savage hordes, of states and of societies... The individual simply plays the part of the prism which receives the rays, dissolves them according to fixed laws and lets them pass out again in a predetermined

(1) Quoted from ibid. p.59f by Habermas op.cit. p.76f.
(2) Thomas H. Huxley "On The Physical Basis of Life" (1868) METHODS AND RESULTS: ESSAYS (1893), Macmillan, London, 1912, pp. 130-165, p.154.

direction with a predetermined colour.(1)

The main conclusions drawn by the Social Darwinists centred around the rejection of any artificial interference in the process of evolution such as morality, government protection of the weak and international law. Consequently, ideals based on the assumption of the moral responsibility of the individual and the right to freedom in society were rejected. The American Social Darwinist William Sumner regarded democracy as the "pet superstition of the age" based on notions of equality and the rights of man which he argued were nothing but unscientific fantasies:

> There can be no rights against Nature, except to get out of her whatever we can, which is only the fact of the struggle for existence stated over again.

What men mistook for natural rights and moral values were "the rules of the game of social competition which is current now and here."(2) And similarly, Gumplowicz wrote:

> The premises of 'inalienable human rights' rest upon the most unreasonable self-deification of man and overestimation of the value of human life.(3)

Positivist sociology characterized by the attempt to explain everything in terms of laws has been most fully developed in U.S.A. Exemplifying this orientation, one of the major figures in American sociology wrote in 1968 "I would be the

(1) Ludwig Gumplowicz THE OUTLINES OF SOCIOLOGY, Philadelphia Acad. of Pol. Science, Philadelphia, 1899, pp.156, 148 and 157.
(2) Quoted by Matson op.cit. p.39, from W. Sumner WHAT SOCIAL CLASSES OWE TO EACH OTHER, Harper, N.Y., 1883, p.135.
(3) Gumplowicz (1899) op.cit. p.180.

last to dispute the central importance of laws in sociological explanation, and the last to deny that these laws must be both derived theoretically and grounded empirically."(1) Disputes which do take place in mainstream American sociology generally presuppose at least this much. American sociology has been characterized by two forms of reductionism, one reducing everything to its constituents, the other reducing everything to the whole. Until recently the latter of these prevailed in the form of structural-functionalism or systems theory. However, this holism has been permeated by positivistic ideas and in no way mitigates the nihilistic tendencies of reductionist science. In accordance with positivistic ideas generally, the exponents of both forms of reductionism claim that social science is value free. Thus one of the major systems theorists, David Easton, wrote:

> I must dwell for a moment on my working assumption about the properties of value judgements, an assumption which has informed and will continue to prevail in the present work. This assumption, generally adopted today in the social sciences, holds that values can ultimately be reduced to emotional responses conditioned by the individual's total life-experiences. In this interpretation, although in practice no one proposition need express a pure fact or a pure value, facts and values are logically heterogeneous. The factual aspect of a proposition refers to a part of reality; hence it can be tested by reference to the facts. In this way we check its truth. The moral aspect of a proposition, however, expresses only the emotional response of an individual to a state of real or presumed facts. It indicates whether and the extent to which an individual desires a particular state of affairs to exist. Although we can say that the aspect of a proposition referring to a fact can be true or false, it is meaningless to characterize the value aspect of a proposition in this way.(2)

(1) Quoted by Richard J. Bernstein in THE RESTRUCTURING OF SOCIAL AND POLITICAL THEORY, Basil Blackwell, Oxford, 1976, p.20 from Neil J. Smelser "Some Replies and Some Reflections"
(2) Easton, David THE POLITICAL SYSTEM: AN INQUIRY INTO THE STATE OF POLITICAL SCIENCE, Knopf, N.Y., P.221.

However, where explanations take the form of a reduction to the whole, there is an implicit assumption that the maintenance and survival of the whole is what is important and that the significance of everything else must be judged in this light. The constituent parts of the system are seen as serving a function within the whole like cogs in a machine; and individuals are judged by the efficiency with which they fulfil their function. Individuals who are no successfully moulded by society to fulfil a function are thus classified as deviant and seen to be in need of reform. Those who play no part in the functioning are defined as superfluous and all activities which do not contribute to the functioning of the whole are then regarded as expendable luxuries.

Recently, American society has developed in a way which demands more than justification of the existing order of things by its social scientists. It demands that social science show how society and people can be controlled. This development has been described by Alvin Gouldner in THE COMING CRISIS OF WESTERN SOCIOLOGY:

> Functionalists usually have expected that the order-maintaining mechanisms in society would work best...without rational planning and without deliberation. It was in this spirit that Functionalists cautioned against the unanticipated consequences of purposive social action in the midst of the of the Great Depression... Today, however, it is being heavily supported, and <u>not</u> to show how things work spontaneously or naturally; it is being supported to show how organisational management, through <u>deliberate planning and governmental intervention</u>, can make things work better. As Hermann Kahn, who should know about these matters, has observed: "It simply isn't worth, say $150 000 of anybody's money to find out that they are doing everything right." In response to this new pressure

> for deliberate and rational policy-making, which Functional theory has such difficulty with, there is now a rapid growth of new theories, such as decision theory, cybernetics, and operations research, that seek to do precisely this. (1)

To provide the means for such deliberate planning and intervention it is necessary to adopt an approach which reduces wholes to their constituents so that the means of purposive control can be identified. Since such things as purposes and meanings are not relevant to this task, they are explained away, either crudely in terms of stimulus and response or more subtly in terms of bits of information and feedback. Political science has also been developed by positivists in this fashion, and its practitioners see themselves as involved in a value free enterprise to provide the knowhow to control society to any group who is interested. Thus the behaviourist political scientist George A. Lundberg wrote:

> Social science should strive for a similar position (to the physical sciences)... If social scientists possessed an equally demonstrably relevant body of knowledge and technique of finding answers to questions, that knowledge would be equally above the reach of political upheaval. The services of real social scientists would be as indispensible to Fascists as to Communists and Democrats, just as are the services of physicists and physicians.(2)

However, such social science is not value neutral. By conceiving of people as things to be controlled it denies their intrinsic significance and implies that the only rational end is their efficient control. It is nihilistic.

The positivistic materialist approach has been even more influential in the field of psychology. The first attempts

(1) Alvin W. Gouldner THE COMING CRISIS OF WESTERN SOCIOLOGY, Avon, N.Y., 1970, p.346.
(2) George A. Lundberg CAN SCIENCE SAVE US? Longmans, Green, N.Y., 1947, p.47f.

to develop psychology as an experimental science on the model of physics were undertaken in Germany, most notably by J. F. Fechner (1801-1887).(1) From this starting point psychology developed in different directions: one, being atomistic, looked for the elementary units of consciousness and eventually eliminated concern with consciousness altogether with the behaviourism of Watson, while the other, emphasising mental activity (Brentano), functions (James) and the holistic properties of consciousness (Gestalt psychologists) is best represented today by the school of Piaget. It is the atomistic, reductionist approach which represents positivistic materialism, and this has generally dominated the field.

The behaviourist conception of humans centred on the concepts of stimulus and response, denying any need for an understanding of the consciousness mediating their relationship. Thus the founder of behaviourism, J. B. Watson wrote: "psychology, as the behaviourists views it, is a purely objective, experimental branch of natural science which needs introspection as little as do the sciences of chemistry and physics."(2) This necessarily involved a rejection of and concern with purpose, a conclusion emphatically stated by one of Watson's disciples, Z. Y. Kuo:

> The concept of purpose is a lazy substitute for...careful and detailed analysis... The duty of a behaviourist is to describe behaviour in exactly the same way as the physicist describes the movement of a machine... This human machine behaves in a certain way because environmental stimulation has forced him to do so.(3)

(1) Klaus F. Riegel PSYCHOLOGY OF DEVELOPMENT AND HISTORY, Plenum Press, N.Y. 1976, ch.11 "Structural Analysis of the History of Experimental Psychology" p.175ff.
(2) John B. Watson BEHAVIOUR: AN INTRODUCTION TO COMPARATIVE PSYCHOLOGY, Holt, N.Y., 1914, p.27.
(3) Quoted by Matson (1964) op.cit. p.61.

The implications of the conception of man developed on this basis have been worked out by B. F. Skinner throughout his work, but especially in his behaviourist idea of utopia described in WALDEN TWO and in his book BEYOND FREEDOM AND DIGNITY. To begin with Skinner rejected the notion of freedom of the will as incompatible with science: "The hypothesis that man is not free is essential to the application of scientific method to the study of human behaviour."(1) because "We cannot apply the methods of science to a subject matter which is assumed to move about capriciously."(2) Then having denied the possibility of human freedom, Skinner went on to endorse the view that if this is the case then people must be seen as things to be manipulated: "We all control, and we are all controlled. As human behaviour is further analysed, control will become more effective."(3) Since freedom has been rejected as illusory, Skinner's ideal of society is not one which centres on the freedom and dignity of the individual but one which centres on effeciently controlling its members to ensure the survival of society. He argued that "A scientific conception of human behaviour dictates one practice, a philosophy of personal freedom another."(4) and concluded that "A scientific analysis may lead us to resist the mere blandishments of freedom, justice, knowledge, or happiness in considering the long-run consequences of survival."(5) His behaviourist utopia envisaged a complete control of its member's behaviour through conditioning.

(1) B. F. Skinner SCIENCE AND HUMAN BEHAVIOUR, Macmillan, N.Y., 1953, p.447.
(2) ibid. p.5f.
(3) ibid. p.438.
(4) ibid. p.9.
(5) ibid. p.436.

There have been developments to refine the crude mechanistic images of man put forward by some of the adherents of reductionism. For instance, intervening mechanisms have been placed between the stimulus and the response to overcome the crudity of the stimulus response conception of man, and the concept of stimulus has been modified by more sophisticated accounts of perception, often based on information theory. But this has not altered the basically mechanistic view of man. It is no more noble to be an information processing mechanism than a stimulus response mechanism. All this means is that the elementary units into which the relationship between an individual and the world is analysed are taken to be bits of information rather than stimuli. Such concepts as understanding and purpose are still ruled out as unscientific, and the reductionist spirit remains unchanged. As Ludwig von Bertalanffy wrote:

> I don't care a jot whether Professor A, B or C have modified Watson, Hull and Freud here and there and have replaced their blunt statements by more qualified and sophisticated circumlocutions. I do care a lot that the spirit is still all-pervading in our society; reducing man to the lower aspects of his animal nature, manipulating him into a feeble-minded automaton of consumption or a marionette of political power, systematically stultifying him by a perverse system of education, in short, dehumanizing him ever farther by means of a sophisticated psychological technology.(1)

Given that much of sociology and psychology have been developed within the framework of positivistic materialism, the question arises as to how significant is the image of man presented by them. It is evident that this image has not been accepted in the same way as the economic image of man. There are a

(1) Cited by Arthur Koestler in THE GHOST IN THE MACHINE, Pan Books, Bungay, Suffolk, 1967, p.353.

number of reasons for this. Economics only claims to characterize the nature of man in a limited domain, while psychology and sociology must lay claim to a total account of the nature of man. For this reason the subject/object dichotomy is forced out into the open as man, the object of investigation is also the subject who does the investigating. The difficulty the positivistic materialists have in accounting for their own efforts to explain human behaviour severely reduces the plausibility of their ideas and provides support for the justification or development of alternatives. In fact, the most brilliant figures within the human sciences such as Marx, Weber, Simmel, James, Mead, Durkheim and Piaget among others have been opposed to positivistic materialism and its nihilistic implications.(1) The success of the opponents of the reduction of humans to law governed entities is evident in the statement made by Whitehead in 1925:

> A scientific realism, based on mechanism, is conjoined with an unwavering belief in the world of men and of the higher animals as being composed of self-determining organisms. This radical inconsistency at the basis of modern thought accounts for much that is half-hearted and wavering in our civilization.(2)

But most science has not developed as Whitehead argued it should to conceive the physical world in a way that would be consistent with the conception of humans as self-determining organisms, but has gradually worn down this conception of humans. To some extent this has been supported by the developments in the economic image of man and the developments which have taken place in society accordingly. Traditional

(1) H. Stuart Hughs CONSCIOUSNESS AND SOCIETY (1958) Paladin, Frogmore, 1974 has described this reaction from the 1890's.
(2) Alfred North Whitehead SCIENCE AND THE MODERN WORLD op.cit. p.73.

capitalism has given way to a military industrial complex involving extremely large organizations with the government playing a much larger role in directing society, and this has given a far greater role to positivistic social science. Institutions, whether government or business have turned increasingly to psychologists and sociologists in order to increase the control over their employees, to predict and control people with whom they deal or who oppose their designs, and to gain control over society generally.

The evidence for the permeation of society by scientistic modes of thought is the way in which humanities disciplines have lost status in the twentieth century. Ernst Gellner has described this:

> The deprivation of the humanist intellectual of his full cognitive status has happened fairly recently. Signs and portents, in philosophy and elsewhere, can be traced very far back: but as a general and widely recognized phenomenon, it is very new, and has occurred within this century, and almost within the last few decades. The magnitude and profundity of this social revolution can scarcely be exaggerated.(1)

In place of the humanistic intellectual:

> The educated public in developed countries turns to the scientific specialist when it wants information about some facet of the world... It suffices that the specialist is part of a discipline which is incorporated into the wider body of what is recognized as 'science'.(2)

A typical symptom of this is the almost complete elimination of political philosophy over the last few decades.(3)

(1) Ernest Gellner "The Crisis in the Humanities and the Mainstream of Philosophy" in CRISIS IN THE HUMANITIES ed. J. H. Plumb, Penguin Books, Harmondsworth, 1964, pp.45-81, p.72f.
(2) ibid. p.72.
(3) Alfred Cobban IN SEARCH OF HUMANITY: THE ROLE OF THE ENLIGHTENMENT IN MODERN HISTORY, George Braziller, N.Y. 1960, ch.2.

Not only have people turned away from the humanities. Those scientists who emphasised the role of beliefs, freedom and creative action tend to have been interpreted from the point of view of positivistic materialism. This is evident in the case of Weber and Durkheim, but even more so in the case of Marx and Freud. For instance, the ethics underlying Freud's vision of man were essentially stoic as he held that the important thing was that people should understand themselves and thus act freely even if this only resulted in their understanding why they suffered. Since then Freud's ideas have been used by people to explain away the greatness of individuals, to help them feel better and to free them from taking responsibility for their actions. And where positivistic approaches in the human sciences have been rejected as in humanistic psychology, sociology and Marxism - these have tended to insulate themselves from the mainstream of science. This exemplifies the fracturing of thought between the objective and subjective realms, with humanistic science, confined to the subjective realm being classed more as literature than as science and downgraded with the rest of the humanities.

Consequently, despite the froth and bubble produced by those people reacting against reductionist accounts of humanity, it is possible to discern a line of development by which the mechanistic image of man has been continuously gaining ground to conjoin with the irrationalist conception of man now prevalent in economics. And this in turn facilitates and legitimates the development of a social order devoted to the technical domination both of the world of nature and of its own members. The final result of this development is the increasing prevalence of such modes of thought in people's everyday lives. This is most clearly evident in institutional settings where individuals are labelled insane or children are labelled as delinquent and are then treated as mechanisms to be controlled, or in the economy or government where management techniques have been developed to manipulate people. But the mechanistic attitude towards people is also advancing to informal relationships as for instance where children are regarded not as responsible agents who need to acquire wisdom about life but as beings who can be made to behave correctly by the use of modern child rearing techniques. Finally, individuals come to accept themselves as socially and biologically determined mechanisms, cultivate emotional detachment from the outside world and other people, cease taking responsibility for their actions, for their lives and for anyone or anything else and concentrate on cultivating by therapeutic techniques a feeling of well being divorced from any awareness of the world, creative achievements or intimacy with others.(1) The final result of the development of positivistic materialist human sciences is thus the subjugation of the entire population by the ethos of efficient technical control. As Hannah Arendt wrote:

> If economics is the science of society in its early stages, when it could impose its rules of behaviour only on sections of the population and on parts of their activities, the rise of the "behavioural sciences" indicates clearly the final stage of this development, when mass society has devoured all strata of the nation and "social behaviour" has become the standard for all regions of life.(2)

(1) Christopher Lasch "The Narcissist Society" in THE NEW YORK REVIEW Sept. 30, 1976, pp.5-13.
(2) Hannah Arendt THE HUMAN CONDITION, Uni. of Chicago Press, 1958,p.45.

THE PROBLEMS OF POSITIVISTIC MATERIALISM

The most significant problem of the world-view based on positivism and materialism is its nihilistic implications. The rise of science was largely the product of the attempt to arrive at a rational understanding of the universe and man's place within it. Now positivistic materialist science is undermining rationality. As Max Horkheimer wrote in ECLIPSE OF REASON:

> The philosophers of the Enlightenment attacked religion in the name of reason; in the end what they killed was not the church but metaphysics and the objective concept of reason itself, the source and power of their own efforts. Reason as an organ for perceiving the true nature of reality and determining the guiding principles of our lives has come to be regarded as obsolete. Speculation is synonymous with metaphysics, and metaphysics with mythology and superstition. We might say that the history of reason or enlightenment from its beginnings in Greece down to the present has led to a state of affairs in which even the word reason is suspected of connoting some mythological entity. Reason has liquidated itself as an agency of ethical, moral, and religious insight.(1)

In place of reason understood as the principle of the universe from which the natural order, ideas of justice, equality and liberty are held to correspond, reason has become a subjective instrument. The only acceptable form of rationality is that of determing the means to ultimate ends which are themselves seen to be unjustifiable. Ideals and our ultimate decisions are left dependent upon factors other than reason. The consequences of this are that:

> Justice, equality, happiness, tolerance, all the concepts that...were in preceding centuries supposed to be inherent in or sanctioned by reason, have lost their intellectual roots. They are still aims and ends, but there is no rational agency

(1) Max Horkheimer ECLIPSE OF REASON Oxford Uni. Press, N.Y., 1947, p.17f.

> authorized to appraise and link them to an objective reality. Endorsed by venerable historical documents, they may still enjoy a certain prestige, and some are contained in the supreme law of the greatest countries. Nevertheless, they lack any confirmation by reason in its modern sense. Who can say that any one of the ideals is more closely related to truth than its opposite? According to the philosophy of the average modern intellectual, there is only one authority, namely science, conceived as the classification of facts and the calculation of probabilities. The statement that justice and freedom are better in themselves than injustice and oppression is scientifically unverifiable and useless. It has come to sound as meaningless in itself as would the statement that red is more beautiful than blue, or that an egg is better than milk.(1)

The only valid role for reason is as a means for increasing control over the world, and this instrumental rationality has become the reference point for the legitimation of courses of action and of institutions. For instance, democracy is justified by its effects as an instrument for legitimating power, resolving conflicts and maintaining peace. But based on this foundation, democracy is open to replacement by more efficient instuments. No objection founded on reason can be opposed to such an action. However, it is not only on instrumental rationality that the democratic principle is founded. It is also founded on the principle of the majority. Since it is held that men are the best judges of their own interests, the resolutions of a majority are superior to any conclusion drawn by reason. So in place of objective reason the majority principle becomes sovereign and through all kinds of polls and modern techniques of communication verdicts are elicited on every matter. It

(1) ibid. p.23f.

is not whether a war is just, or whether this generation is justified in permanently destroying large parts of the environment, or whether a racial minority has a right to equal treatment which is important, but whether public opinion considers it so. This leaves the problem of how people are supposed to form their opinions. Since it is accepted that these are not rational but are determined by heredity and the environment, public opinion becomes an object of scientific manipulation, both by politicians who are involved in impression management rather than presenting reasons for policies, and by various interest groups. The more popular opinion is able to be manipulated, the more the majority is presented as the ultimate arbiter of all aspects of life. This means that while the principle of majority rule supplies an alternative to instrumental rationality as a source of justification for democracy, this itself is swallowed up by instrumental rationality through the manipulation of public opinion.

With such a state of affairs, the individual is left without grounds for deciding how to live. Individuals may be principled, but they have no grounds for being so or for justifying their principles. They may exalt human dignity or concern themselves with the environment or other species of life, but to do so simply expresses subjective attitudes. Works of art are no longer means of communicating the artist's vision but are commodities and their consumption is a series of haphazard emotions severed from any concern with truth. There is no way to justify one's ideals or grounds for deciding between ideals since the only solid reference point for the justification of beliefs is science, and positivistic materialist science implies that a person's actions and beliefs are determined by his or her constitution and environment, and that the world itself is utterly meaningless. This implies that no person can be held responsible for his or her actions or take responsibility for them, whether good or bad, and if a person experiences situations as significant or meaningful as in the contemplation of nature or in moments of intimacy, the experience must be regarded as a subjective illusion. While tolerance is often held to be important in modern societies, this is not the tolerance advocated by John Stuart Mill in ON LIBERTY where it was argued that it is ncessary to allow diverse viewpoints to be put forward in order to arrive at the truth and to appreciate that we have arrived there. The tolerance of modern society allows all individuals to hold their own private views without any obligation to rationally justify them, so long as these are not acted upon in a way which would upset the status quo.

Instead, it is regarded as wrong to challenge another's views on fundamental or significant questions or to attempt to impose one's own views on anyone else. Such issues are ruled out of polite conversation and there is no dialogue to mediate between the opinion forming mass media and the individual.

With this emphasis on technical control, humans have increased their potential to create to a greater level than ever before, but with a positivistic materialist conception of the world, there are no longer any grounds for believing that any ends are worth striving for, except perhaps, ever greater consumption. What Ortega y Gasset wrote in 1932 is thus even more true for the present:

> ...we live at a time when man believes himself fabulously capable of creation, but he does not know what to create. Lord of all things, he is not lord of himself. He feels lost amid his own abundance. With more means at his disposal, more knowledge, more technique than ever, it turns out that the world today goes the same way as the worst of worlds that have been; it simply drifts.(1)

It was suggested earlier that in traditional societies people define themselves and their place in the world in terms of their society's cosmology. This cosmology is the ultimate ground for the resolution of arguments and the legitimation of beliefs, actions and goals. In a society in which the cosmology cannot serve this function, individuals can only define themselves in relation to others and attain self-hood through being recognized as significant by others. To achieve this in the absence of grounds to justify an independent standpoint, the individual must conform to and try to realize the ideals of the group. With no coherent world-view accepted by society as a whole outside science, the norms of various groups are likely to differ arbitrarily. As the individual must play a large number of different roles in different groups, his or her life must lose coherence.

That this has been the case is argued by J. H. Van Den Berg in his historical study of the changing nature of neuroses. Van Den Berg points out that the first symptoms of neurosis were not described until the eighteenth century, and that the

(1) Ortega y Gasset THE REVOLT OF THE MASSES (1930) George Allen & Unwin, London, 1972, p.33f.

symptoms were first confined to upper class English people.(1) Shortly afterwards the phenomenon of hypnosis characterized by a strange second state of mind made its appearance.(2) Then at the end of the eighteenth century and the beginning of the nineteenth century the Doppelgänger theme made its appearance in literature.(3) This began with Ludwig Tieck's RYNO of 1781 in which a sense of alienation was expressed by the main character at his own presence and voice. As this theme developed in different works the relationship between the two personalities changed from friendly and peaceful coexistence to a complete division. In later versions such as R. L. Stevenson's DR JEKYLL AND MR HYDE of 1886 the two personalities are completely opposed to each other and in Wilde's PICTURE OF DORIAN GRAY there is a total hostility which leads to the hero's suicide. Towards the end of the nineteenth century the double ego made its appearance in daily life and was noted almost simultaneously by Ribot (1884), Bernheim (1884), Azam (1887), Van Eeden and Van Renterghem (1887), Dessoir (1889) and Janet (1889).(4) This syndrome was characterized by individuals having two personalities, both awake, alternating in one individual. At the same time Freud began to develop his psychology according to which the individual was understood as the battleground of various subconscious forces. In 1891 William James claimed that a man has as many social selves as there are individuals about

(1) J. H. Van Den Berg DIVIDED EXISTENCE AND COMPLEX SOCIETY (1963) Duquesne Uni. Press, Pittsburgh, 1974, p.86ff.
(2) ibid. p.68ff.
(3) ibid. Ch.4.
(4) ibid. Ch.2.

whose opinion he cares who recognize him, and in 1893 Durkheim noted that in a fragmented society, the individual has as many states of life as there are groups to which he belongs.(1) Following up such ideas H. S. Sullivan (1892-1949) showed how individuals were unable to carry on conversation or activities because of the interference effects of contradictory self-images. This state of affairs was described by Pitirim Sorokin in 1947:

> If the groups of an individual are in conflict; if they urge him to contradictory actions, duties, thoughts, convictions; if, for instance, the state demands what is disapproved by the church and the family, then the respective egos will be mutually antagonistic. The individual will be a house divided against himself, split by inner conflicts. There will be no peace of mind, no unclouded conscience, no real happiness, no consistency in such an individual. He will be like a ball pushed in opposite directions by several forces...(2)

In 1950 Riesman developed the concept of the 'other directed person' in THE LONELY CROWD.(3) The other directed person finds it impossible to set his own course and must constantly adjust to each new social grouping. Each individual must be constantly on the alert to avoid conflict with others and must continually avoid any communication which might be provocative in order to avoid conflict with others. This leaves each individual isolated despite the emphasis on gregariousness. This state of affairs is captured by the development of the dramaturgical metaphor for understanding social reality. Its most important exponent, Erving Goffman (1956) presented individuals as nothing but actors:

(1) ibid. p.3f.
(2) Pitirim A. Sorokin SOCIETY, CULTURE, AND PERSONALITY (1947) Cooper Square, N.Y., 1969, p.351.
(3) Van Den Berg (1963) op.cit. p.198ff.

> In their capacity as performers, individuals will be concerned with maintaining the impression that they are living up to the many standards by which they and their products are judged... But, qua performers, individuals are concerned not with the moral issue of realizing these standards, but with the amoral issue of engineering a convincing impression that these standards are being realized. Our activity, then, is largely concerned with moral matters, but as performers we do not have a moral concern in these moral matters. As performers we are merchants of morality.(1)

Alvin W. Gouldner described the implications of this form of sociology:

> Dramaturgy reaches into and expresses the nature of the self as pure commodity, utterly devoid of any necessary use-value: it is the sociology of soul selling... Moving increasingly from an inner- to an other-directed social world, dramaturgy capitalizes on the natural culmination of utilitarianism in anomie. In other words: dramaturgy is not the antidote to utilitarianism but the symptom of its pathology. Disdaining the inhibitions of the older, somewhat "square" utilitarian culture, the dramaturgist is determined to outwit it at its own game. He is, at bottom, moved by an impulse to get something for nothing, and therefore insinuates that there is nothing to get and nothing to give: all is appearances.(2)

The dating of the emergence of these ideas suggests a clear development towards an increasing fragmentation and dissolution of the self.

The final result of the development of the positivistic materialist world-view is to leave people with a sense of the total and utter meaninglessness of their lives. This phenomena has been the main object of investigation of the psychotherapist, Victor Frankl, who has coined the term 'noogenic' neurosis to describe the condition of those

(1) Quoted by Alvin W. Gouldner (1970) op.cit. p.383, from Erving Goffman THE PRESENTATION OF SELF IN EVERYDAY LIFE Edin. Uni. Press, Edin. 1956, p.156.
(2) ibid. p.383f.

suffering from this meaninglessness and an associated feeling of inner emptiness or void.(1) This he attributes to the frustration of the will to meaning which follows from the indoctrination of people with reductionist science, arguing that "Contemporary nihilism no longer brandishes the word nothingness; today nihilism is camouflaged as nothing-but-ness. Human phenomena are thus turned into mere epiphenomena."(2) While 20% of neuroses are held to be noogenic in origin, the incidence of the experience of inner emptiness varies between countries. Frankl found that while forty per cent of Swiss, West German and Austrian students had experienced this inner void and emptiness, the figure for American students was eighty one percent. He suggested that this difference is at least partly due to the greater domination in American universities than European universities of reductionist ideas.

But while the most significant problem of the world-view based on positivism and materialism for people who believe that there is more to life than reacting to stimuli is its nihilistic implications, this does not mean that this vision of the world is not correct. It is possible that people do simply react to what attracts them or what repels them and that this is entirely determined by their environment and biological makeup. It is possible that people who sacrifice their own well being on what they think are compassionate grounds have no choice but are determined in their actions by their genetic makeup, and that those who sacrifice more than is necessary

(1) Victor E. Frankl "Reductionism and Nihilism" in BEYOND REDUCTIONISM: THE ALPBACH SYMPOSIUM eds Arthur Koestler & J. R. Smythies, Hutchinson, London, 1972, pp.396-416.
(2) ibid. p.398.

for kin survival are nothing but genetic abnormalities. Calls for justice are nothing but the efforts of the weak to protect themselves from the strong, and this interferes with the evolutionary process allowing the weakest to survive. And that all that is really important is controlling the environment, both physical and social to maximise the amount of time that one experiences a state of well being.

However, not only does positivistic materialism lead to nihilism, it is characterized by inconsistencies and insoluble problems which suggest that its claim to be the objectively valid world-view should be questioned. For instance, it is impossible to account for the relationship between mind and body. To establish a relationship between any two things it is necessary to compare them in terms of some third factor common to both. For instance to establish a relationship between a table and a dog it is necessary to compare them in terms of spatial position, a factor which they possess in common. But thoughts and extended objects have no such common 'third' and so are utterly incommensurable. The denial of the existence of consciousness is implausible, while it is impossible to account for such consciousness in terms of mechanical processes. Similarly, there is the problem of the relationship between our ideas of the world and the material world itself. If our perceptions on which knowledge is based are produced in us by action of physical entities on the sense organs, then what we perceive and know cannot be the external world but at best a representation of it. But since our ideas of the world and the world itself are totally incommensurable we must conclude that it is meaningless to talk about the world as it is in itself and that there is only the world as we experience it. Knowledge then can only be about the relationships between experienced phenomena. But since phenomena are only defined in opposition to the real world, without the conception of the real world which they are supposed to represent, we must conclude that the phenomena are reality itself. But if we accept this naive realism and regard our experiences as being reality as it is in itself, we must conclude that our perception is produced in us by the action of external entities on our bodies. And so the argument goes on round in a circle. A corollary of this problem is that we have no way of knowing that there are other minds, no way of knowing that what we perceive as people really have consciousness as we do. And finally, the last major problem which arose with the development of positivistic materialism, the problem of free will and determinism has not as yet been satisfactorily resolved. It seems impossible to deny that we are free to act as we choose, and yet it also seems impossible that thoughts could bring about an interruption in the laws of nature. Despite three hundred years of effort no satisfactory solution to these problems has been found within the framework of positivistic materialism.

Even more serious than the failure to overcome this disjunction between the subjective and the objective realms of being, positivistic materialism is self-contradictory. For instance, to assert the truth of materialism is to assume that it is possible to have knowledge of the world. But if all our apparent beliefs are determined by physico-chemical laws, then there are no grounds for saying that any individual's beliefs are any better or any worse or more in accordance with the truth than any other individual's. So to assert that materialism is true is at the same time to imply that there is no such thing as truth, and this is self-contradictory. Similarly, positivism is self-contradictory. Positivists argue that only statements which can be tested against experience or which are tautologies can be held to be true. But this statement is neither empirically verifiable nor analytically true, and anyone who states it as true is implying at the same time that it is not true and is therefore contradicting him or herself. Finally, while empiricism and materialism tend to support each other, in the last analysis they contradict each other. Both empiricism and materialism imply that the world should be understood in terms of laws, and since the positivists are concerned to order their deductive systems in the simplest way, they are committed to arguing that science should aim to reduce all the laws it has discovered to the basic laws of physics. However, empiricism and materialism each begin on different sides of the subjective realm/ objective realm dichotomy, and this leads to basically opposed positions. For instance, the laws of materialism are regarded by materialists as the principles on which the universe is based and while they may enable predictions to be made, they are regarded as more than simply the means for making such predictions. The positivists on the other hand regard laws as nothing but the means for making predictions and such laws are not held to imply anything about the world in itself. But more basic than this, the materialists are concerned about particles of matter whereas the positivists are concerned with making predictions from one experience to another, and while materialists have no place in their scheme for experience, positivists have no way of justifying the belief that hypothetical entities such as atoms are anything more than heuristic devices for supporting the mathematics whereby predictions are made. Thus in the last analysis, positivism and materialism are mutually exclusive.

Given these problems, it must be acknowledged that the world-view based on positivism and materialism should be at least questioned, despite the achievements of science, and that the cynics and nihilists are not on such firm foundations as they tend to believe.

TRANSCENDING POSITIVISTIC MATERIALISM

In attempting to overcome the problems of positivistic materialism, two strategies have been adopted. The first strategy is to develop an epistemological theory which delimits the scope of materialist science. Science is then seen not as an attempt to discover the way the world really is, but as revealing at most a particular facet of it. This then leaves it open to understand other phenomena such as human consciousness in entirely different terms. The second strategy is to reject the materialist conception of being and to develop an alternative ontology. Such attempts have been attacked as 'metaphysics' by the positivists, and consequently the first strategy has been more commonly adopted.

The first person to adopt the first strategy was Berkeley. Berkeley's target throughout his writings was the philosophy developed around the new physics with its bifurcation of the world into primary and secondary qualities, appearance and reality, and the rejection of the familiar world for an abstract world of time, space, matter, motion and force. However, Berkeley did not want to denigrate science but to put it into perspective. According to him, the familiar world should be seen as reality, and the notions of physics should be seen as abstractions from this which are useful in the ordering of experience. In SIRIS he developed the analogy of the relationship between language and grammar to accomplish this task. The familiar world must be seen as equivalent to language so that natural philosophers could then be seen as abstracting out the grammar of this language. Understood in this way it can be seen that the grammar cannot replace the language which, Berkeley argued, would be equivalent to focussing on the grammar of a poem while ignoring its meaning. Furthermore such abstractions are inherently defective. While we normally have an intuitive grasp of nature as whole this is lost when we start abstracting, and once we begin abstracting, our abstractions are always provisional. We are always driven to new levels of abstraction with each level being more generalized, quantifiable, predictable and universal than that which preceded it. But at the same time there is a law of diminishing returns since we get further and further from the familiar world.

Kant also argued for a dualism in which the world as understood by science was given only a limited significance, but unlike Berkeley, Kant thought that the familiar world is a world of mechanical causes. He divided reality into two realms - things in themselves or the noumenal realm about which nothing can be known except through analogical thinking, and the objects of experience, or the phenomenal realm. How objects of experience appear to us is partly dependent upon the mind, as all our experience is ordered in accordance with certain rules, the categories of the understanding and the forms of intuition. The categories are the fundamental conditions of our thinking as the forms of intuition: space and time, are the fundamental conditions of our sensibility, and derive not from the world but from the mind or transcendental ego itself. Only by conceiving the world in these terms is the world intelligible. Every phenomena is then seen to have two dimensions, one to previous penomena which are understood empirically to have caused it, and to the noumena. The realm of the noumena can only be known about analogically, but by using such analogical thinking it is possible to understand the basis of morality. When a person acts on purely rational grounds, that is, according to the categorical imperative, his or her actions can be seen as a causa noumena, or a free act of will. Since it can be assumed that this noumenal realm will be such as to make such moral action intelligible it can be concluded that there must be a God and that there must be a life after death in which people will get their just deserts for their moral or immoral behaviour. So while the phenomenal realm with which science deals is a realm of causal determinism, it must be believed that the noumenal realm is a realm of moral freedom and immortality in which justice prevails.

Another solution to the problem of positivistic materialism which has been developed in a number of forms and which has had a very wide influence is to conceive of the world as so complex that any particular conceptual scheme can only reveal one of its facets. Wilhelm Dilthey developed this view in order to justify a different approach to the social sciences than that of the natural sciences. However, a similar idea had been developed earlier by Kierkegaard who argued that while science had its own domain of validity, it had nothing important to say about life.(1) For this Kierkegaard tried to develop the category of the individual, something with which science did not concern itself. According to Kierkegaard there is no thought which can embrace both these different ways of conceiving the world, and movement between them required a 'leap'. These ideas were developed further by

(1)THE DIARY OF SOREN KIERKEGAARD ed. Peter Rohde, Philosophical Library, N.Y., 1960, p.99f.

Höffding who in turn influenced the physicist, Niels Bohr.(1) The widespread acceptance of Bohr's complementary interpretation of quantum theory gave added plausibility to the sort of ideas which had been espoused by Dilthey, and the idea that the concepts of materialism can be accepted as simply complementary to conceptions of humans emphasising their freedom and creativity still has widespread currency. It underlies Habermas's conception of knowledge constitutive interests(2) and has been used by Floyd W. Matson to justify humanistic social sciences(3) and by Victor Frankl to justify his conception of man as a being with a will to meaning.(4)

Some philosophers have attempted to take the knowing subject as the point of departure for their philosophies rather than the objective world as understood by science. This enables science to be seen as simply one of the productions or creations of the subject among others with no claim to ultimate priority. The Neo-Kantian Ernst Cassirer developed his philosophy of symbolic forms along these lines, but the most influential of such philosophers have been the phenomenologists. Rather than seeing the sciences of spirit as having their own domain of validity, these are seen as foundational with the sciences of nature being given an entirely derivative status. As Husserl wrote:

> In regard to nature and scientific truth concerning it...the natural sciences give merely the appearance of having brought

(1) Gerald Holton "The Roots of Complementarity" in THEMATIC ORIGINS OF SCIENTIFIC THOUGHT: KEPLER TO EINSTEIN Harvard Uni. Press, Cambridge Mass., 1973, pp.115-161, esp.pp.144-149.
(2) Jürgen Habermas KNOWLEDGE AND HUMAN INTERESTS (1968) tr. Jeremy J. Shapiro, Heinemann, London, 1972.
(3) Floyd W. Matson (1964) op.cit.
(4) Victor Frankl "Reductionism and Nihilism" (1972) op.cit.

> nature to a point where for itself it is rationally known. For true nature in its proper scientific sense is a product of the spirit that investigates nature, and thus the science of nature presupposes the science of the spirit... Spirit is not looked upon here as part of nature or parallel to it; rather nature belongs to the sphere of spirit.(1)

Husserl suggested that the notion of intentionality as developed by Brentano provided the starting point for such a science of the spirit, and this was eventually developed as transcendental phenomenology. He then claimed:

> It was [transcendental phenomenology] that overcame naturalistic objectivism, and for that matter any form of objectivism, in the only possible way, by beginning one's philosophizing from one's own ego; and that purely as the author of all one accepts, becoming in this regard a purely theoretical spectator.(2)

Husserl also argued for the primacy of the Lebenswelt over the mathematical formalism of physics.

The last important philosophical movement to delimit the scope of natural science was linguistic analysis inspired by Ludwig Wittgenstein. According to this, language must be taken as the starting point of philosophy. The social world is then seen as consisting of a number of forms of life, each of which involves its own language game with its own rules of play. The central language games are those centred on everyday life, and these are highly complex with variations from game to game which are not immediately evident, while the language games of science and mathematics are regarded as more regular. The describe language as a whole and the relation between old and new language games, Wittgenstein drew an analogy with the development of a city:

(1) Edmund Husserl "Philosophy and the Crisis of European Man" in PHENOMENOLOGY AND THE CRISIS OF PHILOSOPHY tr. Quentin Lauer, Harper Torchbooks, 1965, pp.188-190.
(2) ibid. p.190.

> Our language can be seen as an ancient city: a maze of little streets and squares, of old and new houses, and of houses with additions from various periods; and this surrounded by a multitude of new boroughs with straight regular streets and uniform houses.(1)

The symbolism of chemistry and the notation of infinitesimal calculus are described as "suburbs of our language."(2) This suggests that the forms of life of everyday life and of the scientific enterprise can proceed without disturbing each other. Philosophical problems are seen to arise when the rules of language games are confused with each other due to similarities of surface grammar and the way to overcome such problems involves recognizing that each form of life or language game has its own unique significance. When philosophy has pointed out how the confusions of past philosophers have arisen, it leaves everything as it is, allowing the materialist scientist to get on with his work and the man in the street to continue with his or her common-sense outlook on the world.

The problem with those philosphies which take the familiar or commonsense understanding of the world as basic and the scientific conception of the world as derivative such as Berkeleyism and linguistic analysis, is that the common-sense world is not unproblematic and is influenced by the ideas of science. It is largely composed of ideas and ways of understanding which are simply old philosophical ideas which have been generally accepted, and there is nothing simply given. Berkeley argued that the ideas we experience are themselves indubitable and that it is only the inferences

(1) Ludwig Wittgenstein PHILOSOPHICAL INVESTIGATIONS tr. G. E. M. Anscombe, 3rd ed. Basil Blackwell, Oxford, 1968, "Philosophical Investigations I", p.8.
(2) loc.cit.

we draw from them that are mistaken, but this is much evidence from psychology which will be discussed in a later chapter to suggest that there are not such indubitable entities. Berkeley's conception of the familiar world with its recourse to archetypes in the mind of God is essentially Neo-Platonic, and this indicates the extent to which his 'familiar world' embodies notions from philosophy. Since commonsense does incorporate new ideas, it is hardly surprising that less than a hundred years later Kant took everyday experience to be constituted by the concepts of Newtonian physics. So the division between the familiar world and the world as it is interpreted by science loses its validity. Another problem with the acceptance of the unproblematic nature of the commonsense world is that it obscures the problems people face in everyday life and the constant efforts needed to understand the world in a more satisfactory way. This is a criticism which has been particularly levelled at linguistic analysis with its acceptance of commonsense 'forms of life' by Ernest Gellner, who wrote:

> there are no...conceptual wombs to crawl back into: the modern world is a Babel of 'forms of life', undergoing change with bewildering rapidity. The real trouble with this kind of philosophy is that it wholly obscures both the tremendous changes which our society has undergone, and the choices which it faces. In its preoccupation with allegedly pathological deviations from sense it wrongly implies that there exists some viable status quo ante to which we could return. But there isn't.(1)

And in fact whether we conceive the world materialistically and act accordingly or conceive it in some other way is one of the choices we must confront.

(1) Ernest Gellner "The Crisis in the Humanities and the Mainstream of Philosophy" in CRISIS IN THE HUMANITIES, ed. J. H. Plumb, Penguin Books, Harmondsworth, 1964, pp.45-81, p.65f.

The acceptance of incommensurable ways of understanding the world as exemplified by Kant, Dilthey, Husserl, Cassirer, Bohr, Wittgenstein and Habermas inevitably leads to insoluble problems where these ways of understanding the world intersect. This is evident in Kant's philosophy when we consider an individual is free to exercise his or her moral will and to act according to the categorical imperative. But when we consider the individual phenomenally, it is impossible to describe when a causa noumena takes place since time is only a form of intuition and irrelevant to the noumenal realm. A causa noumena therefore cannot be thought of as acting at a particular time. Also, phenomenally the individual's actions must be thought of in completely deterministic terms, so that "Before ever they have happened, they are one and all predetermined in the empirical character."(1) Consequently, Kant is led to argue that if we completely understood an individual so that "his future conduct could be predicted with as great a certainty as the occurrence of a solar eclipse, we could nevertheless still assert that the man is free."(2) So it is impossible to say when a person exercises his or her free will, and its exercise does not interrupt the "laws of nature which determines succession in time."(3) Such an account of free will can hardly be regarded as satisfactory.

This typifies the problems engendered by any attempt to adopt different ways of understanding the world at the same time. When contradictions arise as they necessarily must if these ways are different and incommensurable, either one of them

(1) IMMANUEL KANT'S CRITIQUE OF PURE REASON tr. Norman Kemp Smith, Macmillan, London, 1964 (A 553, B 581) p.476.
(2) Immanuel Kant CRITIQUE OF PRACTICAL REASON, tr. Lewis White Beck, Bobbs-Merrill, Indianapolis, 1956, (100) p.103.
(3) Kant (1964) op.cit. (A 553, B 581) p 476.

must take precedence over the others or the world must be seen as unintelligible. Wherever the concepts of positivistic materialism are accepted, it becomes necessary to either accept that freedom of the will is illusory or else accept that there are interruptions in the workings of the laws of nature which are totally inexplicable from the conceptual framework of materialism. And if they are inexplicable from this point of view, though intelligible from another, it is impossible to decide when to adopt one way of viewing the world and when the other. For instance, it is impossible to decide at which point an individual should stop being viewed as a physico-chemical mechanism and when he should begin to be viewed as a responsible agent. It is impossible to say that after a certain amount of investigation, neurophysiology will reach a line beyond which it will not be able to go since to do so would enter the realm of free will.

It could be argued that these philosophies which take the knowing subject or language as a point of departure provide an overarching perspective from within which various views of the world can be allotted their own domains. This involves taking the side of the subjective realm as the ultimate reference point for the analysis of the world rather than the objective realm and it is assumed on this basis that the ontological status of intentional subjects is guaranteed against the implications of any ideas about nature. However it is only possible to ignore the impossibility of ascribing any ontological status to intentional subjects in terms of the concepts by which nature is understood if the ontological status of nature understood in this way is denied. While this might appear acceptable in the case of physics alone, it appears highly implausible when chemistry and biology are included. With the acceptance of the theory of evolution it is necessary to see humans as the product of evolution and it is hard to avoid concluding on this basis that 'spirit' is part of nature and that nature is more than something which "belongs to the sphere of spirit." This problem has been succinctly stated by C. F von Weizsacker:

> Firstly, by being the act of a subject, every 'objective' cognitive insight exists only as a result of certain 'subjective' conditions. Secondly, we must ask what we can know about the subject of cognition when we consider that it lives in the world of objects, being one of its parts.(1)

Neither side of this problem can take precedence over the other and it is unacceptable to adopt incommensurable ways of viewing each problem. We must conceive the world in such a way that it can be thought of as existing independently of any subjects, but at the same time it must be understood in such a way that it can be seen to have evolved constitutive subjects and producers of language who are capable of understanding its nature. If the world is understood in materialist terms it is impossible to account for the evolution of such subjects. Thus the problem of modern culture is not that too high a place is given to the scientific conception of the world but that the materialist conception of being assumed by science is inadequate. This is not to denigrate the achievements of those idealist traditions in philosophy which have ignored the implications of materialist science and continued to understand the human order in terms of the

(1) Quoted by Jürgen Habermas in KNOWLEDGE AND HUMAN INTERESTS 2nd ed. tr. Jeremy J. Shapiro, Heinemann, London, p.358 from C. F. von Weizsacker DIE EINHEIT DER NATUR, 1971, p.140f.

behaviour and activity of subjects of consciousness, nor of the ways these philosophies have been developed by the sciences of humanity. But it does imply that idealism must be rejected in philosophy and that philosophy must once again concern itself with the ontology on which science is based if it is going to overcome the problems engendered by the rise of positivistic materialist science. The return to ontological questions is further called for by the problems encountered in the natural sciences by the proponents of materialism. For instance, while some physicists such as Weinberg interpret field theory in the language of particle theory, it is questionable whether the theories of relativity can be adequately understood in these terms. Also the mutability, wavelike character and the indeterminancy of elementary entities such as electrons casts doubt on whether these can be thought of as particles. In thermodynamics the attempt to understand entropy entirely in terms of the motion of particles has given rise to insoluble problems. And apart from the problem of consciousness, biologists have been unable to account for the differentiation of cells and the genesis of form in multi-celled organisms in terms of materialism.

A number of thinkers have adopted this second strategy to the problems of positivistic materialism and attempted to develop alternative ontologies to materialism for science. Notable among philosophers in this respect are Leibniz, Kant before he developed his critical philosophy, Schelling, Hegel, Engels, Bergson and Whitehead. There have also been a number of attempts by scientists themselves, notably field theorists such as Faraday, Maxwell, Einstein and Mendel Sachs; thinkers attempting to develop anti-reductionist approaches in biology such as Driesch, Paul Weiss and Waddington; and a number of other thinkers who have attempted to extrapolate from their own disciplines such as the physicist David Bohm, the chemist Ilya Prigogine, the psychologist Piaget and the mathematician René Thom. However, despite the enormous influence of philosophers' thought on the problems of ontology as compared to the influence of the ideas of epistemology, philosophy has been far more preoccupied with epistemological questions than with ontology. This reflects the furious attacks which have been made on metaphysics by the positivists who have defined science in opposition to metaphysics. For this reason I will begin my attack on positivistic materialism by showing the inadequacy of positivism and its derivatives. It will be argued that rather than science having been replaced by metaphysics, science and metaphysics are indissociably related and that the development of ontology is vitally important for the advancement of science.

This will open the way for an attempt to develop an alternative conception of being to materialism. I will then try to develop a version of process philosophy and try to justify it by showing how it can resolve those problems engendered by the acceptance of the materialist conception of being. In particular process philosophy will be shown to be able to serve as the foundation for a scientifically justified ethics and for an evaluative and therefore ethically oriented science of humanity, thus overcoming the opposition between science and ethics.

CHAPTER II

EPISTEMOLOGY : SCIENCE AND METAPHYSICS

> ... there is something more in the human search for knowledge than the wish to get the facts right - basic as that is. We want to feel that the world can be understood as a unity, and that the rational mind can find ways of looking at it that are simple, new, and powerful exactly because they unify it.
>
> J. Bronowski
> Humanism and the Growth of Knowledge (1)

In this chapter I will criticise the empiricist epistemology of positivistic materialism with its associated rejection of metaphysics. At the same time I will attempt to develop an alternative epistemology to justify metaphysics, and in particular to justify the efforts to develop alternative conceptions of being to materialsm.

The essence of the argument against metaphysics is the belief that science has achieved the means for attaining certain knowledge as opposed to the baseless speculations of metaphysics, and the defence of this belief stands or falls with what are taken to be the criteria by which such certainty is achieved. Empiricists have traditionally tried to establish such criteria, with the most rigorous efforts in this direction having been undertaken by the logical positivists. Though the ideas of the logical positivists have been under severe attack during the last twenty years, it is necessary to examine the assumptions on which their position is based to identify the source of the opposition to metaphysics. I will therefore develop my own

(1) J. Bronowski "Humanism and the Growth of Knowledge" in THE PHILOSOPHY OF KARL POPPER, ed. Paul Schilpp, Library of Living Philosophers, Open Court, La Salle, Illinois, 1974, pp.606-631, Bk. 1, p. 627f.

epistemology initially through a critique of the claims of logical positivism to describe the nature of scientific truth.

The alternative epistemology will centre on the concept of understanding rather than the concept of knowledge. Where the aim of disciplined enquiry is seen to be the attainment of a deeper understanding of the world rather than just the accumulation of knowledge or the establishment of laws by which predictions can be made, science and metaphysics must be regarded as inseparable. If understanding is to be attained, then it is just as important to obtain a comprehensive world-view as to know about any particular aspect of the world, and the accumulation of specialist studies, no matter of how many types, does not add up to such a comprehensive world-view. Furthermore it will be seen that particular enquiries take place within a framework of assumptions and are committed to a basic conception of the world. It is this which relates particular enquiries to each other and to the world as a whole. If science is not to proceed blindly then these assumptions and commitments must be examined, and the possibility of alternatives must be considered. At the same time it will have been shown that the type of rationality involved in the establishment of scientific theories, or even in the development of mathematics is in no way superior to that involved in the development and justification of metaphysical systems. Thus as opposed to logical positivism in which metaphysics is rejected as nonsense, leaving science to be dogmatically identified with the concepts of materialism, my epistemology will be seen to imply that materialism is the conception of being of only one metaphysical system and that attempts should be made to develop alternatives.

LOGICAL POSITIVISM

To all empiricists the exemplary form of knowledge is that which is attained by science and a considerable amount of effort has gone into the analysis of science to show that it has a certain basis in observation. According to logical positivists, either truths are formally true merely asserting a tautology, or they are based on observation. This means that if statements are not tautologies they can only be known to be true through a proper experimental investigation. For this we must know what sort of observation or experiment would verify or falsify them.

Since all epistemologically significant statements can then be regarded as either formal tautologies or truths of common experience or natural science, it is held to be an illusion that there is a class of meaningful metaphysical statements about the nature of the world. While Hume formulated the classical anti-metaphysical position of empiricism, writing:

> When we run over libraries, persuaded of these principles, what havoc must we make - If we take in our hands any volume - of divinity or school metaphysics, for instance - let us ask, DOES IT CONTAIN ANY ABSTRACT REASONING CONCERNING QUANTITY OR NUMBER? NO. DOES IT CONTAIN ANY EXPERIMENTAL REASONING CONCERNING MATTER OF FACT OR EXISTENCE? NO. Commit it then to the flames, for it can contain nothing but sophistry and illusion. (1)

this view has been echoed in the works of the logical positivists. Thus A. J. Ayer who was the main exponent of logical positivism in

(1) David Hume, AN INQUIRY CONCERNING HUMAN UNDERSTANDING, Bobbs-Merrill, Indianapolis, 1955, p. 173.

England referred to this passage from Hume, writing, "What is this but a rhetorical version of our own thesis that a sentence that does not express either a formally true proposition or an empirical hypothesis is devoid of significance?" (1)

It was pointed out that logical positivism as it stands is logically incoherent since a statement of its basic assumptions is meaningless in terms of itself. The force of logical positivism rests with its identification with the achievements of science and it is in its interpretation of scientific knowledge that it must be understood and its achievements evaluated. But to understand how the logical positivists have interpreted scientific knowledge it is necessary to understand the basic ideas on which this interpretation is based. The easiest way to do this is to find where these ideas originated and how they were developed and synthesized.

While logical positivism must be seen as a development of the positivist movement described in the last chapter, the thinkers who were the immediate source of ideas for the logical positivist movement which began in Vienna were Mach, Poincaré, Frege, Cantor, Russell and Wittgenstein. From Mach the logical positivists took over the idea that scientific statements must be empirically verifiable. By this Mach meant that all empirical statements must be able to be reduced to statements about sensations. Thus the subject matter of science was seen to be about empirical regularities. However Mach left no place in his

(1) A. J. Ayer, LANGUAGE, TRUTH AND LOGIC (1936), Penguin Books, Harmondsworth, 1971, p. 72.

scheme for mathematics, and in order to fill this gap ideas were borrowed from the philosophy of science developed by Poincaré. According to Poincaré, scientific laws are largely a matter of convention and the data of experience could be explained by more than one hypothesis. If all these equally accounted for the facts then the only reason for choosing between them would be convenience. Thus hypotheses are nothing but convenient ways of ordering experience. The theoretical terms of these hypotheses were then seen to be conventional abbreviations for phenomenal descriptions and so any assertion made using them could equally be made in a purely phenomenal language. The theoretical terms were thought to be formulated in such a way that the relations between them could be expressed mathematically. In this way mathematics could be seen to be involved in science. But according to this view mathematical laws should be seen as nothing but convenient ways of expressing relations holding between phenomena.

The logical positivists were also influenced by the philosophers of mathematics: Frege, Cantor and Russell, and the logical atomism which developed from it. In particular they were influenced by Wittgenstein's TRACTATUS LOGICO PHILOSOPHICUS. The most important idea taken over from this group of thinkers was that mathematical statements of scientific laws could be formulated in terms of mathematical logic. They then accepted Wittgenstein's idea that the certainty of mathematics stemmed from the fact that it simply expressed identities or tautologies. Thus the logical positivists were able to reconcile their assumption that all knowledge is founded on experience with the certainty of the mathematical forms used in scientific theories.

The confluence of these ideas led to the original formulation by the logical positivists of their view of the nature of science. According to this, a scientific theory should be able to be axiomatized. There are three types of term involved in this axiomatization: the terms of logic and mathematics, theoretical terms, and observational terms. The axioms of the theory are the scientific laws which specify the relationships holding between theoretical terms. The theoretical terms must be able to be defined by observational terms. These definitions were referred to as correspondence rules, so called because they relate the theoretical terms to the corresponding observational terms.

Only entities which could be referred to in observational terms, or entities which could be referred to in theoretical terms which in turn could be given a phenomenal definition by correspondence rules could be introduced into scientific theories. This led to the doctrine of cognitive significance according to which the only meaningful discourse was that in observational terms referring to phenomena or in theoretical terms which were abbreviations for expressions in phenomenal language. Since the phenomenal conditions in terms of which assertions using theoretical entities could be verified were then thought to be the conditions in terms of which theoretical entities were defined, the doctrine of cognitive significance led to the slogan 'The meaning of a term is its method of verification', and it was concluded that the only meaningful discourse about the world was that which is empirically verifiable. Thus all meaningful discourse about the world had to be reducible to assertions in observational language and science was seen as resting on a foundation of protocol sentences. Originally protocol sentences were thought to be in sense datum language, and as such, incorrigible. However, this was replaced by the idea that protocol sentences had to be in physicalist language and make assertions about things and their properties which could then be verified by observation. All metaphysical discourse was ruled out as nonsense since it could not be reduced to protocol sentences.

In some versions of logical positivism this came to be thought of as the method by which science should be developed: science was seen as developing upward from observations expressed in protocol sentences to theoretical generalizations about phenomena, achieved through the introduction of theoretical terms defined by correspondence rules. However this was not usual. More commonly it was thought that the function of the philosopher was not to give an account of how scientific theories develop but to describe the structure of those theories already in existence to reveal the grounds of their validity.

In this account of science it was extremely important to maintain the distinction between theoretical and observational terms since if science was to be seen as being based on a solid foundation of experience, observational assertions had to be regarded as being able to be verified without difficulty. This would only be possible if different observers were uninfluenced by their theoretical background. But some observations have to be expressed in theoretical terms. This is the case for instance when a voltmeter is read. To get round this problem theoretical terms were divided into observational terms and non-observational terms and the non-problematic status of observational terms was maintained by specifying that all theoretical language had to refer to directly observable entities, things or attributes.

The first aspect of the original model to be shown to be inadequate was that dealing with correspondence rules. The correspondence rules had been designed to serve three functions: they defined theoretical terms, they guaranteed the cognitive significance of these terms, and they specified what experimental procedures were to be admissable for applying a theory to phenomena. In the original model the correspondence rules were thought of as explicit definitions of theoretical terms. These definitions had to be entirely in terms of an observational vocabulary. The definition also specified the conditions for the application of theoretical terms. The trouble with this was that it is impossible to define in this way dispositional properties, that is, what things would do in certain circumstances, though they are clearly cognitively significant. To come to terms with this problem correspondence rules were considerably weakened.

On the new model correspondence rules came to be incorporated as part of the theory and specified the conditions under which the theoretical postulates or laws could be applied to observable phenomena. This meant that correspondence rules had to contain at least one observational term and at least one theoretical term. On this view if a theory is to be regarded as cognitively significant, it has to imply observable consequences. To test a theory it is then necessary to be able to deduce what would be observed in the future by means of the theory from present observations. The correspondence rules could then be thought of as all the admissable experimental procedures for applying the theory to the observational phenomena. In this scheme the theoretical terms would not be defined individually or completely in terms of the observational vocabulary. It is the theory as a whole which must be shown to be cognitively significant by being testable. Thus it was no longer possible to think of theories being built up from observations, though the empirical significance of the theory still had its source in the observational language. Observation was now only of significance in the verification of theories. The positivists then argued that discovery of theories was of no importance for philosophy but is a matter for psychologists, historians or sociologists. Philosophy was henceforth only to be concerned with the logic of justification.

This model of theories is what is generally called the hypothetico-deductive model. The theory makes predictions about what will happen, with predictions and explanations being regarded as formally identical. The only difference is that predictions come before the fact while explanations come after it. An explanation is thought to be made by showing that what is observed is covered by a law in terms of which it could have been predicted.

However, a problem then arose about the status of the theoretical entities in the hypotheses since they could no longer be thought of as simply abbreviations for observations. Every attempt to do away with these entities has failed. On the instrumentalist interpretation these entities were regarded simply as postulates necessary for making predictions. However the uncomfortable position involved in holding that theoretical terms are necessary while not referring to anything in the world has led most adherents of this model of scientific theories to adopt a realist line.

The development of the logical positivist model of science has thus vastly altered the status of the theoretical apparatus. Originally it was only thought of in relation to the problem of showing the place of mathematics in science and little attention was paid to it. In the later versions of logical positivism theories are thought of as being about the behaviour of real non-observable entities which relate in incompletely specifiable ways to their observable manifestations. Thus it is now problematic how the theoretical apparatus can connect in a clearcut way with the phenomena and this has considerably weakened the positivist's ideal of rigour. Thus while Reichenbach wrote in 1936 of the philosophy of one of the leading logical positivists, Rudolf Carnap, that "his theory may be regarded after a fashion, as a modern fulfilment of Descartes' quest for an absolutely certain basis of science" (1), John Passmore in 1966 concluded a review of Carnap's efforts by stating that, "In so far as was his ambition, most logical positivists would now admit, he certainly failed to fulfil it". (2) Yet even with the looser criteria for the acceptance of a theory and the looser relationship between theories and experience this model of scientific theories still strongly emphasizes mathematics and mathematical logic and is often referred to as the deductivist approach to science.

One of the consequences of this emphasis on certainty was that it seemed difficult to account for how a scientific theory could be rejected. Logical positivism was committed to the belief that scientific knowledge is cumulative. This problem led to a later development concerning the nature of scientific growth. According to the positivists a theory can be replaced by a new theory for one of three reasons. First, though a theory may have been highly confirmed, technological developments might reveal the theory to be predictively inadequate, thus eroding its support. Second, a theory might be expanded to cover phenomena which were not covered by the original formulation of the theory. An example of this is the extension of classical particle mechanics to rigid body mechanics. Third, several theories which enjoyed high degrees of confirmation may be reduced to, or included in a more inclusive theory. The positivists believed that most theories were supplanted for the

(1) Cited by John Passmore, A HUNDRED YEARS OF PHILOSOPHY, (1966), 2nd ed. Penguin, Harmondsworth 1968, p. 393.
(2) loc. cit.

second and third reasons. This is the basis of the idea that science grows by theory reduction.

Central to this view is the belief that all the consequences of the theory which is being reduced to the broader theory must be able to be deduced from the broader theory. For this to be possible the concepts of the original theory must be fixed and not affected by the reduction. Kepler's planetry laws are claimed to have been reduced to Newton's laws of motion in this way. Hence the logical positivists were able to retain the notion that old theories which have a high degree of confirmation are not rejected and could thus still cling to their belief that the reason for the success of science is that it has only accepted as knowledge that which has been empirically verified. Thus according to the logical positivists science grows by either increasing the scope of old theories or by assimilating old confirmed theories into more comprehensive theories and science can still be regarded as a cumulative enterprise.

This describes the final version of the logical positivist's position as it was developed by its main proponents, Carnap and Hempel. Other philosophers still defend positions which were abandoned by Carnap such as phenomenalism and instrumentalism, but it is generally held that the position of Carnap and Hempel is the least vulnerable to criticism. (1)

(1) Frederick Suppe, "The Search for Philosophic Understanding of Scientific Theories" in THE STRUCTURE OF SCIENTIFIC THEORIES ed. Frederick Suppe Uni. of Ill. Press, Urbana, 1974, especially on p. 54f.

I have now given a sufficiently detailed account of the logical positivist's view of the nature of scientific theories to isolate its fundamental tenets. Firstly, there is the distinction between theory and observation. The maintenance of this distinction is essential if observation is to be able to provide a solid foundation for certain knowledge, and if theory is to be regarded as providing explanations of that which is observed. Secondly, it is assumed that the meaning of concepts does not change with different theories. This is supported by the idea that concepts are defined at least indirectly by cognitive significance. This is essential for the validity of the idea of knowledge growth by theory reduction. If this is rejected then it is no longer possible to think of knowledge growing by accumulation which in turn means that the achievements of science can no longer be regarded as certain, as distinct from those of metaphysics. Thirdly, it is assumed that science is essentially concerned with prediction, and explanation is regarded as an ex post facto prediction. Even in the realist formulations of logical positivists the mathematical formalism in terms of which predictions are made is regarded as the essential aspect of scientific theories. Such a view is essential if it is thought that theories are verified or falsified by the success of their predictions. Fourthly, it is assumed that the only valid forms of reasoning in science are those which can be formalized by mathematical logic. This is required to guarantee certainty and to maintain that all knowledge is ultimately grounded in experience. Finally there is a basic assumption underlying the whole project of attempting to find the universal structure of scientific theories and this is that there is a universally valid scientific method independent of the theories which are developed in science.

CRITIQUE OF LOGICAL POSITIVISM

In the following sections I will attack all of the fundamental tenets of logical positivism outlined in the last section. I will begin with an examination of observation and through this, I will attack the possibility of drawing a distinction between observation and theory. I will show how the nature of observation has been misunderstood by the logical positivists and that in fact observation is as sensitive to theory as theory is to observation, and that, far from science being built on a solid foundation of observation, one of the main aims of science is to improve our powers of observation.

I will then examine the nature of concepts and show the inadequacy of the positivist's understanding of these. It will be shown through examples that the development of concepts is one of the most important creative features of the scientific enterprise and involves considerable effort, and that in scientific advances the concepts of new theories have different meanings from the concepts of the theories which they replace. This will show that the positivist view of scientific development as the accumulation of certain knowledge through theory reduction is invalid, and at the same time indicate that the positivist conception of scientific theories as means for making predictions and the conception of scientific rationality as that which can be formalized in mathematical logic should be rejected.

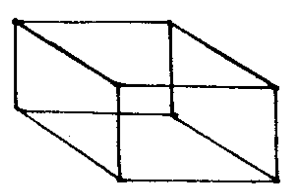
These accounts of the nature of observation and concepts will then form the starting point for the development of an alternative view of the nature of science. I will show that theories are really analogies, metaphors and paradigms in terms of which the world is understood, that 'understanding' must be taken as the goal of science rather than the ability to make predictions, and that explanation is a way of making the world intelligible and not just an ex post facto prediction. Furthermore, to conceive of theories as instruments for understanding the world bypasses the realist/instrumentalist dispute of the positivists and paves the way for a thorough re-examination of the nature of the reasoning involved in science. It will be shown that while developments in science are essentially rationally based, mathematical logic is largely irrelevant for understanding this rationality. In its place I will try to develop a logic of understanding. This will be seen to imply a development of logic with science, thus undermining the last assumption of positivism that it is possible to formulate a scientific method independent of any scientific theory. It will also be argued that science is a community matter in which each scientist must be understood as developing a tradition rather than adding to an accumulation of knowledge. I will then make a careful analysis of understanding, drawing on the tradition of hermeneutics and on the ideas of Michael Polanyi. The most important feature of understanding will be seen to be not that which is the focus of attention but that which is tacitly understood when any specific subject is focussed upon. At this stage I will have shown all those ideas which formed the basis of the attacks on metaphysics to be wrong and the epistemology developed through the critique of logical positivism will facilitate an affirmation of the enterprise of metaphysics.

OBSERVATION

In this section I will examine the nature of observation. Observations are not simply experiences. While both animals and humans experience the world in such a way that they can understand the situation they are in and take appropriate action, only humans can make observations. An observation is not a thing we do since if this were the case we would say that an observation happens at a particular time, but this is not the case. Rather, an observation is something which is made. As such it can be recorded in books, presented in graphs, be expected or unexpected, accurate or inaccurate. When in an experimental situation not everything which a person sees is an observation. Only that which is relevant to the enquiry would be considered as such. Thus an observation is something that a person sees to be the case which is relevant, or is thought to be relevant to what that person is enquiring into. It is not that which is given in experience as the empiricists would have it.

People can make different observations in the same situation. This can occur because they are concerned with different problems or because one of them has been inattentive. However different observations are also made because the observers adhere to different theories about the world. For instance that which Galileo would have seen as a pendulum in which a body repeats almost the same motion over and over again, an Aristotelian would have seen as a body falling with difficulty, moved by its own nature from a high point to natural rest at a lower one. (1) In this way observation, that is, what is seen, is theory impregnated. Yet such a view seems to be opposed by a great many thinkers besides the logical positivists. What can the reason be for this? The most influential idea which has led people to believe that two people observing the same situation must be in some sense seeing the same thing is that their retinas are both being stimulated by the same radiation. It is concluded from this that they must be receiving the same data but interpreting it differently. N.R. Hanson has replied to this that "there is more to seeing than meets the eyeball". (2) However, the influence of the idea that there is some unquestionable data to which interpretations are added makes it necessary to examine this point in more detail.

Consider the case of the figure below. Some people will see a cube viewed from above while others will see a cube viewed from below.



It is impossible to view the figure as both those things at once. So in what sense can we talk of seeing or observing the same thing? It might be said that the same object is observed but that this is

(1) As noted by Thomas S. Kuhn, THE STRUCTURE OF SCIENTIFIC REVOLUTIONS 2nd ed., Uni. of Chicago Press, Chicago 1970, p. 118f.
(2) N.R. Hanson, PATTERNS OF DISCOVERY, Cambridge U.P., Cambridge 1961, p. 7.

interpreted in different ways. It can be agreed that the same object is observed. If this were not the case there would be no problem. But different things are seen while observing the same object and it is simply wrong to use 'interpretation' in this sense. One might talk about interpretation when viewing something through a mist, where vague outlines only provide clues to what is seen. But in the above situation we do not first focus on the lines and then interpret what they represent, we simply see either a cube viewed from above or a cube viewed from below. There can be no reason to insist that the observers must see the same thing unless one has made a prior commitment to this belief for reasons other than a consideration of what is being seen. In the above visual experience the lines which are seen by people viewing the figure are only considered <u>after</u> the visual experience of seeing the box. We observe holistically and analysis of the whole into its constituent parts is a secondary activity.

There are cases where reports of what is seen are made in terms of sensations. For instance it might take the form; 'there was a faint streak of green light at one end while the main body was red'. But statements such as this are only made in situations governed by confusion and conceptual muddle where the person does not know what he is looking at. In doing this the person is always trying to make his observations cohere against a background of accepted beliefs. Such cases are non-typical and it is wrong to conclude from these that in every situation there is a prior awareness of data which can be described in phenomenal terms which is then followed by an interpretation.

The nature of observation is further illuminated by the figure below of a bear climbing a tree. In recognizing it as a bear the elements of

the figure cohere into a unified Gestalt. Yet the organization of the lines to form a picture is not part of the picture in the same way as the lines. Without this organization the lines do not hang together. This organization is an essential part of seeing. In seeing it as a bear we see that if the tree were seen from the other side, the whole bear would come into view. Also we see that the bear could not wave his paws in the air without falling. Thus in seeing something we are aware of much more than meets the eye. What is seen is understood against a background of beliefs, and we see that a number of states, possibilities and conditions hold.

The degree to which observation extends beyond the passive reception of data is evident from the way seeing can take on a generalized form. For instance if we observe that tacks which are not attracted to each other are attracted to a screwdriver, then we can see that the screwdriver is magnetized. This is to see that the screwdriver will always attract iron fillings. This involves seeing into the future as we can see what will happen in future situations. It also involves seeing into the past as we can assume that at some time the screwdriver must have become magnetized. But seeing into the future and into the past is not unusual. We can see by the date on a coin when it was minted, by the postage stamp on a letter from where it came. When we look at a large key and a small lock we can see that it will not fit into the lock and so on. Such conclusions are drawn by simple observation. They are seen. It is not a matter of drawing inferences from the data.

This suggests that to be able to see things one must have a considerable amount of background knowledge. Such background knowledge is clearly evident when we give causal explanations. For instance when we try to explain why the wheel of a machine will not turn we note that a belt is loose. In observing this we observe why the wheel will not turn. But it is only possible for us to see this because we have some understanding, some background knowledge of how the machine works. At a more basic level it is also necessary to know that if the wheel suddenly stops turning then there must be some reason for it. It is assumed that all events have some cause.

To understand the instruments used in science even more background knowledge is required. Some scientific knowledge is required to see that the movement of a needle of a galvinometer means that there has been a change in current intensity. More knowledge would be required to see that this means that the capacitor has discharged. Yet this is seen by the scientist who reads the instruments. Unless the scientist is using faulty instruments and is unsure as to what could be the cause of a changed reading, there is no process of inference. When a physicist enters his or her laboratory, what s/he sees is different from what is seen by someone who is ignorant of science. S/he sees what the instruments can be used to measure, and s/he sees what they mean when they indicate that something has happened. If asked to explain what s/he is doing and what s/he has observed s/he can only answer in the concepts of physics. S/he will not answer in the terms used by the non-scientist and then explain how these relate to the theoretical concepts of physics, s/he will simply tell the ignorant non-scientist that if s/he wants to understand what is going on then s/he must go and learn some physics. The layman is blind to what the physicist sees.

An explanation in terms of the constituents of the behaviour of some material results in there being a change in what is seen. For instance if we explain the increase in evaporation of water at high temperatures in terms of the molecules which are its constituents, then we see that the water is a system of molecules, and seeing water in this way makes its behaviour intelligible. When this theory is accepted what we observe is different from what was observed before the theory was encountered. Having accepted the theory what is observed is not the water as it was seen before, the behaviour of which can now be explained by the behaviour of molecules. The decrease in the quantity of water is not simply explained by saying that molecules have escaped through attaining high levels of kinetic energy. The decrease in volume is the escape of molecules from what <u>is</u> a system of molecules. This is what the evaporation of water is, and this is what is seen.

Another example which shows very clearly how theory can alter what is observed is the demise of witchcraft. Numerous people claim to have seen the devil and been influenced by demonic forces. There is no reason to doubt these claims. It is well known that people have hallucinations and experience themselves as governed by outside forces as a result of psychological disturbances. But these experiences are interpreted this way now because of the prevailing world-view. Before the rise of physical sciences the prevailing cosmology made observations of demonic influences perfectly acceptable. It is reasonable to think that when such experiences were acceptable there would have been a lot more of them, as people would not be inclined to dismiss so readily unacceptable experiences as phantasy. Rather they would have been inclined to attend to such experiences. But with the rise of materialism all such observations were dismissed. This was because the language of demonic influences had no place in the new cosmology. This meant that there had to be a reformulation and reinterpretation of quite common observational statements which had been backed up by a great number of people. The same things were no longer observed because what was experienced was seen against a background of a different set of beliefs.

It is evident from this analysis that what is seen in a given situation depends on the background knowledge, that is, what theories we hold. Consequently what is seen or observed is theory dependent and there is not a non-problematic ground of observation either in phenomenalistic or in physicalistic language which could provide science with a certain foundation on which the logical superstructure of science could stand. Observation is as sensitive to theoretical developments as theory is to observation. In its early stages theories are designed to conform to and explain what has been observed. Later theories form part of the background beliefs, and as such, allow an expansion of the perceptual horizon. New observations can be made which would not have been possible before the propounding of the theory, and these can then lead to the development of new theories.

The analysis above shows that not only is science not built on, or anchored in a certain ground of observation, but that one of the achievements of science is to extend our perceptual horizons so that what is seen is increasingly pregnant with information. But science does not do just this. It was seen at the beginning of the analysis that observations are things which can be recorded and communicated. What science does is to expand the perceptual horizons not only of the individual but also of the community. Perception is expanded in such a way that it can be communicated and appropriated by other people. The increased appreciation of what is perceived becomes common property. Thus observation does not have anything like the characteristics attributed to it by those thinkers influenced by logical positivism and cannot serve the purpose required of it by them.

CONCEPTS

While the positivists gradually retreated from their view that the meaning of concepts could be straightforwardly defined by correspondence rules and recognized that their meaning could only be understood in the context of the theories of which they formed a part, they did not think that concepts merited much attention in their own right. At most they were concerned to elucidate the difference between observational terms and theoretical terms and to define the ontological status of theoretical terms. In this section I will argue that the development of concepts is a long arduous process and that concepts are more significant than positivists with their emphasis on logic and prediction are prepared to allow. Secondly I will point out that concepts change their meaning with new theories, and that this makes it impossible to think of knowledge growth in terms of theory reduction.

To illustrate the way in which concepts are developed I will first consider how the concept of intertia as it came to be understood by Newton was developed. (1) The most basic weakness in the system of Aristotelian physics was its analysis of the motion of objects. The Aristotelian system assumed a hierarchically ordered cosmos in which each thing had its natural place and the natural state of anything was to be at rest. It was only because things were not in their natural places that there was any autonomous

(1) As described in Alexandre Koyré METAPHYSICS AND MEASUREMENT, Chapman & Hall, London, 1968, pp. 29-34, and Paul K. Feyerabend in "Explanation, Reduction, and Empiricism" in MINNESOTA STUDIES IN THE PHILOSOPHY OF SCIENCE, VOLUME III, Herbert Feigl and Grover Maxwell eds., Uni. of Minnesota Press, Minneapolis, 1962, pp. 53-59.

impulse towards locomotion. All such motion was then thought to be either of things moving towards their natural places or due to the continuous action of something, its efficient cause. The trouble with this theory was that in terms of it, it was difficult to explain how a thrown object can continue to move up in the air away from its natural place after it has been released. Aristotle tried to explain this by the action of the air. It was at this point that the Aristotelian system first came under criticism.

The Parisian nominalists such as Buridan and Oresme argued that this was an unsatisfactory explanation since the air, which would hardly be able to move a heavy object, was supposed to act both as the efficient cause of the continued motion of the object as well as the cause which slowed it down by providing friction. They formulated the impetus theory according to which a motor, such as the hand, transfers to the object an inner moving force which acts on the projectile continuously, thus keeping it in motion. At the same time it overcomes the resistance of the medium to the movement. In the process the impetus is weakened and used up. But no agreement could be arrived at concerning the ontological status of the impetus. In trying to fit it into the Aristotelian framework of concepts they thought of it as a kind of form, as a kind of habitus or as some sort of quality like heat. Whatever it was it was thought to be 'immortal' in the absence of any resistance to movement.

Given this it would seem that the impetus theory is nearly identical to the law of inertia as it was finally developed in Newton's mechanics.

However the concept of impetus underwent considerable evolution before it came to be assimilated into Newton's celestial mechanics. Galileo who was strongly influenced by the work of the Parisian nominalists rejected the idea that impetus could be immortal. His argument against this is that if impetus is believed to be an immanent force then it must spend and finally exhaust itself in the production of motion. For this reason Galileo considered impetus to be the effect of motion instead of its cause.

The main objection Galileo had to the medieval concept of impetus was that such a force would require constant creation ex nihilo and so was not capable of being treated mathematically. But his redefinition of the concept had far reaching implications. It meant that motion could be thought of as the natural state of a body. This undermined the whole edifice of Aristotelian cosmology where everything was thought to have its natural place, and motion away from this could not be thought of as but unnatural.

Galileo was the first person to use the notion 'state of motion' which was so central to the formulation of Newton's law of inertia. However, Galileo did not succeed in formulating Newton's law. Galileo wrote:

> all external impediments removed, a heavy body on a spherical surface concentric with the earth will be indifferent to rest and to movement toward any part of the horizon. And it will maintain itself in that state to which it has once been placed: that is, if placed in movement toward the west (for example), it will maintain itself in that movement. (1)

(1) Translation by Stillman Drake, DISCOVERIES AND OPINIONS OF GALILEO Garden City, N.Y., Doubleday Anchor Books, 1957, "Letters on Sunspots" p. 113, cited by I. Bernard Cohen in "History and the Philosophy of Science" in Suppe (1974) op. cit. p. 325.

Here we see that motion is always understood in relation to the earth. Galileo had only considered the state of motion in relation to objects moving on the surface of the earth or on a "horizontal plane (which) is coincident with the surface of a sphere concentric with the earth". (1)

Galileo never again used the term 'state of motion' and it dropped out of sight until it was revived by Descartes. But Descartes did not simply accept this notion as it was expressed by Galileo. He transformed it into a general principle holding for all of nature and he argued that if motion was to be considered a state then it was necessary that it be rectilinear as well as uniform. He added to the basic law that a body will continue in any given state of motion a second law stating that all motion is rectilinear. But he also thought it necessary to explain the conservation of 'motion of matter' as depending on and deriving from the 'immutability of God'.

It was from Descartes that Newton derived the concept 'state of motion'. But Newton formulated a single law which showed the behaviour of moving bodies to be due to the properties of matter rather than a consequence of the attributes of God. In order to do this Newton borrowed the notion of inertia from Kepler. This reveals another instance of conceptual transformation. It was Kepler who

(1) Cited by Cohen ibid. p. 326.

introduced the notion of inertia, but he meant by it only the resistance of matter to being moved, or the tendency of matter to remain in a state of rest. This was an original idea of Kepler's since it implies that a body will come to rest at any point at which a motive force ceases to act upon it and is thus incompatible with the Aristotelian doctrine of natural places. However it was still assumed that all motion needs explaining and that rest is the only natural state. Inertia is the resistance with which bodies oppose motion. In Newton it is the resistance with which they oppose a change of state, whether that state be rest or motion in a straight line. Thus what Newton did was to transform both the concept of inertia and the concept of 'state of motion' so that the state of motion came to be seen as due to inertia and thus as a consequence of the quantity of matter, i.e. mass, while the concept of inertia came to be extended to bodies in motion as well as bodies at rest. He then formulated his law of inertia, claiming that a body will continue in a state of rest or uniform motion in a straight line unless acted on by an external force.

Such conceptual change is universal in science. For instance in relativity theory the concept of mass is understood as a relation involving relative velocities between an object and a coordinate system. This transformed the concept of mass of classical mechanics which was seen as a property of the object itself independent of any coordinate system, and since the concept of inertia is understood in terms of mass, this meant that this concept also was changed. Also in the development from the phenomenological theory of thermodynamics to statistical thermodynamics there was a complete transformation of the meaning of concepts. In phenomenological thermodynamics heat was seen as a fluid, while in statistical thermodynamics thermal energy is seen as the kinetic energy of molecular motion. Much the same laws concerning heat transfer and entropy loss can be derived from the statistical theory as from the phenomenological theory, but they have a different significance. Also heat transfer and entropy change are conceived in statistical theories as only probable tendencies, and the direction of these can change momentarily. This is not possible in the phenomenological theory, so these notions must have a different meaning in the two theories.

The nature of these conceptual changes suggests that one of the main features of science is the creation and transformation of concepts from generation to generation, and that the advancement of science is largely a matter of the evolution of concepts. As Kierkegaard wrote: "Concepts, like individuals, have their histories and are just as incapable of withstanding the ravages of time as are individuals". (1) Furthermore, the concepts involved such as inertia and mass are the cornerstone of physics and their development suggests that far more is involved than simply enabling correct predictions to be made. Rather the development of concepts must be seen as the development of new conceptions of the world.

But this undermines the logical positivists' views about science.

(1) Soren Kierkegaard THE CONCEPT OF IRONY tr. Lee M. Capel, Collins, London, 1966, p. 47.

In the account of logical positivism it was seen that since science was supposed to accumulate certain knowledge, progress in science was thought to be almost entirely a matter of extending the scope of established theories or by encompassing established theories in new, broader theories. This was called growth by reduction. Nagel, who was one of the main proponents of the theory of reduction, stated its aim:

> The objective of the reduction is to show that the laws, or the general principles of the secondary science, are simply logical consequences of the assumptions of the primary science. (1)

This means that only theories which contain old theories or are at least consistent with them are admissable in a given domain. But if old theories are to be regarded as capable of logical derivation from new theories before the new theories can be regarded as successful, then the concepts involved in the theories must be identical. Their meaning cannot be altered by the new theory. Thus by showing how concepts change with theoretical developments, I have shown the theory of reduction to be wrong. It is impossible to deduce the Medieval theory of motion involving the concept of impetus as an acting force maintaining a body in motion from the Newtonian theory of motion with its concept of inertia (which Newton still referred to as impetus) as a property of matter. It would not even be possible to deduce Galileo's theory of motion from Newton's theory. Nor is it possible to derive the phenomenological theory of thermodynamics from the statistical theory,

(1) Cited in P.K. Feyerabend "Explanation, Reduction, and Empiricism" in MINNESOTA STUDIES IN THE PHILOSOPHY OF SCIENCE, VOLUME III, Feigl and Maxwell eds., op. cit. p. 23.

or classical physics from the general theory of relativity. The concepts in the theories belong to different conceptual frameworks and the logical positivists are incapable on their assumptions of coming to terms with the complexities involved in this.

All we can say about the relation between the new theories and the old ones they replace is that they are analogous in some respects. To understand this analogy it is impossible to rely on mathematical logic and theory neutral observations. Only when it is admitted that reason cannot be reduced to logicality can these analogies be understood.

The above analyses show that the logical positivists' account of knowledge growth, their account of the relationship between old theories and new and their ideals of certainty to be wrong. The attempt to account for the meaning of theoretical concepts in terms of the contents of experience or measuring operations, that is, the attempt to derive correspondence rules to define theoretical terms, must also be seen as futile. Theories must be understood as at least to a large extent concerned with the invention and transformation of concepts in a way that is incomprehensible if the goal of science is accurate prediction.

Despite the arguments adduced in support of the rejection of a theoretically neutral observation language and for the reality of conceptual transformations in scientific theories, these views have been opposed on the grounds that they must lead to the conclusion that science is impossible. (1) It is argued that if these

(1) This position is taken by I. Scheffler in SCIENCE AND SUBJECTIVITY Bobbs Merrill, Indianapolis, 1967.

anti-positivist views were correct, then what a person sees and the meaning of the terms s/he uses would be determined by the theory which s/he holds. This would imply that it is impossible for theories to be compared since the adherents to different theories would see different things, and there would be no common terms in which differences between theories could be expressed. Furthermore it would imply that no observation report could falsify or disconfirm a theory since observations could only be expressed in terms which gain their meaning from the theory. Therefore if a prediction were not fulfilled, it would be impossible to say what was observed since the terms in which the observation was made would only allow that which was consistent with the theory to be expressed. To express what is contradictory to the theory would only be possible by changing the meaning of the terms, and this would mean that the observation could no longer contradict the theory. Thus all the principles of theory would have to be seen as analytic and science would become a non-empirical discipline.

Such criticisms are not applicable to the position which I am defending since in opposition to the subjective idealism which forms the starting point of even those empiricists who go on to argue for realism, I have presupposed the existence of the world independent of any experience or knowledge of it so that all observation and knowledge is experienced as an incomplete grasp of the world. This assumption of an independent world is characteristic of those anti-positivists attacked by Scheffler. Thomas Kuhn for instance makes it clear that when he talks about people with different theories being in a sense in different worlds, he is not denying the existence of an independent world. Thus he writes:

> I am, for example, acutely aware of the difficulties created by saying that when Aristotle and Galileo looked at swinging stones, the first saw constrained fall, the second a pendulum. The same difficulties are presented in an even more fundamental form by the opening sentences of this section: though the world does not change with a change of paradigm, the scientist afterwards works in a different world. (1)

What anti-positivists have been arguing and the position I have been supporting is that the world cannot be known as it is independently of any interpretive scheme, and different interpretive schemes alter the way the world is experienced and observed. The adequacy of theories must be judged according to their ability to make this independent world intelligible.

It might be impossible to compare theories if all the terms of a language changed their meaning as a result of a change in theoretical outlook, but no-one has attempted to justify this position. It is possible that all the terms of a language may eventually change their meaning, but this will only occur piecemeal, so that there is always a body of commonly understood terms which can serve as a basis for communicating new ideas. In doing this the meaning of terms can be negotiated without difficulty. Words are not fixed in their meaning but are inherently open textured. Thus the fact that people are committed to different coneptual frameworks and mean different things by words does not stop them communicating. The words in a language do not simply reflect the conceptual structure

(1) Thomas Kuhn, op.cit. p.121.

of theories. This is clear from the studies of Piaget where it was shown that the learning of a vocabulary does not result in the children acquiring the interpretive schemes expressed by this vocabulary. This means that language is not a logical calculus and can be used by people in disputes even though they adhere to different theories with different conceptual frameworks.

The argument that two theories cannot be compared if there is any conceptual changes is only valid if it is accepted that the only possible form of comparison is that in which deductions are made to yield different expectations as to what will be observed. But it is possible to see different theories as in some sense analogous as has already been pointed out, and then it is always possible to find reasons why one theory is better than another. For instance it is possible to show many reasons why the Newtonian theory of motion is better than the Aristotelian theory even though the concepts have different meanings, including the concept of motion. It is not necessary to specify what sort of reasons could be found for all possible conflicts in science. This demand only has weight if one accepts the formalist position of the logical positivists. What must be rejected is their conception of rationality.

The argument that it is impossible to falsify a theory by observation is also invalid. It is perfectly possible to express quantitative results which are not expected without changing the meaning of the terms used. But the basic inadequacy of the argument is that it is based on a misconception of the nature of scientific theories. That this is the case will be argued in more detail in later sections in which it will be shown that it is not predictions which are of central importance in theories but making the world intelligible. This being the case then it can be seen that meeting with situations which are unexpected from the point of view of the theory results in the experience of an anomaly. It is not necessary to give expression to these anomalies in terms of the concepts of the theory. For instance it is possible to describe the evidence used in support of witchcraft using the language of witches, knowing all the time that what is comprehensible if one accepts the theories of reality held by witches is anomalous in terms of modern science.

Finally it can be concluded that the alteration of the way the world is seen and the transformation of the meaning of concepts does imply some measure of incommensurability between theories. But this should not be regarded as evidence against these ideas but rather as grounds for accepting them. If there were no incommensurability it would be impossible to explain how it is that disagreements between scientists are not immediately resolved, or how there could be any of the problems in communication between proponents of new theories and the old guard. Unresolved disagreements and communication difficulties have been a recurring feature within the scientific community, and to ignore this is to fail to face up to the reality of science.

THEORIES

Having argued that science is essentially concerned with increasing our powers of observation and with developing more adequate concepts for interpreting the world, I will now attempt to develop an account of scientific theories which accords with these arguments. I will attack the logical positivist's conception of theories and then attempt to justify a conception according to which a theory is basically an analogy which is articulated into a conceptual framework in terms of which the world is understood. In this conceptual framework, there are certain things which are taken as paradigmatic and not in need of explanation, while everything else is made intelligible by being related to the paradigm. In this way a theory becomes a metaphor and determines the way the world is seen. A successful theory is the one which is most successful at making the world intelligible to the holder of the theory.

As was pointed out earlier, from the point of view of logical positivism, even in its realist formulation, a theory is a device for making predictions. On this account, an explanation is made when a statement describing a state of affairs is deduced from some other statement or statements, where the explaining statements are at least as general, and usually more so, than the statement which is to be explained. The most common form of this is where a statement describing a phenomenon is deduced from a law and a statement asserting that the conditions under which the law obtains actually do so. Thus the explanandum is a logical consequence of the explanans, which contains a general law which is used in the deduction. This explanans must have empirical content to be adequate as such. This means that there is a symmetry between explanation and prediction, and the basis of the prediction is the explanation. An explanation is an _ex post facto_ prediction. The success of a theory is determined by its explanatory power, and by this is meant the number of successful forecasts to which it leads. (1)

The most obvious argument against this account of theories is that it does not accord with the practice of science. Predictions are not a major factor in theories. The only prediction to have been made in chemistry was Mendeleev's prediction of the properties of new elements from his periodic table. (2) Explanatory theories in biology and geology involve no predictions at all. It hardly seems justified to exclude these fields from what is counted as science. One can hardly doubt the explanatory power of Darwin's theory of evolution, yet nothing has been predicted by it, even _ex post facto._

Not only do most scientific explanations not make predictions, but predictions are not explanations. Complex mathematical schemes have been worked out to predict the movement of tides, yet having been worked out without a theoretical base they have lacked any power to explain the predicted events. Babylonian astronomy developed parallel to Greek astronomy and the Babylonians were far superior to the Greeks as far as predictions went. But the Babylonians still referred to the stars by divine names and offered no ideas to explain

(1) These conditions are given in Carl G. Hempel, ASPECTS OF SCIENTIFIC EXPLANATION AND OTHER ESSAYS IN THE PHILOSOPHY OF SCIENCE, Free Press, N.Y. 1965, Ch. 10.
(2) R. Harré, THE PRINCIPLES OF SCIENTIFIC THINKING, Macmillan, London, 1970, p. 18n.

why the stars and planets behaved the way they did, while the Greeks on the other hand laid the foundations for successfully explaining this behaviour. It was Greek speculation and not Babylonian prediction which was the starting point of modern astronomy. (1)

Also the logical positivist's emphasis on the importance of deduction and prediction in their account of how a theory comes to be verified is also unsatisfactory. The logical positivists believe that a theory is verified by giving rise to successful predictions, and that what is essential to a theory is the laws by which deductions as to what will be observed can be made. But since these laws must be universally applicable, no amount of evidence will confirm a theory. This difficulty led Karl Popper to emphasize falsification by failure to make correct predictions rather than verification through correct predictions as the essence of scientific development. This was an advance over logical positivism in one respect since it gave prominence to the role of speculation in science. But Popper's position is still tied to the ideals of mathematical logic with the central place in theory being given to predictive laws. The problem with this is that it is possible to work out any number of generalizations to account for the observed phenomena. Since the logical positivists do not allow any generalization to count as law since they must be related by reduction sentences to accepted theory, they have some way of distinguishing accidental generalizations from genuinely law governed sequences, but Popper has no way of choosing between propositions

(1) Stephen Toulmin, FORESIGHT AND UNDERSTANDING, Hutchinson, London, 1961, p. 28f.

other than through eventual falsification. The effect of this must be to gradually eliminate all generalizations except those with the least scope and content. But even with the logical positivist's commitment to the most general laws there are still no grounds for believing that the entire edifice of scientific laws is not a fabric of accidental generalization since they are all based in the same way on statements which are ostensive definitions.

In actual practice neither verification by predictive success nor falsification is able to account for the acceptance or rejection of a theory. Crystallography theory for instance was accepted when there was no possible way to verify or falsify it simply because it made the phenomena intelligible. (1) Where theories do yield predictions they are frequently accepted even when the evidence is against them. It is assumed that falsifying observations will eventually be explained. Thus Einstein's special theory of relativity was accepted when the only evidence for or against it that would be acceptable to those who took predictive capacity as the central feature of a theory, falsified it. (2) Furthermore a decision was made in favour of Einstein's relativity theory over the theory of Lorenz despite the lack of any experimental evidence. (3) Einstein's theory was accepted because of its success in resolving problems of classical physics in an elegant and simple way. As Lorenz wrote: "Einstein's theory...gains a simplicity that I have not been able to attain". (4)

(1) Michael Polanyi, PERSONAL KNOWLEDGE, Routledge & Kegan Paul, London, 1958, pp. 54-55.
(2) Ibid., p. 12.
(3) Brian Easlea, LIBERATION AND THE AIMS OF SCIENCE, Chatto & Windus, London, 1973, p. 71f.
(4) Cited ibid. p. 72.

I will now argue that what is really involved in science is the attempt to make the world intelligible, and the central feature of theories which makes this possible is the analogy on which they are based. (1) The place of analogies in theories can be shown by considering a simple example. X-ray diffraction is explained by seeing the crystals which diffract the X-rays as lattices. This explanation uses the analogy of a lattice to make the diffraction intelligible. Normally in a lattice what is significant are the linear strips, while in a crystal what is significant are the atoms which are at the point of intersection of the lattice. This indicates the element of construction necessary in using analogies. This use of analogy depends for its explanatory power on relations of similarity and difference between the explanans and the explanandum. These relations are not covered by the mathematical logic emphasized by the logical positivists.

The explanation of the behaviour of gases by seeing them as particles in motion also involved the construction of an analogy. The proponents of the kinetic corpuscularian theory of gases developed the idea of particles in motion in such a way that just those characteristics of particles which would explain the phenomena in question were appropriated for the model. While the particles or billiard balls on which the analogy is based have a certain colour, it is not thought

(1) The importance of analogy was first argued by N.R. Campbell in opposition to the philosophy of science of P. Duhem. More recently Thomas Kuhn in his celebrated book THE STRUCTURE OF SCIENTIFIC REVOLUTIONS op. cit. emphasised that metaphors have a central place in scientific theories. Campbell's views have been defended by Mary B. Hesse in MODELS AND ANALOGIES IN SCIENCE, Sheed and Ward, London, 1963 but the most vigorous modern exponent of the view that it is the analogies which are basic to theories is R. Harré (1970) op.cit.

that the molecules or atoms of a gas are coloured. The analogy is constructed in such a manner that it is analogous to the behaviour of the gas to be explained. That is, the constructed analogy is such as to imply that we would expect the behaviour of gas we do in fact observe. The analogy then allows inferences to be drawn concerning the behaviour of gases from what we would expect about the behaviour of particles of matter. This is effective since the behaviour of material particles is well known and can be understood in terms of Newtonian mechanics, and we can now apply this knowledge to that about which we knew little. However gas molecules are not just material particles and the most elaborate development of the analogy based on material particles fails to completely account for the behaviour of gases.

Darwin had the task of explaining the great variety of animals and plants and their distribution, and the apparent fact that these were different from the population of plants and animals which had existed previously on earth. He knew that animal and plant breeders achieved developments or changes in their stocks by selective breeding and he had also read Malthus' book which set out to show that there tended to be an excess of population so that only some of these could survive. Spencer had elaborated this notion and coined the phrase 'survival of the fittest' as a description of the outcome of the competition for survival. Darwin then constructed his analogy from these two elements. The diversity and change of species was seen as a result of selective breeding, and the breeder was seen as the pressure of excess population in a limited environment. It was necessary for him to assume that characteristics would be inherited and that despite this there could be some variation in this. The gap in the theory was later filled when the work of Mendel was discovered.

Each of these cases clearly shows the nature of analogy construction. However the analogies are not thought of as analogies after they have been accepted. The analogies come to be taken as metaphors and are thought of as simple descriptions of the way the world is. The world is seen as whatever the analogy is, and the problems they were designed to explain are no longer seen as problems, but as an intelligible aspect of the world. The notion of Darwinian evolution is so taken for granted that it is used as an analogy to explain other phenomena such as the development of the elements and the stars.

There is one branch of science which does not seem to support this analysis of theories and that is quantum theory. Quantum theory has been influenced by logical positivism. For this reason quantum theorists have tended to emphasize the mathematical aspects of their theory and play down the role of analogy and any attempt to give a semantic interpretation to the mathematical schemes. But analogies are just as important here as anywhere else. A typical example of the way analogies are used is the way electrons are talked about. According to quantum theory it is not possible to identify an electron on two occasions as electrons do not have an individual identity. This non-identity can be interpreted according to two different analogies. One is the analogy of identical billiard balls where since continuous observation is impossible it makes no sense to identify them on different occasions (though the electrons might be identical) and the other is that of pounds, shillings and pence in a bank account where it makes no sense at all to talk of the self-identity of each pound. The second analogy is required to validate the Fermi-Dirac statistics, and to justify this position the second analogy is argued for. Such arguments are in common usage in quantum theory. (1) Hesse has also shown how Dirac's prediction of the positron was only possible because quantum theory was given a visual interpretation. The use of such analogies would thus seem to invalidate the strictures of the orthodox school (the Copenhagen school) against the attempt to develop a complex analogy to account for the wave-particles duality of electrons. Such an attempt would be in accordance with the normal practices of science and there is no reason why the impossibility of making exact predictions should affect this attempt since the analogy could be used to explain why such exact predictions cannot be made.

Scientists are not completely free to use whatever analogies they like. They have to be consistent with the other analogies used by science, or attempt to reformulate the whole basis of science. Underlying all science there tends to be a basic analogy or metaphor which unites all the others. This analogy and the concepts developed from it then largely determine what analogies are likely to be

(1) Mary B. Hesse (1963), op. cit. p. 57.

acceptable in particular domains. For instance there had been many theories of evolution before Darwin came on the scene, but Darwin's theory was acceptable because it did not imply that there was a purpose working in nature. With the mechanistic metaphor predominating in science any teleological explanations would have to be regarded as unacceptable.

Some idea of the importance of these basic or root metaphors can be gained by examining the reorienting of thought which took place with the acceptance of mechanism as the basic analogy of science. As was seen in the introduction the mechanistic analogy became a major factor in natural philosophy when it was adopted by Kepler. The working through of this analogy culminated in the physics of Newton who, while rejecting the extreme mechanistic views of the Cartesians in favour of a religious-Platonistic synthesis, betrayed his debt to the mechanistic analogy when he asserted that the Creator has to interfere in the workings of the world to ensure its regular functioning. (1)

Bronowski has characterized the change in world view from the middle-ages to the world-view dominated by the mechanistic vision as a change 'from a world of things ordered according to their ideal nature, to a world of events running in a steady mechanism of before and after'. (2) After the replacing of the root metaphor of the world-view from one based on organic processes or artifacts made according to a plan, even those

(1) E.J. Dijksterhuis THE MECHANIZATION OF THE WORLD PICTURE tr. C. Dikshoorn, O.U.P. London, 1961, p. 495.
(2) J. Bronowski and Bruce Mazlish THE WESTERN INTELLECTUAL TRADITION Penguin, Harmondsworth, 1970, p. 134.

who attacked the idea of mechanism saw the world in terms of the concepts deriving from this metaphor. The whole galaxy of ideas which went to form the new science clearly cohere as part of the mechanistic metaphor.

The ideas which dominated the new science are those which spring to mind when examining a machine of the sort around at the time of its development such as the clock. First, the machine is a configuration of parts having specified location. This is reflected in Newton's conception of space. Second, to understand a machine it is necessary to specify all the parts in exact quantitative terms. This is reflected in the new science banishing all non-quantifiable qualities to the subjective realm. Third, there are effective relationships or laws which can be expressed in the form of equations between the parts of a machine which is again reflected in the form taken by Newtonian mechanics. Fourth, a machine works on its own and does not require the interference, or at least not constantly, of purposeful agencies. Fifth, machines are composed of inert material and any change is a change of relationships between the inert parts of the machine. This is probably the most fundamental aspect of the mechanistic metaphor as will be seen. The working through of this analogy involved the development of an entirely different framework of concepts with the meaning of such concepts as space, time, cause, law, quality, matter being entirely transformed.

Mathematics has been extremely important in the rise of the mechanistic analogy, and as was indicated in the introduction, the acceptance of the mechanistic analogy followed the revival of neo-Platonism with its emphasis on mathematics. The importance of the analogy of mechanism in this respect was that it allowed the world to be understood in purely quantitative terms. But this does not imply that the mechanistic analogy was nothing but a support for the mathematics. The use of mathematics itself can be understood as analogical. The neo-Platonists were concerned with proportion and perfect forms, most notably the circle. The rise of the mechanistic analogy was associated with the development of coordinate geometry and the differential calculus. In each case mathematics must be seen as part of the refinement of the analogies with which they were associated, with mathematical form being seen as the perfect end to which things aim in the case of Platonism and with mathematical laws being seen as the description of movement through space with the analogy of mechanism. Thus rather than seeing mathematics as important because of the predictions which it makes possible, with the underlying analogy being nothing but a heuristic device for these mathematically expressed predictive laws, the development of mathematics should be seen as a development of the basic analogy, with the ability to make predictions being a byproduct of this development. That this is the case will be argued more fully in Chapter 4 where the mathematics involved in the development of modern science will be examined.

Apart from the transformation in the meaning of concepts and the development of new mathematics, the adoption of a new root metaphor by science brought about a change in paradigms in terms of which things were made intelligible. I am using the notion of paradigm here in the sense in which it was originally used by Lichtenberg in the mid eighteenth century. (1) According to Lichtenberg what happens in physics is that puzzling phenomena are made intelligible or made sense of by relating them to some standard form or process which he called a paradeigma. This standard form or process was something which we are prepared to accept for the moment as self explanatory. I will illustrate the meaning of 'paradigm' and show how paradigms are related to root metaphors by examining two paradigm shifts associated with the introduction of the mechanistic metaphor. The first of these was the change in paradigm associated with the development of the theory of motion and the second was the change which took place in how material change was understood in chemistry. These two paradigms are different in that the first was a change taking place within a domain of enquiry, while the second was a change in relation between different domains, that is, between biology and chemistry.

Aristotle proposed that within limits, how far a body can be moved by a given amount of effort is inversely proportional to the size of the body to be moved, and the distance a body will be moved is directly proportional to the amount of effort expended. Taking note of the effect of the different conditions Aristotle further noted that the distance travelled is inversely proportional to the strength of resistance offered to the motion. All this was worked out approximately without exact mathematical formulation, and it was

(1) The historical background of this notion is presented in Stephen Toulmin HUMAN UNDERSTANDING, O.U.P., Oxford 1972, Vol. 1, p. 106f. The notion is used in Toulmin (1961) op.cit. The notion as developed by Kuhn in THE STRUCTURE OF SCIENTIFIC REVOLUTIONS op.cit. lacks clear definition as Kuhn realized.

always understood in relation to bodies moved in relation to the earth.

What this reveals is that Aristotle took as normal and not in need of any explanation the state of rest, and explained any deviations from this in terms of the effort of the mover. He only considered motion as that which is achieved when the force propelling the body is balanced by that body's resistance to motion, or the tendency of the body to return to a state of rest. Since rest was paradigmatic Aristotle did not try to work out what would happen if the force propelling a body met with no resistance, and since he was only concerned with more or less constant velocity, he did not try to work out a concept of instantaneous velocity. Where the resistance to motion is so small that there is no limit velocity due to the balance of forces, as in the case of a freely falling body, then the paradigm is no longer effective in making sense of the phenomena.

Freely falling bodies could only be made sense of by a change in paradigms. Newton achieved this when he took uniform rectilinear motion moving independently of any force as self explanatory. This then became the new paradigm in terms of which everything else had to be understood. Yet the change was not easily brought about since Aristotle's paradigm was tied to the whole framework of his metaphysics. Aristotle had started with the analogy of the development of organisms in order to explain the universe. Motion was thus understood in terms of the efforts of organisms to achieve goals in the everyday world. The heavenly bodies were seen as belonging to a different realm with entirely different properties. On earth, any change was understood as deriving ultimately from the purposeful movement of organisms, and without these, the state of rest was taken as normal. This was so taken for granted that the idea of their being a void was rejected on the grounds that there would be no reason 'why anything set in motion would stop anywhere. ... Hence, a body would either continue in its state of rest or would necessarily continue in its motion indefinitely, unless interfered with by a stronger force.' (1)

Newton, starting from a different metaphor, could take the idealized situation of a body moving in this way as the paradigm. This meant that everyday experiences could no longer be taken for granted but had to be shown to be intelligible in terms of an idealized situation. But it successfully made intelligible a whole range of phenomena which had previously been unexplained. For instance the paradigm enabled the question to be asked 'Why don't the planets continue in straight lines?' in such a way that an answer could be provided which connected celestial phenomena and terrestial phenomena. While Kepler had shown that Tycho Brahe's observations of Mars could be made intelligible if it were assumed that Mars moved around the Sun in an elliptical orbit, why this should be so remained unintelligible, a fact to be explained. In Newton's system this regularity ceased to be an arbitrary fact but became intelligible since it was now seen that satellites must move in conic sections. In terms of the Newtonian paradigm, the behaviour of tides, the appearance of comets, the motions of planets and the fall of stones could be seen as an

(1) Cited by Judith Willer, THE SOCIAL DETERMINATION OF KNOWLEDGE, Prentice-Hall, Englewood Cliffs, 1971, p. 117f. from Aristotle's PHYSICS.

intelligible pattern of relationships.

While this paradigm is a case of understanding different kinds of motion in terms of one kind of motion, the second paradigm which I will examine will involve events being understood in terms of other events of an entirely different sort. Whereas the paradigms involved in the first instance concerned which of two states of motion was to serve as a paradigm not in need of further explanation, the second case will be concerned with which of two sciences is to be considered basic in explaining material change. Whereas in the Aristotelian system, such change was understood in terms of it being the nature of things to develop towards a goal, the new science of chemistry came to take inert or inanimate matter as its paradigm and to explain all change in terms of the constituents and structure of the material. In Aristotle's case biology was paradigmatic and structural change was understood in terms of physiological development, whereas physics and chemistry came to be paradigmatic in the new science, and physiological change came to be understood in terms of structural changes of inert material.

This paradigm shift is evident in the demise of alchemy. The alchemists assumed that all material substances possessed the capability of improvement and that nature itself was in the process of self-development. What the alchemists hoped to do was to accelerate the pace of development of these substances by providing them with the appropriate conditions. Since all things were thought to be developing it could be assumed that the base metals were simply at an earlier stage of development than the noble metals. It was thought that if a small quantity of gold were added as a seed to a mixture of copper and silver, the natural transformation of these metals into gold would be accelerated. (1)

It can be seen from this that the alchemists were not being unscientific, they were simply drawing the conclusions implicit in the paradigm reigning at the time as to the nature of material change. The fact that the expected results did not follow shows the inadequacy of the paradigm, but it must be admitted that there were good grounds for assuming that everything in nature was developing and so taking this as paradigmatic.

Modern chemistry attained its form by taking as paradigmatic the idealized notion of pure, inanimate, inert material. All change had to be explained from the point of view of the changing relationships between the inert elements out of which all bodies were thought to be composed. Change could no longer be taken for granted as self-explanatory, and concern with the ends to which changes were leading was excluded from the realm of science.

This example is parallel to the example of the paradigm shift in the study of motion in a number of ways. It shows how the world is understood in terms of an ideal of natural order which is taken for granted. It also shows how the function of science is to make sense of phenomena, rather than simply enabling their prediction. The paradigm largely determines what is a problem to be explained. What

(1) Stephen Toulmin (1961) op.cit. p. 71ff.

is disregarded from one point of view comes to be something which can be explained from a different point of view. Thus organic development is taken for granted in the Aristotelian scheme but is something which needs explaining in the framework of mechanistic materialism. Observation, far from being a passive affair, is always a matter of formulating questions in terms of the paradigm. What occasions questions is anything which is seen to be unusual and as the existence of some unexpected regularity in the world. After one has formulated a question such as 'Why is there a regularity in tide movements?', one looks to see if the behaviour of tides is what could be expected in terms of the prevailing paradigm. Also, the development of paradigms is part of the process by which analogies or metaphors are articulated for use in making the world intelligible. In a similar way to the concepts which are developed in a theory, paradigms are not self-evident or simply encountered in experience but must be constructed with the expenditure of a great deal of creative effort.

It can now be seen that it is the analogies which are central to scientific theories, and that the aim of theories is to make the world intelligible. Scientific theories are expressed in a scientific text by charts, diagrams, models and photographs as well as by deductively related propositions and mathematical laws. But these are all vehicles of thought, that is, part of a picture statement complex in terms of which theories can be communicated and discussed, and it is wrong to identify the theories with these vehicles of thought. With continuous work in the field the scientific worker reunites the complex so that instead of appearing to express abstract relations between terms, they lead to an understanding of what the theory is meant to explain. What is involved in this is that the analogy which has been articulated into a conceptual framework to provide paradigms in terms of which everything else can be related, comes to be taken as a metaphor in terms of which the world is seen. The metaphor can be regarded as successful if it can be developed in such a way that the world can be seen, perceived or intellectually grasped as intelligible.

It can be seen from this that laws are not the primary feature of a theory but are merely abstractions from the way the world is intellectually grasped. As such they are only intelligible in terms of the whole theory. They are not essential features of a theory since many theories, for instance Darwin's theory of evolution, do not involve anything which could be expressed as a law. Scientific progress is not the discovery of laws but the development of the way the world is perceived, conceived and generally understood. Deeper understanding is attained when what had previously appeared as anomolous now becomes intelligible, and the way the world is now seen shows that the way the world had been previously understood was relatively superficial. What provides the unity of this understanding is the underlying metaphor which gives coherence to the conceptual framework, the paradigm and to each particular experience which is successfully explained. Each particular analogy in science is developed to be consistent with the others, and the overall unity of science is provided by the root metaphor to which all particular theories are related.

REALISM AND INSTRUMENTALISM

Empiricism has been traditionally racked by the problem of the relationships between knowledge, perception and the world itself. Perception is thought to be either nothing but the phenomena of consciousness with there being no grounds for believing in an independently existing world, representation of the real world, or experience of the world as it is in itself. Knowledge is thought to be either nothing but the instrument for making predictions from one perception to another, or as a representation of the real world. In the instrumentalist position, the validity of a theory is defined as its ability to make correct predictions with theoretical entities being nothing but heuristic devices, while in the representationalist position, truth is understood as the correspondence of ideas or of propositions with the real world, and if a theory is able to make correct predictions in the sense of enabling ideas or propositions to be deduced which correspond with reality, then this indicates the reality of the theoretical entities postulated by the theory. It has been suggested that logical positivism has been characterized by a development away from the phenomenalist view of perception and the instrumentalist view of theories to a realist view of perception and a representationalist view of knowledge with an acceptance of the reality of theoretical entities, though all combinations of views of perception and knowledge have been defended.

In the epistemological viewpoint I have been developing here in opposition to empiricism, it is making the world intelligible or understanding the world which is of central significance, and observation and knowledge must be understood as secondary to this; as vehicles of thought facilitating enquiry and communication. It will be argued that this overcomes the problem of the relationship between experience and the world because understanding presupposes a pre-existing world which is to be understood. But to begin with I will criticise realism, both in relation to perception and in relation to knowledge. I will then show that if the nature of experience is properly understood so that understanding is made the central concept of epistemology, then the rejection of realism does not lead to phenomenalism or to the instrumentalist view of theories.

All forms of realism, that is, both the representational and naive forms of realism in relation to perception, and realism in relation to knowledge are undermined by the evidence for activity in cognition on the part of the subjects who perceive and know. The processes by which theories are constructed has been outlined already and it was shown how these constructed theories largely determine how the world is seen. Piaget has shown how adults come to experience the world in the way they do through a long process of cognitive development, and then the world is seen by assimilating experience to cognitive structures. From this we can conclude that when a person sees something or knows something, this is largely due to the constitutive activity of the person. Now if realism has any meaning at all it can only be that the things in the world as they are perceived or known exist as such in some sense independently of perception or knowledge. In relation to perception this can mean either that one learns to experience the world the way it really is or one constructs ideas which represent the way things really are. In relation to knowledge it means that our representations correspond to the way the world really is. But before we could know that the way the world is perceived or known is just as it would be if it were not perceived or known, it would be necessary to compare the world as it is perceived or known with the world as it is in itself, independently of any cognitive activity. But this is obviously impossible.

It has been held that the argument that we cannot perceive or know the way the world is in itself because our perception and knowledge is always mediated by interpretive schemes must lead to the conclusion that if we could experience the world without interpretive schemes, then we would see and know the world as it really is. But to simply have experiences as might a baby or someone with brain damage is not to perceive the world at all. It is also argued that since our perception or knowledge of the world in no way alters this world, the world as it is perceived or known is no different from the world as in itself. This misses the point of the above argument against realism. The way the notion of 'alter' is used here only has meaning in the context of the world as it is understood. It is impossible to use concepts in relation to the world independently of our understanding of it because to understand the world is precisely to use concepts to interpret it. As soon as we start using concepts such as 'alter' we are already interpreting it.

While this argument is in itself grounds for rejecting the realist theory of knowledge, the conception of knowledge as beliefs which correspond to the facts is so widely held that I will examine this further. The correspondence conception of knowledge seems to have gained plausibility originally from the view that knowledge is an 'idea' or copy of an impression or idea obtained in perception. It was thought by philosophers such as Locke, Berkeley and Hume that copies are distinguished from the original by noting that they are less vivid and lively. But the correspondence conception is now tied to propositional logic and propositions are supposed to be true if they correspond to the facts. Furthermore the truth of these is supposed to be mind independent, and logical relations are also thought to be truths about the world and independent of thought. It is these ideas which I will now criticise.

First I will examine the nature of facts. Facts imply other facts, as can be seen if we look at the facts that 'all men are mortal' and 'Socrates is a man.' These facts obviously imply that 'Socrates is mortal' and this is another fact. This implies that facts are different from events and states of affairs since these are generally thought to stand in causal relation to one another, not in logical relationship. The difference can be further shown if we consider the event 'the battle of Waterloo' which occurred in British history with the fact that a battle was fought at Waterloo. The event occurred at a particular time but the fact is timeless. Also, facts can be negative as when we say that 'men are not immortal' and there are hypothetical facts such as 'if a person jumps from a flying aeroplane, he will be killed.' So facts cannot be thought of as events or states of affairs in the world.

Now consider the nature of propositions. A proposition is what is possible to be thought to be the case though it does not have to have actually been thought or asserted. This distinguishes it from a statement. Propositions imply propositions and it is between propositions that logical relations hold. And propositions can be negative or hypothetical. It can be seen from this that all the characteristics which apply to facts also apply to propositions and the only distinguishing feature of facts is that they must always be true whereas a proposition can be false. Thus it must be concluded from this that a fact is nothing more than a true proposition and these two terms can be used synonymously. Thus facts are not in the world and cannot be thought of as corresponding to propositions.

Thus it is meaningless to talk of a proposition being true by virtue of there being a correspondence with the fact, and a proposition cannot be verified by seeing whether or not it corresponds to the fact. To do this would be to see if a proposition is true by seeing if it corresponds with the true proposition; or to say a proposition is true if it is true. This is a tautology and says nothing.

In support of the correspondence theory of truth it is said that in common usage people often talk about an account of events being false if it does not correspond to the facts. But to take an example, suppose a policeman says he did not assault a student. The fact that would falsify such an assertion is not that the student was assaulted by the policeman but the fact that the student is seen to have injuries which he did not have before he was detained by the policeman. In such contexts 'corresponds' refers to related facts and appeals to the principle that if two propositions are logically inconsistent, one at least must be false. From this it can be seen that common usage does not support the correspondence theory of truth.

To verify or falsify a proposition by observation it is first necessary to formulate the proposition and then look to see if it is true. For instance if we take the proposition 'there is a table in the room' which is false, we can see that to simply look into the room would not be adequate to become conscious that there was not a table there. One does not receive knowledge by the purely passive reception of visual stimuli. One only becomes conscious of there not being a table in the room if one is looking to see if there is a table there. It is necessary to have first formulated the proposition before we can become aware of its truth or falsity. In this process the proposition cannot be thought to correspond to anything. It would make impossible demands on the concept of correspondence to say that in some sense the proposition "fish cannot speak in English if they are thrown in the air" corresponds to something in the world.

While this shows the correspondence theory of truth to be false, there is still an element of support for a form of realism if we think of propositions as completely independent of the mind, true or false whether we know about this or not and logical relations as relations between things in the world. If this were accepted then knowledge could still be thought of as the discovery of true propositions and logical relations. In opposition to this I want to show, as has already been suggested, that propositions are a type of vehicle of thought, and are instruments for enabling us to investigate, understand and communicate about the world. To begin with I will further examine the nature of propositions.

Propositions are not the same things as the words which are required to express it yet it requires words to give them expression. This is obvious since the same proposition can be expressed in different languages. For this reason there has been a tendency to grant propositions the ontological status of Platonic entities. (1)

A proposition is what is thought or what could be thought to be the case. When given expression it can be identified with the meaning of the sentence or clause. But 'meaning' can have two senses, one being the 'general meaning' of the sentence is independent of any context, the other being the 'thing meant' by the sentence. If we take the sentence 'My brother is sick' expressed by Sam Jones' sister and 'My son is sick' expressed by Sam Jones' mother, the 'thing meant' is the same in both sentences but the 'general meaning' is different. The 'thing meant' can be different when the same sentence is spoken by different speakers. This is not true of all sentences since the sentence 'All men are mortal' is true whoever it is spoken by and the 'general meaning' and the 'thing meant' coincide. But what this

(1) Gottlob Frege was the main proponent of this idea. See "The Thought" (1918) in MIND Vol. LXV, July 1956 pp. 289-311.

discussion has revealed is that there is a difference, and it is the 'thing meant' which is true or false, not the 'general meaning'. We do not speak of the meaning of the sentence being true or false, we only think of what is meant by the sentence being true or false. But this requires people to entertain propositions, so they cannot be Platonic entities. This is so even if the notion of 'proposition' includes those cases which could be thought or meant as well as all those which are or have been. Thus Russell is wrong when he asserts that Edinburgh's being north of London is true even if there are no minds in the universe, since people are required for the proposition to be able to be thought. (1)

In defence of the idea that logical truths are about things in the world, Russell gives an example of the law of contradiction; that a beech cannot be both a beech and not a beech at the same time, and points out that this is not the thought of a beech not being a beech but the things in the world that this truth refers to. (2) But logical relations hold between propositions, and these are in some sense mind dependent. It is not the thought of beeches being beeches and not beeches at the same time to which the law of contradiction holds. Nor is it between the beeches themselves as things in the world. It is beeches as things in the world as thought of, or as they could be thought of to which the law of contradiction holds.

The rejection of realism does not imply the acceptability of either phenomenalism or that theories are merely instruments for making

(1) Bertrand Russell, THE PROBLEMS OF PHILOSOPHY (1912) Oxford University Press, London, 1967. p.55f.
(2) Ibid. p. 50.

predictions from one inference to another. The realist argument against these positions is that it is possible to provide reasons for believing that the world exists independently of our knowledge or awareness of it. For instance other people seem to be reacting to the same world as we are, and this can most easily be accounted for by assuming an independently existing world. Such an argument is held to be impossible by empiricists such as Berkeley and Hume because they assume that all knowledge must somehow be constructed out of the contents of consciousness, and so it is impossible to make the move from what has been experienced to what has not been experienced. To think of the world independent of the mind means to experience the world as independent of experience which is an impossibility. As soon as we attempt to think of the world independent of our minds we find that we are thinking it and so it is mind dependent. This argument also leads to solipsism. But it is possible to give reasons for assuming the truth of the proposition that the world exists independently of our knowledge of it, and it is not necessary for us to be experiencing the unknown world to accept the proposition as true. It is not necessary to experience the North Pole or even to know what it would look like to accept the proposition as true that there is one.

This abstract argument does not lead to any understanding of the relationship between experience and the independently existing world, and it is this which realism needs to establish to have any significance. However the way in which the whole argument between realism and subjective idealism is framed suggests a common assumption of both positions, namely that one must take as a starting point the experience and ideas of a detached consciousness. Both positions are working within the framework of materialism in which the subject is understood as an ethereal inhabitant of the brain. In opposition to this, by focussing on what actually happens in science, the position I have been developing assumes an active subject embodied in the world attempting to understand it. From this starting point we can no more doubt the existence of the world than we can doubt that we exist. The independent existence of the world is presupposed by all cognition and it is with this independently existing world that we must come to terms and in terms of which our cognitive schemes and theories are found to be adequate or inadequate. Yet the adequacy or inadequacy of these does not involve any question of the relationship between this cognition and the world as it is in itself. This can be illustrated by what is involved in understanding a person. It is unlikely that we would doubt the independent existence of the person, yet the question of what the person is in himself, independent of any understanding is meaningless. In understanding a person we do not attempt to accumulate facts and we are not simply involved in trying to predict behaviour. Nor do we ask if our knowledge of the person corresponds to what the person really is. Our understanding is of an independently existing being and this understanding is superficial or deep, and the depth of understanding can only be judged in relation to other ways of understanding the person. Thus by taking understanding as the central concept of epistemology the problems of empiricism are simply and refreshingly bypassed, and theories, concepts, paradigms and so on must be understood as means for understanding the world.

THE LOGIC OF ENQUIRY

It has been shown that the mathematical logic of the logical positivists is unable to account for the rationality of science in a number of ways. The emphasis on mathematical logic makes it inexplicable how comparisons between theories could be made when different theories alter what is seen and change the meaning of concepts. Yet it has been shown that theories do bring about such changes and it is obvious that there must be ways by which different theories can be compared if the progress that there has been in science is to be accounted for. Secondly it was seen that what is central to the development of theories is the development of analogies, and the effectiveness of these cannot be judged by means of mathematical logic. I will now attempt to show that there is a logic of enquiry involving a logic of discovery and a logic of justification which accounts for these features of science and which cannot be reduced to mathematical logic. It will then be seen that such a logic implies development so that the basic presupposition of logical positivism, namely that there is a scientific method which is specifiable independently of any scientific theory must be rejected.

The logic of enquiry is essentially the logic of 'question and answer' as it was developed by Collingwood. (1) This focusses attention on the asking of and finding answers to questions which is basic both to the investigation of the world and to communicating and justifying

(1) R.G. Collingwood, AN AUTOBIOGRAPHY, Oxford Uni. Press, Oxford, 1939, ch. 5.

ways of understanding it to others, and it emphasises the active nature of the subject both in relation to the world and in the process of arriving at a common understanding. According to the logic of question and answer, a proposition is a proposed answer to a question and it is as an answer to a question, either explicit or implicit, that a proposition should be seen to be true or false. To understand what is meant by an assertion that something is the case it is necessary to know what question is being asked, and agreement, contradiction and truth and falsehood must always be understood in relation to these questions. This logic is entirely consistent with the analysis of propositions made in the last section in which it was argued that propositions are what is meant by sentences rather than the meaning of them.

To increase our knowledge of a field under investigation it is necessary to already have some understanding of it in order to be able to ask the right questions. The questions asked will depend on the background beliefs and assumptions of the inquirer and will usually be formulated to answer a question of broader scope. For instance if I want to find out why my car has stopped I ask the further question whether there is a fuel blockage, and then whether the fuel blockage is in one place or another. I can then examine a particular place which may tell me why the car has stopped. The particularized answer that a place within the fuel line is blocked is an answer to an equally particularized question, but before I can ask this particularized question I must have had some understanding of what makes a car work.

If I am trying to communicate my ideas about the car to another person, the same basic principles holds, except that here I presume an understanding on the part of the person I am talking to, and make statements which, if they are not answers to explicit questions are answers to anticipated questions. I assume that the other person has some understanding of how a car works, and on this basis give my reasons for believing that it is a part of the fuel line which is blocked, anticipating questions as to why it is not something other than lack of fuel which is the problem and why it could not be some other part of the fuel system at fault.

Where enquiry is aimed at improving our means of understanding the world, the answer to a question will be in the form of an imaginative hypothesis or a theory. There has been a specific logic developed in relation to the development of theories to account for problems, but this can be understood as only a specialised aspect of question and answer logic. This logic was first characterised by Aristotle but was not really developed until it was studied by C.S. Peirce, who referred to it as abduction or retroduction to distinguish it from deduction and induction. While the conclusions of a deduction are contained in the premises of a syllogism, induction can only show the concordance of theories with what is observed after the proposition has been formulated. Peirce pointed out that retroduction cannot be reduced to either of these. Retroduction is the finding of the proposition from which the proposition which can be induced is deduced. The notion of retroduction has since been revived and developed by Hanson. (1)

(1) Norwood Russell Hanson, PATTERNS OF DISCOVERY, Cambridge Uni. Press, Cambridge, 1958, Ch. IV.

It is not usually the case that theories come to people as bolts out of the blue in the manner of Kekule's discovery of the benzene ring in a dream. For this reason discovery is not only a matter for psychology, sociology and history as the later logical positivists would have it, but also a matter for philosophy. Because the Baconian inductivists provided a woefully inadequate account of creative thinking, this does not justify philosophers in simply ignoring the problem. This is especially so since it will be shown that the reasons associated with the development of a theory are usually largely the same reasons used in its justification.

The reasoning involved in discovery is clearly evident in Kepler's DE MOTIBUS STELLAE MARTIS in which Kepler set out his reasons for suggesting that the orbit of Mars is an ellipse. The task he was confronted with was 'Given the observations made by Tycho Brahe, how could they be accounted for?' Kepler set out the reasons why a circular orbit would not account for the phenomena. What followed was a long process of enquiry in which various solutions were tried and found wanting. The reasoning involved in these rejections eventually led Kepler to suggest the ellipse as the solution. All modifications of proposed solutions to the problem were made by Kepler for sound reasons. This meant that the solution stood on a different footing than if Kepler had struck out at randon for a solution to satisfy the observations. Such a stochastic solution would not carry its own guarantee that it had to be the solution to the problem.
In setting out the whole process by which the solution was arrived at Kepler was also giving the reasons why the ellipse had to be accepted

as the solution. The development of the process also shows how it was necessary to continually ask questions in order to see if each proposed solution fitted the observations, then to propose solutions to deal with the problems identified, then to ask more questions. The specificity of the questions developed with the development of the background knowledge built up in the process of enquiry. (1)

Retroductive reasoning is evident in the way Newton developed his law of universal gravitation. While still an undergraduate Newton reasoned that the law would be in the form of an inverse square. His reasoning was based on the linkages between Kepler's third law ($T^2 \propto r^3$) and Huygen's law of centrifugal and centripetal force ($F \propto \frac{r}{T^2}$). From these it follows that if the sun exerts a centripetal force on the planets then the force will be proportional to $\frac{r}{r^3}$ or $\frac{1}{r^2}$. Yet it took Newton twenty years before any final formulation of the law was made. (2)

Another example of retroductive reasoning was that involved in the formulation of nuclear physics to account for the regularities of the periodic table. The reasons which led people to expect that a compositional account would be successful in accounting for the phenomena were mostly based on the nature of the order discovered. The order was periodic and discrete, that is, the items in the table had values

(1) Hanson, loc.cit. gives a detailed analysis of this.
(2) Norwood Russell Hanson A GUIDE TO THE PHILOSOPHY OF SCIENCE, George Allen & Unwin, London, 1972, p. 65.

which were integral values of a fundamental value. Secondly compositional theories had been successful in other domains. The first reason was straightforward enough. The second shows how the nature of reasoning is influenced by theories. The success of a particular way of thinking alters the way problems will be tackled in the future.

This is even more evident in the case of stellar evolution. After the spectral classification of stars was published people began to suspect that there was an order which could be accounted for on the basis of evolution. Thus the difference between this classification and the periodic table is instructive. In this case the order is not discrete but can be viewed as an increase or decrease of the factor on which the ordering is made. This could then be accounted for only in terms of evolution.

But such a theory did not occur to the founders of star spectroscopy who consequently failed to order their classes effectively because they were working before evolution came to be accepted in biology. (1) It was only when evolutionary theory had been successfully applied elsewhere that an effective ordering was made on the basis of the evolutionary idea. This clearly indicates the way in which reasoning principles and new substantive information are introduced into science with its development. Today the attempt to account for phenomena in terms of evolutionary ideas is commonplace.

(1) Dudley Shapere "Scientific Theories and Their Domains" in Suppe (1974) op. cit. p. 554.

It has already been shown that often the reasons involved in discovery are also largely the reasons involved in justifying a theory. However more light can be thrown on how background information is relevant, how logic is influenced by theory, and generally how the ideas of mathematical logic are largely irrelevant to the sort of reasoning involved in science by examining the logic of justification.

In characterizing the justification process the sort of reasoning that logicians have focussed on is the analytic argument where the conclusion is entailed by the premisses. However this is not the sort of argument which is normally used in justification. To take an example: suppose someone asserts that Smith's car has four cylinders and in justification of this provides the information that Smith's car is a Volkswagen. There are three parts to this argument. First, there is the data or the grounds for the assertion i.e. it is a Volkswagen; second, there is the conclusion which is the original assertion, i.e. it has four cylinders; and third, there is indicated only implicitly the warrant which enables one to draw the conclusion from the data or grounds i.e. a Volkswagen is a car with four cylinders. If the warrant is challenged then it requires backing, which is the fourth feature of an argument. This might take the form of a history of the make of the car, but in general it is possible to draw on a wide variety of sources. Thus an argument involves grounds for the conclusion, the conclusion, the warrant, and finally the backing for the warrant. Where the data and the backing entail the conclusion we have an analytic argument. In this situation the backing simply supplies enough grounds to entail the conclusion and the backing replaces the warrant. Where the data does not replace the warrant but simply provides additional support for it, then the argument is a substantial argument. (1)

It is important to be clear about what is meant by warrant here, and what is the distinction between the data or grounds on which an argument is based and the warrant. The warrant is the rule which allows the inference to be made from the data to the conclusion. Unless we are prepared to accept warrants of some kind at least implicitly, it will be impossible to submit arguments to rational criticism. Unlike the data, the warrant is usually only implied in the argument. Warrants vary as to the force with which they tie the data to the conclusion. Some warrants authorize us to ascribe 'necessity' to the relation while others only allow a tentative acceptance of the conclusion, or allow us to accept the conclusion only with qualifications. For if we justify the assertion that Bill is an opponent of apartheid with the data that he is a Swede, the conclusion can only be held with limited conviction on the basis that most Swedes are humanitarians. Where warrants do not grant necessity to an argument, then the criteria which lead to its acceptance or rejection are more like values than rules, and the judgements as to whether to accept the conclusion is thus more like a value judgement.

Where the argument involved is an analytic argument, then there is no problem about the warrant. For instance if it is asserted that

(1) The terminology used here comes from Stephen Toubrin THE USES OF ARGUMENT, Cambridge Uni. Press, Cambridge, 1968 passim.

seven times seven is forty-nine it would be quite out of place to question the grounds for drawing the conclusion. Where any questions arise it is simply a matter of replacing the implied warrant with data which makes it more clear that the argument is analytic. However where a substantial argument is involved the warrant may require backing. What sort of backing is involved will depend on the context of the discourse. For instance the warrant which enables us to assume that if something is a whale then it must also be a mammal is based on classificatory schemes. The warrant which enables us to conclude that if someone is born in Bermuda he will be a British citizen is based on how he is seen in the eyes of the law, while we can assume that a Saudi Arabian will be a Muslim because of factual considerations about Saudi Arabian society. Thus while the warrants of analytic arguments are invariant, the warrants of substantial arguments depend on their context for their validity.

In substantial arguments, the data and warrant-backing produced in support of a proposition are often of a different logical type. For instance when we make assertions about the remote past and then back them by data about the present and immediate past, then we are making a type jump. Without such a jump, no amount of evidence produced in the form of statements about the contents of ostensibly nineteenth century documents could justify drawing any conclusions as to what happened in the nineteenth century. Similar type jumps are made in the attempt to justify an ethical claim with statements about our situation, about possible consequences of different courses of action, or about the feelings and scruples of other people concerned, and in justifying a belief as to how people are feeling or what they are thinking from what has happened to them, what they have written, said and done. Perhaps more importantly, type jumps are involved in cases where we make generalizations and back them up with statements about particular instances. It is obvious from this that substantial arguments involving type jumps are the most common form of arguments.

It has been noted that the reasoning principles involved in the logic of discovery develop with the development of science. The nature of this development can now be clarified. The relationship between the background ideas or context and any particular enquiry or argument is not a one way affair. When an enquiry is successful in solving a particular problem, the methods or reasoning principles which are part of the context in terms of which the questions in the enquiry are formulated, are also strengthened. This then substantiates arguments backed by this context. On the other hand failure to explain a particular problem might lead to the whole context which had previously been taken for granted being questioned. What happens most frequently however is that the context is not rejected but is slightly altered with each successful enquiry. This relation between context and particular enquiry is reflected in the arguments surrounding the justification of the results of such enquiries. The main difference between the sort of dependence between the context and a particular case of enquiry on the one hand, and arguments backed by a context on the other hand is that with enquiry the context tends to be modified to accommodate the results of new enquiries while in arguments the contexts are more often revised to avoid having to accept unacceptable conclusions. For this reason arguments are seldom completely final because it is always open for a person to redefine the concepts in terms of which the aim of the enquiry is formulated so that what has been achieved in this enquiry can be saved.

It might be thought that this means that there are two forms of rationality, one associated with mathematics and a less rigorous form associated with normal and scientific enquiry and argument. However a study of what actually happens in mathematics has revealed that mathematics is no different in this respect from any other discipline. (1) When mathematicians are criticised they redefine their aims, concepts and so on until their proofs are acceptable to their critics, and this is not something merely accidental which occurs only in rough drafts, but is an essential part of the development of mathematics. Furthermore, as in other disciplines there is always the possibility of new developments upsetting old ways of thinking, so that this process of refining proofs can never be known to be complete.

It is now possible to consider the implications of these analyses of the logic of enquiry for science. Firstly in relation to the logic or justification the acceptability of type jumps makes it intelligible how rational arguments can take place between people who use different concepts to interpret the world and who observe it differently. It is only in analytic arguments involving a logical calculus that a

(1) Imre Lakatos, PROOFS AND REFUTATIONS, ed. John Worrall and Elie Zahar, Cambridge Uni. Press, Cambridge, 1976.

change of meaning in the terms can make the conclusions completely incommensurable, and similarly it is only the demand for analyticity of argument which leads to the requirement of an absolutely certain foundation in theory-neutral observation in terms of which all theories can be judged. Secondly both the logic of discovery and the logic of justification imply that the context which forms the background to particular enquiries is of central importance. A considerable part of science must be involved in the development and criticism of these contexts, and since these then develop with science, the logic of science itself must be seen as developing. This contradicts the most basic assumption of logical positivism as it has been expressed by Scheffler:

> Underlying historical changes of theory there is... a constancy of logic and method, which unifies each scientific age with that which preceded it and with that which is yet to follow. Such constancy comprises not merely the canons of formal deduction, but also those criteria by which hypotheses are confronted with the test of experience and subjected to comparative evaluation. (1)

In opposition to this, Stephen Toulmin's view must be accepted:

> Great logical innovations are part and parcel of great scientific, moral, political or legal innovations. In the natural sciences, for instance, men such as Kepler, Newton, Lavoisier, Darwin and Freud have transformed not only our beliefs, but also our ways of arguing and our standards of relevance and proof: they have accordingly enriched the logic as well as the content of natural science. (2)

(1) Scheffler (1967) op. cit. p.9-10.
(2) Stephen Toulmin (1968) op. cit. p. 257.

This implies that the whole enterprise of the logical positivists to work out the universally valid criteria in terms of which all theories of science must be judged, must be rejected as invalid.

THE SCIENTIFIC COMMUNITY

In this section I will describe how the development of science is a community affair and is dependent on various intrinsic and extrinsic factors. While the individual begins his cognitive development by interacting with the environment, what comes to be taken as reality is increasingly determined by what is seen as such by others. (1) Finally, that which is granted the status of reality is that which would be recognized as such by an ideally rational person, the 'generalized other'. In this way subjective feelings and biases are distinguished from what is objectively real. Science must be understood as the attempt to ascertain what is objectively real. But this does not entail the view that science must determine what the world is independently of any subjects. The concern with objectivity first developed with the Greeks who were confronted with the fact of radically different points of view. Parmenides, and following him Plato, argued for a sharp distinction between beliefs held by people generally which have no validity and an absolute truth approachable through rigorous logical thought. But an alternative view was adopted by Socrates who understood objectivity simply in terms of intersubjective validity. For him such validity could be attained by means of a court of reason as an impartial forum in which any person could put his or her point of view and argue for it. (2) The problem of objectivity was then how to keep people's

(1) Peter L. Berger and Thomas Luckmann THE SOCIAL CONSTRUCTION OF REALITY, Penguin Books, Harmondsworth, 1967.
(2) This notion is taken from Stephen Toulmin HUMAN UNDERSTANDING op.cit. Vol.I.

minds open to reason. In line with the position that has been argued for here, it is this view of objectivity in terms of which science must be understood.

For a court of reason to exist there must be people with the freedom and resources to develop ideas in opposition to the prevailing views and means by which these ideas can be presented and evaluated. Evidence that such a court of reason is required for science is that when these conditions are met there has been rapid progress in science, while as soon as they have ceased to exist, science has stagnated. The first illustration of the effect of such conditions was the rapid development of thought which took place in ancient Greece where the nation was highly decentralized politically, yet possessed a common culture and language. This meant that individuals or groups could maintain their autonomy from the immediate social context by simply shifting to a place in which their views were acceptable yet at the same time they could not isolate themselves from people holding other ideas. This forced them to justify and develop their ideas to maintain their credibility. As Ben-David wrote:

> Bands of adventurers and dissenters could move out and experiment with new political and religious ideas in small, selected circles without colliding head on with established religion and government and without cutting themselves off from the nation and its culture. This frontier made possible much bolder flights of imagination and experimentation with religiously and politically incomplete or even dangerous notions. Such notions gave rise to scientifically modern and almost specialized secular ideas that do not have many parallels in other traditional civilizations. (1)

(1) Joseph Ben-David THE SCIENTISTS ROLE IN SOCIETY, Prentice-Hall, Englewood Cliffs 1971, p. 36.

Other periods in which there has been a flowering of ideas exemplifies similar conditions. For instance there was a rapid development of ideas with the establishment of universities in Medieval Europe. As distinct from the situation in China, India and Islam in which similar institutions were established, the towns in which these universities sprang up were autonomous corporations, scholars became a distinct self-conscious group powerful enough to defend their interests, and individuals were very mobile, migrating to the country in which they were freest to pursue their enquiries. But the clearest case is presented by the conditions under which science came to be dramatically successful in nineteenth century Germany.

German universities created a degree of autonomy from the rest of society, and maintained an openness in the exchange of ideas which was unique. This followed partly from the political decentralization of the German speaking people. But the organization of the universities were such as to maximise the freedom of individuals both in the universities and in their movements between universities. Thus students could choose their lecturers and whether or not to attend lectures, and they could transfer credits from one university to another. Furthermore, anyone who qualified for an academic appointment by making an original contribution based on original research was entitled to lecture at any university as a Privatdozentur, making a living from the attendance fees of students who attended their lectures. In this way a court of reason was maintained throughout the entire intellectual community. Universities had to compete with each other for students which forced them to conform to this court. As Ben-David noted:

> competition among the universities and the mobility ensuing from it created an effective network of communications and an up-to-date public opinion in each field that forced the universities to initiate and maintain high standards. It was the interuniversity networks of communication and public opinion in the different fields, and not the formal bodies of the university, that represented the scientific community. (1)

As soon as the conditions for the existence of a court of reason have ceased to exist, previously scientifically creative societies have come to an intellectual standstill. This happened as the Greek city states lost their independence to be finally incorporated into the Macedonian Empire and as philosophers took on a specialized social role as teachers, and in the Middle Ages when universities came to be more integrated into the society as a whole and were required to fulfil the needs of society. (2) Most commonly the court of reason has been destroyed in different societies through the loss of individual or group autonomy consequent to the institutionalization of science. Thus England, France, Germany and U.S.A. have successively been the centres of scientific activity in the world in each case for a period of about 80 years. (3) In each case what destroyed the creativity of the scientific communities in these countries was institutionalization. As Ben-David remarked: "It seems a paradox that just when science became institutionalized in England, that country lost its leadership in science to France". (4)

(1) Ibid., p. 123.
(2) Ibid., p. 54.
(3) J.R. Ravetz, SCIENTIFIC KNOWLEDGE AND ITS SOCIAL PROBLEMS, Penguin Books, Harmondsworth, 1973, p. 67n.
(4) Ben-David op. cit. p. 78.

In turn French science stagnated after being assimilated into the highly bureaucratized system of higher education. (1) Then German universities began to lose their creative impetus as the oligarchic tendencies within each university began to consolidate, allowing the professors to gain increasing power at the expense of students and junior staff. (2) Finally U.S.A. which succeeded Germany as the centre of world science has shown increasing signs of deterioration due to what J.R. Ravetz calls its industrialization. (3) In this situation:

> the free market place of scientific results, whose value is established after they are offered and by an informal consensus, is replaced by an oligopoly of investing agencies, whose prior decisions determine what will eventually come on the market. (4)

Ravetz has described in detail how this penetration of science has adulterated its products and led to such phenomena as shoddy scientific papers which clog the channels of communication, and how this is undermining science in U.S.A.

In a court of reason arguments take place between people who share much the same background knowledge or understanding and so are aware of the force of the warrants for different arguments. There is unlikely ever to be complete accord within such a court of reason, and the development towards a consensus is a never ending process which is

(1) Ibid. p. 100ff.
(2) Ibid. p. 129ff.
(3) Ravetz op. cit. esp. ch. 2.
(4) Ibid. p. 45.

always upset by the introduction of new ideas. But where scientists oppose a line of thinking which later comes to be generally accepted, they usually do so for good reasons. For instance scientists put forward reasons for rejecting the attempt to explain the order of the periodic table in terms of the constitution of the elements. However these reasons were rejected as the grounds for supporting the explanation in terms of constitution became overwhelming with the development of ideas, technology and observation in the field. The important thing about this process is that the members of the intellectual community are able to understand new ideas which are very different from prevailing ideas and to develop arguments to decide between these and the old ideas. This was shown in the debate about quantum theory in the 1950's where after an initial phase of heated exchanges and recriminations, the opponents of the orthodox view of quantum theory were able to have their ideas understood and seriously considered. (1)

The court of reason functions against the background of an intellectual tradition of ideas, values techniques and so on which has been handed down from generation to generation of scientisits. Each individual scientist is socialized into a tradition from which he appropriates the achievements of the past, obtains his standards for evaluating what is worth researching and the criteria for accepting solutions

(1) Stephen Toulmin (1972) op. cit. p. 237f. describes this.

to problems. Logical positivists have tended to underestimate tradition because for them all it consists of is an accumulation of certain knowledge. This underestimation of tradition has led to an overestimation of the originality of great scientists which has a detrimental effect in two ways. Firstly it leads to an excessive concern with the distinctive contribution of each individual resulting in a tendency to overspecialize in obscure areas with a consequent shying away from the basic issues of science. Secondly putting great scientists on a pedestal enables the scientific community to reject as arrogance any attempt by individuals to follow the footsteps of these scientists and to attempt to rethink the foundations of science. It is only the most original thinkers who have the courage to assert the importance of what is taken over from others. Thus T.S. Eliot wrote:

> We dwell with satisfaction upon the poet's difference from his predecessors, especially his immediate predecessors; we endeavour to find something that can be isolated in order to be enjoyed. Whereas if we approach a poet without this prejudice, we shall often find that not only the best, but the most individual parts of his work may be those in which the dead poets, his ancestors, assert their immortality. (1)

and Pascal who one would hardly call a plagiarist wrote:

> Let no one maintain that I have said nothing new; my arrangement of material is new. In a game of tennis we both play with the same ball, but one of us uses it to better advantage. I would as soon it were said that I have used well-worn words. The same thoughts, when differently arranged, form a new body of speech, just as the same words differently arranged express new thoughts. (2)

(1) T.S. Eliot, SELECTED ESSAYS Faber, London, 1941, p.13.
(2) Blaise Pascal, PENSEES ed. Louis Lafuma tr. John Warrington, Dent, London, 1973, 4.p.2.

The situation in science is directly analogous. What is involved in all creative endeavours is "a partnership of those who are living, those who are dead and those who are to be born". (1)

As developing a tradition rather than discovering the truth it is necessary for the scientific community to have within it both people involved in the puzzle solving activity of normal science and in the production and elaboration of speculative ideas about the world. The tradition of science presents the individual scientists with puzzles to be solved and problems to be overcome as well as achievements. Normal science is puzzle solving activity in which theories are articulated to deal with particular situations. As these theories are extended they are likely to reveal increasingly large numbers of anomalies which are problematic in terms of the old theories. These problems call for new theories. (2) However the new theories are seldom created _ex nihilo_ but are usually developments of competing theories contained within the scientific tradition as oppositional to the prevailing viewpoint. Old theories would not be rejected if there were not other theories which could be developed to take their place. The existence of different ways of looking at the world are also necessary since old theories often fail to reveal new observations. Thus the success of Galilean science was not based on its being more rational or more empirical than Aristotelian science. It was less so on both counts. (3) But it opened up new areas of enquiry.

(1) Edmund Burke, cited by Michael Polanyi in KNOWING AND BEING, Marjorie Grene ed. Uni. of Chicago Press, 1969, p. 68.
(2) Thomas Kuhn "Reflections on my Critics" in CRITICISM AND THE GROWTH OF KNOWLEDGE Imre Lakatos and Alan Musgrave eds. C.U.P. Cambridge, 1970, p. 241ff.
(3) Paul Feyerabend, AGAINST METHOD, N.L.B. London, 1975, pp.112-113 and chs. 9 & 10 passim.

The new observations made in terms of Galilean science could never have been made while the Aristotlian framework of concepts was adhered to. New ideas are unlikely to be able to compete in consistency or scope with old ideas which have been developed and defended for long periods. It may take a theory two thousand years before it attains any empirical content, as was the case with atomism. But without these counter theories all observations will be made from the point of view of the old theory, and anomalies can easily be made to appear unimportant in the absence of competing alternative theories. Thus it is an essential aspect of healthy science to have competing theories, all of which can gain a hearing and where alternatives are tolerated even if for the time being they do not measure up to the theories generally accepted.

The account of the development of the notion of impetus should give some idea of the importance of tradition, particularly the tradition of speculative thought in facilitating one of the most important achievements in science. However this only involves the explicit level of ideas. Nothing is conveyed of the tacit dimension of understanding and the appropriation of techniques. These factors have been studied in more detail by Polanyi and Kuhn. Kuhn has described how exemplars are of prime importance in the socialization of the scientist. Examplars are the concrete problem-solutions which are encountered by students in laboratories, in examinations and in texts, and the technical problem-solutions in periodicals encountered by scientists during their careers which show them how their job should be done. All scientists encounter problems such as the inclined plane, the conical pendulum, and instruments such as the calorimeter and the Wheatstone bridge. It is by doing these problems and by using these instruments that the scientist learns about nature. Without such examplars, theories and laws would have little empirical content. (1) In other words the appropriation of the tradition of science involves learning how to interpret concrete situations in terms of theories and laws and how to use the appropriate technology rather than simply learning the facts.

This tacit knowledge then enables scientists to make judgements involving tacit inferences which cannot be formulated in terms of explicit rules. (2) This enables them to judge the potential fruitfulness of ideas and lines of research though the grounds for such judgements cannot be fully explained to others. While it is possible to abstract such criteria as scope, consistency with other theories, simplicity, the yielding of puzzles to be solved and the capacity to make qualitative prediction in terms of which theories can ultimately be judged, such judgements can never be reduced to the application of a set of explicit rules. Furthermore such criteria are for the most part not developed explicitly, but evolve with the development of scientific theories and are appropriated by each generation of scientists by means of exemplars and through understanding past achievements of science. Reflection on such criteria as it occurs during disputes between the proponents of different theories might further develop and refine them, but such reflective activity is secondary in the actual

(1) Thomas Kuhn, THE STRUCTURE OF SCIENTIFIC REVOLUTIONS 2nd ed. Uni. of Chicago Press, Chicago, 1970, p. 187ff.
(2) Michael Polanyi, "The Logic of Tacit Inference" in KNOWING AND BEING (1969) op. cit. p. 148ff.

development of science.

This analysis of the nature and importance of tradition in science reveals the misdirected nature of the whole enterprise of attempting to find certain grounds for knowledge. It was pointed out in Chapter 1 that this attempt was initially inspired by the arguments of the sceptics. In the light of these arguments it was assumed that the success of science derives from its acceptance of only that knowledge which had been indubitably established. However with the downgrading of knowledge of facts in relation to understanding, it should be seen that doubt has only a part to play in the attempts to improve the instruments of understanding. Propositions are only formulated in relation to questions arising in the process of enquiry and argument, and the doubting of propositions must be understood as part of this process. Doubt is relevant when ideas are to be questioned and to do this the ideas themselves or the implications of them are formulated as propositions which can then be examined. But while it makes sense to doubt specific propositions it does not make sense to doubt that we have any understanding of the world at all. To assume from the fact that all propositions which can be formulated can in principle be doubted that it is possible to doubt all knowledge is to commit the fallacy of inverse composition, assuming that the properties of the whole can be inferred from the properties of the parts. Propositions are doubted for specific reasons in specific contexts and the fact that we have a notion of doubt implies that there are propositions which we should accept at least provisionally. If this were not the case the notion would be meaningless as the notion of counterfeit money would be meaningless if all money were counterfeit. To be involved in scientific inquiry involves acceptance of the tradition of the scientific community which can only be developed 'from the inside' by developing and extending its ideas and by questioning the validity of particular aspects of it, not by questioning this tradition as a whole.

Also the central place of tradition suggests that it is never necessary for the scientist to establish anything as certain. The scientist's activities must be seen as part of a community enterprise of developing a tradition rather than as adding bits of knowledge. To add to this tradition it is only necessary to develop or show reasons for accepting or rejecting ideas, and arguments in science need only be directed at the establishment of some theory over alternatives by showing them to be the least inadequate or the most promising. There is no need to claim that one is discovering the truth or reality as it really is. As Thomas Kuhn wrote:

> Can we not account for both science's existence and its success in terms of evolution from the community's state of knowledge at any given time? Does it really help to imagine that there is some one full, objective, true account of nature and that the proper measure of scientific achievement is the extent to which it brings us closer to that ultimate goal? If we can learn to substitute evolution-from-what-we-do-know for evolution-toward-what-we-wish-to-know, a number of vexing problems may vanish in the process. (1)

(1) Kuhn (1970) op. cit. p. 171.

UNDERSTANDING

I have now shown logical positivism to be untenable in any of the forms it has taken. Knowledge cannot be grounded in a certain foundation of observation because observation is as sensitive to theory as theory is to observation and it is part of the achievement of science to extend our perceptual horizons. The meaning of concepts changes with theories and it cannot be defined in terms of cognitive significance. New theories involve new ways of seeing the world and new frameworks of concepts. Science does not simply accumulate certain knowledge either as an accumulation of facts or by reducing old theories to new theories of broader scope. The role of scientific theories in making predictions has been shown to be overemphasized. Both the realism and the instrumentalism of the different forms of logical positivism have been rejected, and with them the correspondence theory of truth. The mathematical forms of logic were shown to be largely irrelevant to the sort of reasoning involved in science which was seen to involve a development of logic. This then makes it impossible to formulate a theory neutral scientific methodology. The conclusion pointed to in all these criticisms of logical positivism has been that the real aim of science is to understand the world.

I will now attempt to analyse the meaning of 'understanding' and describe the nature of the development of understanding in science. The process of bringing to an understanding is hermeneutics. (1)

(1) Richard E. Palmer, HERMENEUTICS, Northwestern Uni. Press, Evanston, 1969, p. 13.

There are three basic directions in which the meaning of this concept has developed: to express, to explain and to translate. In all three cases what is involved is the bringing of something strange, foreign and unfamiliar into the realm of the familiar, thus pointing back to the Greek origin of the notion in the messenger-god Hermes who transmuted that which was incomprehensible to man into a form in which it could be grasped by the human intellect. Whereas the term has been mostly used in relation to interpreting texts, especially the Bible, it can be seen from this that its meaning is such as to lend itself to the process of making nature intelligible to humans. It is theory which transmutes experience of the world into a form which makes the world intelligible. What is intelligible can then be expressed or communicated to others. It was seen how the notion of observation implies this.

The first problem of hermeneutics is that, coming to understand something is an essentially relational process. What is understood must in some sense be experienced as a unity in which the relation between all the parts is grasped. The parts together form the whole, but the meaning of the parts derives from their place within the whole. The problematical nature of this is best seen in relation to the understanding of a text, though there are differences between this and the understanding of nature. Particular words, sentences and ideas can only fully make sense in relation to the rest of the work. For instance, the meaning that words have in a sentence can only be determined by their relation to the whole sentence. To know what 'large' means for instance, it is necessary to see what the adjective refers to. But the meaning of the whole sentence can only be arrived at through the meaning of the individual words. Thus it is necessary to understand the whole sentence if the specific meaning of each word is to be understood, and it is necessary to understand the meaning of each word before the whole sentence can be understood. In this relationship between the whole and the parts each gives the other meaning. This means that understanding is circular, and the circle in which both the meaning of the sentence and the meaning of each word stand, is referred to as the hermeneutical circle.

The process of integration which takes place when something is understood is achieved by subordinating some parts of what is being understood to others. In understanding a sentence it must be understood that the verb is more important than the adjectives, and schizophrenics who in their fear of misunderstanding the speaker pay equal attention to all words spoken, fail to understand what is said. In understanding Freud it is necessary to see what is essential to the theory and what is of only subordinate relevance. It is possible to understand much more of the different principles of Freudian psychiatry than another person who has read far less of Freud, yet understand it less because one has failed to understand what is basic to the theory and what is peripheral and how the basic principles are related to the peripheral principles.

If nature is to be understood, this must also be grasped as a whole. If this were not the case, there would be no way of thinking about the relation between the different dimensions of whatever was under consideration. For this, what is being investigated must be made intelligible in terms of a unified field of discourse. This is independent of whether there is any connection such as a causal relationship between the things being understood. The point is that the field must be grasped as a unity if it is to be seen that different things are not so related and the reason for this understood. The particular thing then makes sense through being understood in relation to a context, but the meaning of the context derives from what is made intelligible in terms of it. Also, in the same way as it is necessary to grasp the hierarchy of principles underlying a text, in understanding nature it is necessary to see what is important and what can be ignored or only considered in relation to that which is basic. It is this distinction which was made by the founders of modern science when they made the distinction between primary and secondary qualities.

The difference between understanding the world and understanding a text is that first in coming to understand the world what is of primary importance is the constructing of the instruments of understanding. It was seen that these are mostly analogies which are articulated into conceptual frameworks. This is usually of little importance in the process of coming to understand texts. Second, the text already has an intended meaning whereas it is senseless to talk of the meaning of the world independently of the way it is understood. However these differences should not obscure the essential similarities between the two processes: where what is strange is brought into the familiar world of that which is understood.

Lucien Goldmann used a form of hermeneutics in coming to understand the works of Pascal and Racine. He characterized his method as dialectical and regarded his hermeneutical endeavour as a particular instance of the application of this method. His description of the method encompasses the conclusions I would like to draw concerning how science should be conceived in the light of the previous analyses:

> Although scientific knowledge is built up step by step, we can still hope that each result which is definitely acquired will enable us to move forward more quickly... Needless to say, any contribution which I make will be both completed and transcended by further work carried out along the same lines.
>
> I should, however, like to insist that the above statement of the limitations of my ambitions is not merely the expression of personal modesty. It is part of a definite philosophical position, characterized by the rejection of analytical philosophy which accepts the existence of rational first principles or starts with the recognition of the absolute validity of sense experience. Both rationalism, by assuming the existence of innate and immediately accessible ideas, and empiricism, by its reliance upon sensation or perception, presupposes that at any moment in a particular investigation there is a certain amount of definitely acquired knowledge, from which scientific thought moves forward in a straight line, admittedly with varying degrees of certainty, but without being normally and inevitably obliged to keep returning to problems already solved. Both rationalism and empiricism are thus opposed to dialectical thought, for this affirms that there are never any absolutely valid starting points, no problems which are finally and definitely solved, and that consequently thought never moves forward in a straight line, since each individual fact or idea assumes its significance only when it takes up its place in the whole, in the same way as the whole can be understood only by our increased knowledge of the partial and incomplete facts which constitute it. The advance of knowledge is thus to be considered as a perpetual movement to and fro, from the whole to the parts and from the parts back to the whole again, a movement in the course of which the whole and the parts throw light on each other. (1)

Apart from the absence of concern in this statement for the place of theories it can be seen that the criticisms of atomistic approaches

(1) Lucien Goldmann, THE HIDDEN GOD: A STUDY OF TRAGIC VISION tr. Philip Thody, Routledge & Kegan Paul, London, 1964. p.4f.

to knowledge are the same as those reached in my analysis of science, and the conclusions as to the proper nature of enquiry follow as a consequence. What is then achieved by this enquiry is understanding in which particularities are grasped by being seen in relation to the whole and the meaning of the whole is grasped by seeing the relationship between all the parts.

The second problem of hermeneutics is that it is necessary to have some knowledge of that which is not understood in order to know that one does not understand it. This problem is also overcome by seeing the relation as circular and the relationship between that which is not understood and that which is as dialectical. Thus there are two dimensions to the hermeneutical circle: that between the whole and the parts and that between that which is understood and that which is not. However these are two dimensions to the one circle and should not be completely separated.

Ray Hart has analysed this second dimension in such a way as to make it applicable to scientific understanding. (1) He uses the term 'hermeneutical spiral' rather than hermeneutical circle in order to avoid the connotations of there being any viciousness in the circle from which it might be impossible to extricate ourselves. For this reason I too will use this term, meaning by it both the dimensions described above. As Hart analysed it, the hermeneutical spiral is a

(1) Ray Hart, UNFINISHED MAN AND THE IMAGINATION, Seabury, N.Y., 1968, pp. 60-65.

process in which we have some preacquaintance with what there is to know, that is, of the world or of being, and we always know something which can serve as the starting point of the enquiries. Hart thus sums up the relationship between knowing and being:

> The relation is circular because knowing presupposes being (minimally that of the knower and that of the known) and being presupposes knowing (at some level of apprehension of some dimension of being's givenness). Yet this is not a vicious circle. The circuit 'beginning' (Who can say where the circuit begins?) with the point marked 'something being given' does not return to the same point on the circumference, but to a point 'above' it; and likewise with the point marked 'knowing'. Every spiral involves an enriched cognition of the field of the something-given, and every expansion of the field furnishes impetus for another cognitive circuit: thus an expansion of the knowing mind and of the given itself. Without some such model as that of the helical spiral to adumbrate their nature, being and knowing stand over against each other as blocks of stuff never to have intercourse, as though the givenness of being were never enhanced through knowledge (or constricted through ignorance) and as though what knowledge responds to is an incarnation of itself. (1)

This aspect of the hermeneutical spiral is only important in relation to understanding a text in the sense that it is necessary to have some acquaintance with the subject matter before it is possible to understand what is being said. But it is of central importance in coming to understand the world.

It is obvious from the account of the hermeneutical spiral given here that they are not amenable to analysis by formal or mathematical logic. In terms of this type of logic understanding is impossible. But the logic of question and answer is eminently appropriate for the task of

(1) Ibid., p. 62.

attempting to understand something. It is by such a question and answer approach that the problems of hermeneutics are overcome and one does come to understand situations. Questions arise when something is seen as problematic or anomolous. It is only in relation to such anomalies that the meaning of understanding becomes evident. Understanding is extended or deepened when such anomalies are removed by appropriate answers. Yet we only experience anything as anomalous against a background of that which is already understood. It is on the basis of this that our questions are formulated. But when our understanding is extended, new dimensions of the world are opened up, and as a consequence, the more that is understood, the more there is in the world which is experienced as anomalous. This then leads to more questions. This process goes on at two levels at once. Anomalies are experienced in the world and are cleared up, and then anomalies occur in the relationship between different areas of enquiry in that accepted solutions appear to be contradictory, or at least it is not known what the relationship between them is. Answers to these problems should be such as to enable the parts of the world that are understood to be seen in relation to each other, that is, as a unity. This overview then points to more detailed studies either of the world or of the relationship between ideas. In this process, observation, concepts, theories, and logical principles are all developed.

That this is in fact the way science develops can be seen in the way domains of enquiry develop and in the relationship between domains and theories. (1) First, a domain is unified by being seen as a problem

(1) The notion of domains is taken from Dudley Shapere "Scientific Theories and Their Domains" in SUPPE (1974) op. cit. pp. 518-599.

in need of an explanation. However what counts as problematic is that which is unexpected. This is likely to be the discovery of order where there is no reason to expect it in the existing theoretical framework. Here the anomaly gives rise to the question: Why is there such order? But this question only arises on the basis of existing theory which cannot account for the anomaly. A theory is then required to answer the question. Thus a domain can be defined as the total body of information for which an answer in the form of a theory is expected to account. After a theory has been found, the domain is that which is unified by the theory. But this theory is likely to point towards other phenomena which are likely to be understood in terms of it or which seem to be the sort of things which should be understood in terms of it. The domain is then the total body of information which is relevant to a particular theory. This is the second way that a domain is unified. It is in a domain unified in this way that the sort of normal science as puzzle solving described by Kuhn gets under way. Finally the failure of the existing theory to account for all the anomalies is likely to produce new domains defined in terms of the problems to be accounted for.

An example of an order in need of an explanation, which as such, became a domain is that revealed by the periodic table. The regularity here was in obvious need of explanation and thus constituted a new domain. When nuclear physics had developed to account for this order, the theories about nuclear structure were immediately faced with the task of explaining a host of other phenomena which people simply had not been aware of prior to the development of nuclear physics. Thus the domain of quantum mechanics was brought into being.

The items of a domain include more than just observations. Theories which have unified a domain are likely to become items or phenomena to be explained by a new theory, and as such, theories themselves become items in a domain. Sometimes the items are theoretically determined and are not known to exist. Such was the case with neutrinos and neutron stars and still is the case with tachyons (particles travelling faster than the speed of light) and superstars. Where observations themselves are items in a domain they are only so because they have been ordered in a particular way as were the observation of elements in the periodic table. Isolated facts are seldom important.

That a body of information is a domain is itself an hypothesis and may ultimately be rejected. There must be good reasons for putting forward such an hypothesis. Some relations between a number of items can always be found and it is necessary to have grounds for believing that there are more comprehensive, deeper relations involved. Suspicion that there is such a deeper unity is not in itself adequate for the attempt to provide a theory to account for the domain. The domain must be ready for such an attempt, that is, the domain and the problem relating to it must be clarified, precisely defined, and its extent accurately determined. Then there must be promising lines of research and mathematical techniques available for the formulation of the theory. Spectroscopy at the turn of the century was a potential domain promising deeper relations than appeared evident, but the observations were too disorganized to allow for theories to be put forward. Eventually the results of spectroscopic examinations were explained by theories which had developed to explain the periodic table. It is clear that Einstein could not have solved or even effectively tackled the problems which led to the formulation of the general theory of relativity if non-Euclidean geometries had not been formulated. Finally domains should be thought to be important before they justify the effort necessary for their clarification to the level at which a theory may be formulated. That is, it is necessary to have reason to suspect that the theory will have broader implications for science as a whole. All these reasons for hypothesising that a given body of information is a domain are dependent on background knowledge, that is, what is already understood and not on the world as it is observed independently of theory or on reality as it is in itself.

Although the idea of an explanation as an ex post facto prediction has been rejected, I have still given a central place in my analysis to explanation. It might be asked why I do not simply say that the aim of science is to explain anomalies, instead of understanding the world. The reason why explanation cannot be as central to science as understanding is that anomalies can only be defined as what is unintelligible in terms of existing theories. The existence of anomalies indicates the need for the development of these theories or of new theories to explain them, that is, to make them intelligible. But when the anomalies are explained, they are no longer anomalies and are experienced in a different way. They then fall into the background of that which is understood. Thus we see that 'explanation' applies to that which has been singled out, whereas 'understanding' applies to the whole field of that which is intelligible including all the achievements of previous enquiries.

I will now try to throw some light on that facet of understanding and explanation which 'falls into the background'. When something is understood, its meaning is grasped as unity. But in grasping this as a unity, it is necessary to be aware of all the parts. Such a situation can be described as 'indwelling' in the parts in order to focus on the meaning of the whole. (1) This indwelling is exemplified by the understanding of a sentence. One attends 'from' the meaning of each word 'to' the meaning of the whole sentence. The similarity between the understanding of a sentence and the understanding of the world is evident if we consider the case of understanding how the body functions. The physiology of a person could never be understood simply by cutting bodies into slices and memorising the features of all of these parts. What is required is an imaginative grasp of all the parts so that they can be seen as a functioning whole in much the same manner as it is necessary to indwell in the meaning of the words of a sentence to grasp the meaning of the whole sentence. By indwelling in the parts the whole is understood as a dynamic living being, or alternatively, by indwelling in the whole and focussing on any of the parts, the significance of the parts can be understood in relation to the whole. In either case that which is focussed on is understood in the way it is because attention is directed from that which is dwelt

(1) This concept is taken from Michael Polanyi, 'The Logic of Tacit Inference' (1969), op. cit. pp.148ff.

within to that which is focussed upon.

Understanding involves the use of theories, and to understand something in terms of a theory it is necessary to internalize the theory so that one dwells within it and then attends from the theory to the phenomena to be understood in terms of it. In this way the domain defined by the theory is dwelt within so that phenomena are made intelligible by being related to the domain as a whole. It is not sufficient to understand the meaning of a theory in isolation from such use. A theory is only properly understood through being used to understand the world. Theories then must be seen as the means for indwelling in the world so that any particular phenomena focussed upon can be experienced as intelligible. Ultimately the aim of science must be to facilitate the greatest possible indwelling in the world so that it is grasped as a unity in which all particularities can be understood in relation to the whole.

If understanding is to be taken as the most basic concept of epistemology it is necessary to give some account of the relationship between knowledge and understanding. Knowledge in the strict sense is 'knowledge that something is the case', that is, of what are the facts. But it has already been shown that facts are only true propositions, and that propositions are what is meant as being the case. What a person takes to be the facts are the propositions about the world that the person would commit him or herself to affirming as true. As J.L. Austin put it: "When I say 'I know', I give others my word: I give my authority for saying that 'S is P'." (1) But

(1) J.L. Austin "Other Minds" in LOGIC AND LANGUAGE: Second Series, ed. Antony Flew, Basil Blackwell, Oxford 1973, p. 144.

such claims to knowledge are only made in specific contexts in relation to specific problems. For example, a person might assert as a fact the rate of flow of phlogiston which s/he has measured for a particular experiment, and the validity of the theory in terms of which the proposition is formulated is ignored for the time being. Only within the context in which the theory is accepted is this a valid claim to knowledge. Facts are formulated in the process of enquiry, in making decisions between different theories, in conveying information and in attempting to show how a situation should be understood, either in answer to a question, to instruct or in argument with another person, and in all cases the claims to knowledge derive their meaning from their specific contexts. Understanding, on the other hand, is prior to and presupposed by each of these contexts. Having understood something, a person will be prepared to affirm as facts in appropriate contexts an indefinite number of propositions which can be formulated on the basis of that which is understood. But all these claims to knowledge presuppose understanding which in turn cannot be reduced to the sum of claims to knowledge and which is independent of any particular context within which knowledge claims are made. With the development of understanding, that is, as the world or some domain is dwelt within more fully, there is less and less to be concerned with the facts. As P.B. Medawar wrote:

> The ballast of factual information, so far from being just about to sink us, is growing daily less. The factual burden of science varies inversely with its degree of maturity. As a science advances, particular facts are comprehended within, and therefore in a sense annihilated by, general statements of steadily increasing explanatory power and compass - whereupon the facts need no longer be known explicitly, i.e. spelled out and kept in mind. In all sciences we are progressively relieved of the burden of singular instances, the tyranny of the particular. We need no longer record the fall of every apple. (1)

(1) P.B. Medawar THE ART OF THE SOLUBLE Methuen, London, 1967, p. 114.

Placing knowledge in a secondary position to understanding has important implications. Claims to knowledge are accepted as true or rejected as false while understanding can be to varying degrees of adequacy and there is no limit to the depth of understanding which may be achieved. By taking the notion of understanding as central with theories being seen as means to understanding, the development of science can be viewed as an evolutionary process with progress defined in terms of improvement on existing theories rather than in terms of an ultimate goal. This possibility invalidates arguments directed at the anti-positivist position in epistemology. Thus Trigg argued that if a true account of nature is not possible then knowledge must be unattainable. (1) This is only valid if it is accepted that knowledge means an account of the world as it is in itself. However this has been rejected here, and as the quote from Austin indicated, this rejection is in line with commonsense usage. Knowledge claims only have significance within delimited contexts, are relative to the conceptual frameworks in terms of which they are formulated and must ultimately be understood as part of the social project of developing and communicating understanding. Trigg also criticised Kuhn for saying that in making a judgement about different theories, the scientific community could be mistaken. (2) The concept of mistake is supposed to have meaning only in relation to that which is correct, and 'correct' is equated by Trigg with 'true'. It is then assumed that 'true' only

(1) Roger Trigg REASON AND COMMITMENT Cambridge Uni. Press, Cambridge, 1973, p. 117.
(2) Ibid., p. 118.

has a meaning in relation to nature as it really is. Thus the use of the concept of mistake by Kuhn is seen to be in contradiction with Kuhn's rejection of the notion of a true account of nature. However a judgement which later was found to lead away from modes of thought in which a deeper understanding of the world had been attained could be thought of as a mistake. The notions of mistake and correct can then be seen to attain their meaning in relation to the aim of disciplined inquiry to deepen our understanding of the world.

Finally the notion of understanding avoids the tendency to hypostatise the achievements of science and to exclude the subjects involved in this from proper consideration; as though these achievements could be thought of as that which is accumulated in books. It is obviously the case that the notion of understanding emphasises the personal dimension of science, but there is more involved in the notion of understanding than this. Knowledge in the form: 'knowledge that' implies an objectification of that which is known. It is made an object of thought. Then if I come to know any particular thing, a further objectification is required to know that I know this. And so on _ad infinitum._ This means that there is an infinite regress in which the subject as such is always one stage behind that which is known, and for this reason is often considered not to exist at all. But when understanding is made the central concept of science, the focus of attention or that which is objectified is always seen in relation to that of which one is only subsidiarily aware. It is then possible to be subsidiarily aware that it is I who am understanding something at the same time as I am understanding this something, and no infinite regress is entailed. In relation to the world as a whole it is then possible for people to understand that as subjects who understand the world they are at the same time part of this world.

SCIENCE AND METAPHYSICS

In the preceding analysis I have shown the inadequacy of the basic assumptions and positions of logical positivism. But these have also been the assumptions and views in terms of which metaphysics was ruled out as nonsense, namely the view that true knowledge is based on the certain ground of that which is given in experience, the view that the only valid form of reasoning is that which is formalized into mathematical logic, the corresponding view that the meaning of concepts are fixed and definable in terms of observation, and finally the view that knowledge is cumulative. While such views prevailed and were thought to characterize science and account for its success, there could be no place for the enterprise of metaphysics. Through an examination of what actually happens in science 'our surest example of sound knowledge' it was shown that the aim is understanding rather than the accumulation of knowledge, and this implies that it is just as important to get an overview of the world as it is to examine small areas. In other words science involving specialized disciplines and metaphysics should go hand in hand.

This close association between science and metaphysics is more than a matter of complementarity with science providing the details and metaphysics the overview. The way the details are understood is largely determined by the metaphysical position adopted, while metaphysical systems must be developed in order to grasp particulars. The role of metaphysics in science is as the background beliefs which are dwelt within and in terms of which that which is focussed on ultimately makes sense. The effectiveness of metaphysics has been acknowledged by scientists themselves in relation to their own work. Thus C.H. Waddington wrote:

> I should like to argue that a scientist's metaphysical beliefs are not mere epiphenomena, but have a definite and ascertainable influence on the work he produces, by reminiscing for a moment about my career. I am quite sure that many of the two hundred or so experimental papers I produced have been definitely affected by consciously held metaphysical beliefs, both in the types of problems I set myself and the manner in which I tried to solve them... Maybe my metaphysics was leading me up the garden path (though I don't think so), but the point I want to make now is that it was leading me somewhere and was therefore something more than a set of decorative flourishes on the proscenium arch, giving on to the stage in which the real action takes place. (1)

The nature of the relationship between metaphysics and particular disciplines in science can be illuminated by considering the implications of the question and answer logic of enquiry. When a question is asked, it is always necessary to make assumptions. For instance if a doctor is trying to diagnose a disease he makes a test, say, taking a sample of blood and examining it to see what proportion of it is red blood cells. He has asked the question, "How many red blood cells are there in this volume of blood?" because he assumes that knowing this will indicate whether the patient is suffering from anaemia. He has asked the question, "Is the patient suffering from anaemia?" because he assumes there is something wrong with the functioning of the patient's body if the patient always feels tired. He has asked the question, "What is wrong with the functioning of the patient's body?" because he assumes

(1) C.H. Waddington, "The Practical Consequences of Metaphysical Beliefs on a Biologist's Work: an Autobiographical Note" in TOWARDS A THEORETICAL BIOLOGY 2. SKETCHES ed. C.H. Waddington, Edinburgh Uni. Press, Edinburgh, 1969, p. 72.

that if things go wrong there must be some good reason for this which makes sense in terms of modern medicine. He does not suspect the action of evil spirits. Thus when any question is asked it can be seen to be based on a hierarchy of assumptions. These are assumed even if the doctor does not explicitly ask himself each of the questions which reveals this hierarchy. Unless we accept that there is an infinite regress, it is obvious that in this process of question and answer there must be some point reached where the assumptions cannot be thought of in the same way. It is at this point that the problem becomes one of the science of first principles, that is, of metaphysics.

Such basic principles are part of a general conception of being. In the case of the doctor this is most likely to be a mechanistic conception of the world with a correspondingly mechanistic conception of the human body. He looks for a cause of the disruption of this mechanism in the form of some intervening event. He is unlikely to look at social influences since these cannot be understood within the framework of mechanistic concepts as the cause of the patient's ill health. In other words, the doctor, and in fact all scientists are committed to a general conception of the nature of being in terms of which each particular aspect of the world is understood. This point has been emphasised by the physicist David Bohm who stated at a conference on biology:

> I think the most important aspect of the interchange is the emergence of a common realization that metaphysics is fundamental to every branch of science. Metaphysics is...something that pervades every field, that conditions each person's thinking in varied and subtle ways, of which we are not conscious. Metaphysics is a set of basic assumptions about the general order and structure

> of existence...It seems clear that everybody has got some kind of metaphysics, even if he thinks he hasn't got any. (1)

If this is the case then a science will be blind to what it is doing if it fails to examine its metaphysical commitments. As Whitehead wrote: "If science is not to degenerate into a medley of ad hoc hypotheses, it must become philosophical and must enter upon a thorough criticism of its own foundations." (2) Without such efforts scientists will be dominated by ideas which he will be unable to question. Bohm has also spoken eloquently on this problem:

> ...the practical 'hard-headed' individual has a very dangerous kind of metaphysics, i.e. the kind of which he is unaware... Such metaphysics is dangerous because, in it, assumptions and inferences are being mistaken for directly observed facts, with the result that they are effectively riveted in an almost unchangeable way into the structure of thought...[W]hat is needed is the conscious criticism of one's own metaphysics, leading to changes where appropriate and, ultimately, to the continual creation of new and different kinds. In this way, metaphysics ceases to be the master of a human being and becomes his servant, helping to give an ever changing and evolving order to his overall thinking. (3)

In the present era there has been a tendency to squeeze out scientists with a philosophical orientation, despite the fact that the major achievements in science have been the work of such philosophically inclined scientists as Kepler, Newton, Faraday, Einstein, Bohr, Heisenberg, de Broglie and Prigogine. This can be accounted for partly

(1) David Bohm "Further Remarks on Order" in Waddington ed.(1969) p.41.
(2) Alfred North Whitehead SCIENCE AND THE MODERN WORLD, Lowell Lectures, 1925, Mentor Books, N.Y. 1964 p. 23.
(3) Bohm (1969) op.cit. p. 41f.

in terms of the organization of the scientific community. Research in learning institutions is organized in such a way that people with clear cut areas of investigation in which the contribution of the researcher is clearly evident are most likely to gain support. Research project proposals on the basis of which researchers get their funding must have clearly stated goals before they are likely to be successful, and proposals to question the fundamental tenets of science are unlikely to be able to be formulated in this way. Also scientists gain recognition through publications and it is extremely difficult to succeed in any other way than by specializing in an extremely specialized field in which the state of research can be quickly learnt and a reputation gained on one highly specialized journal. To move from field to field and to attempt to establish oneself in different journals would put any scientist at an impossible disadvantage in this struggle for publication. Finally this organization is favoured by the people who with a certain limited ability have been able to choose a sufficiently obscure subject of investigation to become world authorities in their field, and then on this basis have been able to make a limited contribution to knowledge and be recognized for it.

But also this neglect of philosophical issues and exclusive concern with experimentation has been strongly supported by the prevalence of positivistic epistemologies in the field. Logical positivism in both its instrumentalist and its realist forms have championed the idea that numerous highly specialized studies of the world would lead to an accumulation of knowledge which would add up to a true account of what can be expected in experience or of what the world is really like, and that attempts to develop new ways of looking at the world or to attain an overview are meaningless. Furthermore by setting up an ideal of scientific theories in which predictive ability is the most important factor and where theoretical development is seen in terms of reduction of particular theories to theories of broader scope, logical positivism is implicitly committed to reductionist materialism where the world can ultimately be reduced to the laws of behaviour of the elementary constituents of the universe. Combining this implicit commitment to materialism with a rejection of attempts to develop alternative conceptions of being allows for a dogmatic affirmation of the materialist metaphysic. Since there are a large number of scientists whose work is predicated on an acceptance of the materialist framework of concepts and who consequently are hostile to any attempt to show that their work is based on a misconception, this dogmatism of epistemologists has been used to identify science with reductionist materialism. This has been a standard rhetorical device used by the proponents of materialism to eliminate those who would attempt to establish science on a different conception of being while those scientists who have attempted to develop fundamentally new ideas have generally found themselves having to defend metaphysical ideas. Thus materialists have tried to rule out the ideas of the Naturphilosophen and the phenomenological theory of thermodynamics deriving from this school of thought, anti-reductionist approaches in biology and attempts to develop new approaches to quantum theory as non-scientific speculation, while Maxwell in his defence of field theory, von Bertalanffy and Waddington in defence of different anti-reductionist approaches to biology and David Bohm in the defence of his efforts to develop a non-localizable hidden variable quantum theory have found themselves forced to defend the role of speculative metaphysical ideas in science.

In terms of my epistemology materialism must be seen as only one conception of being among others. Attempts to develop coherent conceptions of being originated with the pre-Socratics. Prior to these thinkers there was no tradition of criticism and ideas developed and stayed around if they seemed useful. When they were no longer useful they were forgotten. With no written tradition and no deep understanding of the cultures of others, people were not aware of the evolution of their ideas. (1) But with the early Greeks where written records were kept and conflicting ideas co-existed side by side, a critical tradition arose in which attempts to transcend cultural relativity through rigorous thought were made. This began a tradition in which there was a demand for complete consistency of ideas, where it was recognized that hypotheses might be wrong, and where the problems raised by other systems of ideas were taken as starting points for the development of new ideas. In this way four major basic types of conceptions of being were outlined: field theory in which everything is seen as a manifestation of the whole, process philosophy in which everything is seen to be in flux, atomistic materialism in which everything is seen to be composed of elementary entities, and formism in which matter is seen to be striving to actualize forms. The most

(1) This has been argued by Robin Horton in "African Traditional Thought and Western Science Part II" in AFRICA Vol. XXXVII, April 1967, pp. 155-186

important empirical investigations of nature made by the Greeks were undertaken in terms of the formism developed by Aristotle. The major conception of being of the Romans, and that which formed the basis of their empirical investigations was essentially a version of field theory. The developments in science from the beginning of the Renaissance assumed the formism of Plato, but to overcome the problems of Aristotlian physics the seventeenth century developed a type of materialism. While this materialism has dominated most of the empirical work of science up to the present it has been challenged from a number of directions. Most importantly Leibniz developed a panpsychist ontology the central characteristic of which was the emphasis on the activity of what most fundamentally is. His concept of living force or vis viva was developed by the Naturphilosophen of Germany and played an important part in the development of thermodynamics. Ostwald's energism in which energy is taken as the fundamental substance of the universe was developed in opposition to materialism on the basis of this thermodynamics. But more importantly Leibniz's ideas were developed as dynamism by Kant and Boscovich. In this atoms were seen as point sources of activity rather than as inert matter. These ideas were then developed by Faraday into a field theory to account for the phenomena of electricity and magnetism. Maxwell developed this further and explained light as electro-magnetic waves. Finally Einstein's theories of relativity brought field theory to a dominant position in physics so that atomism was forced into a secondary position. Thus we can see that the speculative construction of conceptions of being has been a characteristic feature of science throughout its development, and the development of such conceptions of being has been absolutely essential to this development. As Feyerabend wrote: "Metaphysical systems are scientific theories in their most primitive stage. If they contradict a well confirmed point of view, then this indicates their usefulness as an alternative." (1)

The scope of metaphysical positions does not make them any less able to be rationally justified than scientific theories with a very small scope. It was seen that theories are justified through their ability to make the world intelligible without giving rise to inconsistencies, and by doing this better than alternative theories. Usually their justification came from the ability to resolve specific problems. Thus the scope of a theory is irrelevant to the nature or validity of the arguments which are used to support it. Certainty is not gained by studying in detail small areas. The concepts used in these studies are grounded in metaphysical systems, and so the studies are no more valid than the basic metaphor underlying the conception of being which gives rise to the particular study in question. And it is not the aim of science to accumulate certain knowledge.

Furthermore science is a community enterprise. It is not necessary for each individual to develop to the full each idea and show that it is valid. It is enough for a thinker to show some reasons in support of a suggested theory, either his or her own or someone else's to have contributed to the attempt to understand the world. It is not

(1) Paul Feyerabend "Problems of Empiricism" in BEYOND THE EDGE OF CERTAINTY R.G. Colodny ed., Prentice Hall, N.J., 1965, p. 183.

necessary to show that the new ideas are as plausible as those which are generally accepted. Thus Boscovich's dynamism could not compete with the success of materialist atomism, but it has since been developed as field theory to the dominant conception of being in physics. Thus it can hardly be denied that Boscovich has made an important contribution to science even if he did not provide adequate reasons to justify accepting his position at the time.

This analysis provides further support to the defence of metaphysics made by Whitehead:

> It has been an objection to speculative philosophy that it has been overambitious.Rationalism, it is admitted, is the method by which advance is made within the limits of a particular science. It is, however, held that this limited success must not encourage attempts to frame ambitious schemes expressive of the general nature of things.
>
> One alleged justification of this criticism is ill-success: European thought is represented as littered with metaphysical systems, abandoned and unreconciled.
>
> Such an assertion tacitly fastens upon philosophy the old dogmatic test. The same criterion would fasten ill success upon science. We no more retain the physics of the seventeenth century than we do the Cartesian philosophy of that century ... Of course, in that century, dogmatic views held sway; so that the validity both of the physical notions, and of the Cartesian notions was misconceived. Mankind never knows quite what it is after. When we survey the history of thought and likewise the history of practice, we find that one idea after another is tried out, its limitations defined, and its core of truth elicited. (1)

It can now be concluded that any attempt to reject the metaphysical enterprise not only cannot do so on the grounds that it is unscientific, but that metaphysics cannot be rejected without also rejecting science. And if the aim of science is understanding of the world, then metaphysics is just as important as science in achieving this. In the project of understanding the world, science and metaphysics must go hand in hand.

(1) Alfred North Whitehead PROCESS AND REALITY, Cambridge Uni. Press, Cambridge, 1960, p. 20f.

CHAPTER III

METAPHYSICS AND THE ONTOLOGY OF PROCESS PHILOSOPHY

> The useful function of philosophy is to promote the most general systematization of civilized thought. There is a constant reaction between specialism and common sense. It is the part of the special sciences to modify common sense. Philosophy is the welding of imagination and common sense into a restraint upon specialists, and also an enlargement of their imaginations. By providing the generic notions philosophy should make it easier to conceive the infinite variety of specific instances which rest unrealized in the womb of nature.
>
> Alfred Whitehead
> PROCESS AND REALITY

In this chapter I will describe the nature of metaphysics and show what is involved in the development of a metaphysical system. The first essential feature of a metaphysical system is that it be comprehensive. Metaphysics is concerned with the world as a whole and must provide us with a synoptic view of this world. The second feature is that a metaphysical system must be developed without implicit assumptions and must justify itself. It must be fully self critical unlike particular enquiries which can take much for granted. Thirdly a metaphysical system must develop a basic conception of being, defining what there is in the world. I will analyse each of these features in turn, attempting to show what problems arise and how these can be overcome. In this way I will justify the way this thesis has been developed, that is, by beginning with an historical introduction based on a set of presuppositions in which the problems of our cultural heritage are defined, and then taking this as the point of departure for the development of the thesis in terms of which the original presuppositions are to be justified. The most significant feature of a metaphysics will be seen to be its conception of being, that is, its ontology, and it will be shown how ontologies are developed through the articulation of basic analogies. To illustrate this I will examine the development of ontology in early Greek philosophy, the rise of materialism in the sixteenth and seventeenth centuries, and the attempts by Leibniz and Hegel to develop alternative ontologies to materialism. Taking these analyses as a starting point, I will attempt to develop a version of process philosophy based on the analogy of music in which the problems which have arisen in the attempts to develop a coherent conception of being will be overcome.

To provide an understanding of the totality, a metaphysical system must interpret every aspect of the experienced world. To do this it must develop a general conception of the nature of being and in terms of this, of life and of humanity. To understand humans it is necessary to understand the relationship between individuals and society and their place within the world and it is necessary to account for how humans as part of the world are capable of understanding it. It is also necessary to show whether life has any significance and whether there are grounds to justify basic decisions about how to live. In this way the system should put the whole world, including ourselves in perspective. It should not be an exhaustive account of the world, but should provide the foundations and provide directions for each particular domain of enquiry whether this be science, history, art or ethics. And being all encompassing, it should make explicit and justify all the assumptions made in any part of the system. Thus it is implicit in the claim of a metaphysical system to comprehensiveness that it should involve the development of an ontology and that it should proceed without implicit assumptions. However before going on to deal with these two aspects of metaphysics, it is necessary to deal with an important feature following from the comprehensiveness of metaphysics, namely that it must be reflexive and take cognizance of its own significance.

This becomes particularly evident when it is considered that how people understand themselves and their place in the world is a constitutive part of society. It is through a common way of understanding that the fluid interactive processes are stabilized and common action is facilitated. It is the prerequisite for there being any significant social organization. And what is understood is not generally an object of reflection but comes to be presupposed by the structures of practice. For example if a person enters into some sort of bargain with another person in our society, he has tacitly understood that notions such as the autonomous individual, the sanctity of contract and the importance of utilitarian motives are valid. But as was seen in the introduction, different societies with different ways of thinking have adhered to different notions about themselves and as a consequence these societies have been very different from our own.

The different ways in which the world and people's place within it can be experienced is most clearly evident in the work of ethnographers in their study of traditional societies. For instance Roy Willis writes, quoting Godfrey Leinhardt:

> 'The Dinka have no conception which at all closely corresponds to our popular modern conception of the "mind" as mediating and, as it were, storing up the experience of the self. There is for them no such interior entity to appear, on reflection, to stand between the experiencing self at any given moment and what is or has been an exterior influence upon the self'... What Western man would call a 'memory' related to a past experience, Dinka conceive as an exterior agency still potent to act upon them. Where the individual in Western culture encapsulates his personal past within himself, Dinka experience what Western man would regard as interior, psychic phenomena as features of a timeless external world. Both the boundaries of the self and the nature of the external world are differently conceived, and experienced, by Dinka and by Western man. (1)

But if such radically different ways of experiencing the world are possible, then a metaphysics, which must be comprehensive and deal with every aspect of experience, must largely constitute societies or civilizations. That this is in fact the case has been argued in the introduction where the social order of the Middle Ages was seen to be based on the fusion of neo-Platonic and Hebraic thought into

(1) Roy Willis (1974) op. cit. p.81.

the world-view of Christianity. The way the feudal aristocracy conceived of themselves and of the relationship between people and the nature of the social order which developed accordingly as described. But the different ways of experiencing the world is even more evident in the case of the feudal clerisy. The clerical conception of the world was based on Augustinian Platonism. The clerical chroniclers thought of the world as being static and timeless so that anything which happened was seen as an isolated disturbance within an unchanging world. In the early Middle Ages the only criterion ordering the description of events in the chronicles was the relation of the events to the monastery. These were simply listed in the order in which they happened and there was never any attempt at narrative. When any attempt at explanation in terms of human action was made it was always an attribute of a person which was held responsible. Thus when a person who was well thought of was seen as doing something which the chronicler disagreed with, this action was attributed to a previously hidden attribute. Objects, whether they be human or otherwise were only the shadowy ground in which these qualities were seen to inhere. Thus there could be no integration of attributes and there could be no conception of the individual. Following Augustinian realism, universals were taken to be real, and memory, truth, justice, avarice and so on were thought of as the real beings of which persons only imperfectly partook. This way of conceiving people and the world was then reflected in the life of the clerk. As Brandt wrote:

> His mode of perception did not provide any criterion of coherence, since it did not provide for human personality as we know it. The same lack of coherence is apparent in medieval clerical life. Medieval documents abound with evidence that at least a majority of clerks lived a radically incoherent life. (1)

The categories of perception of the clerk gave him no ground for judging consistency in conduct and this was consequently reflected in his actions. Thus he was able to live comfortably with what would

(1) Brandt (1966) op.cit. p.163.

nowadays be regarded as contradictory values.

Brandt's study of the clerical and aristocratic chronicles, revealing a fundemental difference in the modes of perception and general outlook on life between these and the modern outlook, indicates the extent to which people are formed by metaphysical ideas. Brandt concluded that the sense of what is of importance is learnt as a mode of perception, and this 'gives our human world the only shape it can have for us' (1) In the Introduction I tried to show how reductionist materialism has replaced the world-view of the Middle Ages and how it in turn is shaping the modern world.

If this is the case then metaphysics should not be seen simply as the systems of ideas developed by philosophers as a means to understand the world. Metaphysical systems should be seen as actually or potentially the foundations for civilizations. Therefore if metaphysical systems are to be comprehensive, they should be such as to acknowledge this, and to recognize that if they are opposed to the prevailing ideas of the existing social order, then their development is a revolutionary activity. As Alfred North Whitehead wrote:

> [Philosophy] is the most effective of all the intellectual pursuits....It is the architect of the buildings of the spirit, and it is also their solvent:- and the spiritual precedes the material. Philosophy works slowly. Thoughts lie dormant for ages; and then, almost suddenly as it were, mankind finds that they have embodied themselves in institutions. (2)

Philosophy does not leave everything as it is.

(1) Brandt (1966) op.cit. p.105.
(2) SCIENCE AND THE MODERN WORLD op.cit. p. viif.

If a metaphysical system is to be comprehensive, a problem arises as to where to begin. To choose any starting point inevitably involves making a judgement based on presuppositions. But a system developed on an arbitrary set of presuppositions is likely to be nothing more than an expression of the prejudices, peculiarities of mind and the contingent circumstances of the philosopher who produced it. These problems have never been so fully confronted as they were by Hegel who began his ENCYCLOPAEDIA OF THE PHILOSOPHICAL SCIENCES by stating:

> Philosophy misses an advantage enjoyed by the other sciences. It cannot like them rest the existence of its objects on the natural admissions of consciousness, nor can it assume that its method of cognition, either for starting or for continuing, is one already accepted...We can assume nothing dogmatically; nor can we accept the assertions and assumptions of others. And yet we must make a beginning: and a beginning, as primary and underived, makes an assumption, or rather is an assumption. It seems as if it were impossible to make a beginning at all.(1)

The first chapters of Hegel's ENCYCLOPAEDIA are devoted to a critique of the various attempts to arrive at objectivity. The first of these is the pre-Kantian metaphysics of the scholastics in which it was assumed that to think a thing was to find its very self and nature, the second in reaction to the abstract nature of dogmatic metaphysics involved a turning to experience as in empiricism and critical philosophy, and the third approach, the Intuitional theory, held that it is possible to gain an immediate experience of God and truth. The two most important of these from the point of view of the present are empiricism which attempts to find certainty in immediate experience and critical theory which attempts to deduce the categories in terms of which the world must be experienced if it is to make sense. Both the views that it is possible to take experience as the unproblematic foundation of knowledge, and that there is only one coherent set of concepts in terms of which the world can be understood have been

(1) HEGEL'S LOGIC, tr. William Wallace 3rd ed. Clarendon, Oxford, 1975, s.1 p.3.

criticised and rejected in Chapter II. Since there is no immediate acceptance by everyone that anything can be taken as the self evident starting point of all knowledge and philosophy, whatever is taken as the starting point must be defended. And since such a defence implies further assumptions to serve as grounds for the defence, the problem of arbitrary assumptions arises all over again.

The solution to this problem is to justify the assumptions on which the starting point is based by the system which is developed from it. As Hegel put it:

> The very point of view, which originally is taken on its own evidence only, must in the course of the science be converted to a result - the ultimate result in which philosophy returns into itself and reaches the point with which it began. In this manner philosophy exhibits the appearance of a circle which closes with itself, and has no beginning in the same way as other sciences have. (1)

But this means that the metaphysical system is a begging of the question in which the argument which demonstrates the validity of the conclusion is based on the assumption that the conclusion is valid. But this is not necessarily a bad thing. Paul Weiss has argued that such circularity does not necessarily show that there is a flaw in the argument.

> The conclusion which repeats the premiss, conforms neatly to the requirements of the most stringent logic. What is wrong with the circular argument is that it is often uninformative, coming back to its beginning too quickly. But if the circle is all inclusive, if it encompasses all there is, it does all that a philosophical system demands. (2)

The importance of the circular structure of systematic philosophy is most clearly revealed by those systems of thought which do not form such a circle. For instance if logical positivism is taken as a philosophical

(1) ibid.s.17, p.23.
(2) Cited by Jacob Needleman in the Introduction to BEING-IN-THE-WORLD. Souvenir Press, London, 1975, p.33. from Paul Weiss MODES OF BEING Carbondale Ill. 1958. p.193.

system then the starting point is the assumption that all knowledge derives from experience, deduction being merely the statement of tautologies. Thus all statements which have any meaning must be either empirical or analytical. From this starting point it is not possible to develop a system which will return to justify it since it is neither empirically true nor a tautology. This means that logical positivism undermines itself since its basic assumption is defined as meaningless. This is logical positivism's biggest weakness. However if the starting point were empirically justified, the justification would simply prove what had been assumed. But if this were the case logical positivism would be far more defensible as a consequence.

However a problem arises in that if it is possible to construct different metaphysical systems which meet this criterion of consistency. Since each system defines what there is in the world and the criteria for judging the adequacy of its understanding of this world, there is no reason for such systems to coincide. How then is it possible to choose between metaphysical systems?

If a metaphysical system is comprehensive then it must be prepared to confront and explain other metaphysical systems, and to show how they are possible and why they should be rejected. When it is acknowledged the degree to which metaphysical ideas permeate everyday life and the way people experience themselves and the world, and consequently how differently different people's experience of the world is, then it should be recognized that metaphysical ideas do not describe reality as such but provide a way of understanding the world. This implies that there is a world independent of any particular way of understanding it which can be more or less understood. This should be acknowledged by any metaphysical system if it is to be taken seriously which means that it must define itself as one way of understanding the world among others. If this is the case then to justify itself it must show that it promises to form the basis of a deeper, more coherent understanding of the world that its alternatives, and so must define itself in opposition to these alternatives.

This would imply that the best way to begin the construction of a metaphysical system would be to review the metaphysics underlying the existing culture, showing what are its basic assumptions and what are the problems to which these have given rise. The superiority of the new metaphysics would then be demonstrated by its ability to solve these problems. But one's cultural heritage is not something which is immediately given. The individual who constructs a metaphysical system is not a passive recipient of his culture but must actively appropriate it. It is in the process of developing his or her own perspective on the world that she or he must define the problems of this heritage, and since the development of a metaphysical system is simply the development of a more rigorous perspective on the world, it is in terms of this that problems will be defined. But the culture with its problems are independent of the particular perspective of any individual and it is a basic problem for a metaphysical system to interpret the existing culture and to define its problems in an adequate manner.

To do this it is necessary to fully understand the prevailing ideas, and since ideas are developed to overcome problems, it is necessary to understand the problems which they were designed to answer before they themselves can be fully understood. But these problems are likely to be buried in history, and to uncover them it is necessary to delve into the history of their genesis. Such historical inquiry is important for another reason. Since there are a set of assumptions which form the horizon in terms of which everything is understood and all problems and enquiries are formulated, these assumptions tend to be so taken for granted that their being assumptions is lost sight of.

As Whitehead wrote:

> There will still be some fundamental assumptions which adherents of the various systems within the epoch unconsciously presuppose. Such assumptions appear so obvious that people do not know what they are assuming because no other way has ever occurred to them. (1)

If a metaphysical system is to make a radical critique of other systems of thought it is necessary to reveal these unconscious presuppositions, and this can best be done by showing how the world-view of an epoch developed. In this way the presuppositions are not only revealed but the reasons for their original acceptance can be questioned. Without such a study a metaphysical system which involves basically different ideas will appear so contrary to commonsense that it will not be taken seriously. That this is the case can be shown by the sorts of arguments used against Copernicus. In 1581, C. Clavius wrote:

> Copernicus' principles contain a great many assertions that are absurd. He assumes, for instance, that the earth is moving with a triple motion which I cannot understand. For according to the philosophers a simple body like the earth can only have a simple motion. (2)

Finally, it is only by such an historical analysis that the patterns of beliefs which make up a culture can be seen in relation to each other as either the working out of the implications of a metaphysics which has come to dominate the society, or as a reaction to the dominant metaphysics. Since it is necessary for a metaphysical system to prove its superiority to alternatives, and in particular to the system which has come to dominate the exising culture, it is necessary to reveal this as a system against which the proposed new metaphysics can be defined in opposition. Only in this way can the Gestalt shift required to understand the new system be easily indicated. Thus, to interpret the existing culture and to properly define its problems,

(1) Alfred North Whitehead SCIENCE AND THE MODERN WORLD, (1925) Mentor, N.Y. 1964, p.50.
(2) Cited by Philipp Frank in MODERN SCIENCE AND ITS PHILOSOPHY, Harvard Uni. Press, Cambridge, 1949, p.208.

it is best to understand its genesis in history.

However in writing such a history a number of assumptions have already been made which can only be validated through the success of the historical work, or in terms of the system developed from this starting point. As opposed to the positivists' belief in the history of ideas as simply the accumulation of certain knowledge and the replacement by this of superstition, or of Hegel's assumption that the history of ideas is the history of the world-spirit gaining full self-consciousness, I have assumed that the history of ideas can be understood as the struggle of people capable of rationality and of making intellectual progress to develop a more adequate understanding of the world and of their place within it through the development, articulation and extension of analogies.

This thesis is in the process of being developed in accordance with these ideas. In the Introduction I attempted to show that our culture is dominated by positivistic materialism and that this has given rise to a number of problems. I then set out to criticise the epistemological aspect of this world-view and to develop a different epistemology which would justify the attempt to develop an alternative world-view based on a different ontology. In this chapter I am trying to show the nature of metaphysics and to justify the manner in which this thesis is being developed. I will now indicate what is involved in developing an ontology in preparation for examining materialism as an ontology. This will pave the way for the attempt to develop a version of process philosophy as an ontology. In the next two chapters I will try to show how science can be better developed on the basis of a process ontology rather than on a materialist ontology. This will then form the basis for the development of a conception of the human order, the most important feature of which will be having justified a conception of humans as capable of rationality, capable of developing science as I have described it in Chapter II and justifying the conception of humans assumed in Chapter I as beings struggling to orient themselves in the world. Having achieved this the thesis will have been developed in a circle and demonstrated its own coherence. In the conclusion I will then indicate how the problems of positivistic materialism have been overcome and how the ideas of this thesis support an ethics and a critical social science in place of the nihilism of positivistic materialism.

The development of a conception of the nature of being has always been the most important part of metaphysics since it was defined as its major task in Aristotle's METAPHYSICS. Aristotle described this subject:

> There is a science which takes up the theory of being as being and of what "to be" means, taken by itself. It is identical with none of the sciences whose subjects are defined as special aspects of being. For none of them looks upon being on the whole or generally; but each, isolating some part, gets a view of the whole only incidentally, as do the mathematical sciences. Since we are searching for the first principles and most general factors of being, these must clearly be distinctive traits of some nature. (1)

Whatever is to be regarded as primary being in this sense must exist on its own and must be explicable solely in terms of itself. As Etienne Gilson wrote of Aristotle's notion of primary being, it must be "a distinct ontological unit which is able to subsist in itself and can be defined in itself." (2) This conception of being Descartes referred to as substance and described it as "a thing existing in such a manner that it need of no other thing in order to exist." (3) To avoid the connotations of the concept of substance, Leibniz used the term 'monad' when referring to self-subsistent primary being and Whitehead used the term 'actual entity'.

The importance of ontology derives from its forming the basis of all other domains of enquiry. As Aristotle put it:

> ...since any science deals chiefly with what is primary to its subject, other considerations being derived from and dependent upon the primary, the philosopher must have within his province the first principles and primary factors of primary being. Furthermore, as any class of things is united in sense perception and in science (for example, grammar is one science and unites in theory all articulate sounds), so the theoretical science of being includes as its parts the sciences of the species of being within the general class of being as being.(4)

(1) Aristotle METAPHYSICS tr. Richard Hope, Uni. of Michigan Press, 1960 Book Gamma, I, 1003a 21-28.
(2) Cited by Ivor Lecler in WHITEHEAD'S METAPHYSICS, George Allen and Unwin, London, 1958, p.19.
(3) From "Principles of Philosophy" in DESCARTES: PHILOSOPHICAL WRITINGS eds E. Anscombe & P.T. Geach, Nelson, Melbourne, 1966, p. 192.
(4) Aristotle METAPHYSICS op. cit. 1003 b 17-24.

Thus ontology is requiried to be able to view the world as a whole while all particular enquiries require or presuppose some conception of primary being.

The development of a conception of primary being is no different from what is involved in the development of a scientific theory about the nature of a particular aspect of reality except that a theory about the nature of being as such must be all encompassing and account for the possibility of all particular types of being. It was argued in the last chapter that a theory is developed by taking an analogy and articulating this into a framework of concepts, and an ontology is developed in the same way. As Dorothy Emmet wrote: "... a metaphysical theory develops a perspective, an outlook on the world in terms of some coordinating analogy." (1)

The first and most important efforts to develop an entirely coherent conception of primary being were those of the Greeks. The basic positions which were arrived at, the arguments developed in support of them and the problems revealed in each position have formed the starting point and the background for all subsequent thought on the subject. Furthermore the way in which ontologies have been developed is most clearly revealed by the efforts of these thinkers. It is therefore necessary to examine the development of ideas which took place in Ancient Greece in order to make the work of later philosophers intelligible, to understand the present state of the subject and to provide the grounds for justifying any particular conception of primary being.

The Greek world-view was based on the analogy of an intelligent organism. As R.G. Collingwood wrote:

(1) Dorothy Emmet THE NATURE OF METAPHYSICAL THINKING, (1945), MacMillan, London, 1966, p.196

> The Greek view of nature as an intelligent organism was based on an analogy: an analogy between the world of nature and the individual human being, who begins by finding certain characteristics in himself as an individual, and goes on to think of nature as possessed of similar characteristics. By the work of his self-consciousness he comes to think of himself as a body whose parts are in constant rhythmic motion, these motions being delicately adjusted to each other so as to preserve the vitality of the whole: and at the same time he finds himself to be a mind, directing the activity of his body in accordance with its own desires. The world of nature as a whole is then explained as a macrocosm analogous to this microcosm. (1)

Although various ideas which transcended this analogy were developed to overcome problems engendered by the attempt to arrive at a coherent conception of being, notably Parmenides conception of the plenum, the concept of the atom by Leucippus and Democritus and the notion of transcendent forms by Plato, the analogy provided the starting point for these developments, underlay much of Greek thinking and was finally articulated into its most coherent form by Aristotle.

What distinguished the first Ionian philosopher Thales from all previous thinkers was that he attempted to work out the 'physis' or nature of all beings in the world. According to Aristotle, 'physis' originally meant "the generation of growing things...an inherent something out of which a thing begins to grow." (2) suggesting the origins of the term in the organic conception of the universe. This same perspective on the world led Thales to suggest that the physis of all things is water. As Mary Hesse pointed out, the notion of water for Thales must be seen as "retaining association with the life-giving and generative power which is attributed to the gods or spirits of rivers and springs in mythopoeic thought, and with the various bodily fluids involved in generation." (3)

(1) R.G. Collingwood THE IDEA OF NATURE (1945) O.U.P. London, 1976, p.31.
(2) Aristotle METAPHYSICS op.cit. 1014b 15-18.
(3) Mary Hesse FORCES AND FIELDS (1962) Greenwood Press, Westport, 1970, p.38.

However once the quest for the physis of all things had begun, developments in ideas took place in response to the problems of the proposed answers. Thus Anaximander felt the inadequacey of Thales' answer in that water, being a specific substance with determinate properties such as wetness, itself needed explanation and could hardly explain opposite properties such as dryness. Consequently he proposed the Boundless, something infinitely extended but lacking all determinate qualities as the inherent source of all things. In this the notion of physis took on a more neutral connotation and conformed more closely to Aristotle's own definition of it as "the source of movement in things, which are natural because this source is inherent in them, either potentially or completely." (1) Creative processes were seen to occur within the Boundless through the development of vortices. These vortices were seen to generate and separate out the opposites hot and cold, and form themselves into worlds with air, sea and earth. From the sea were seen to arise living creatures from which humans were thought to evolve.

This answer in turn was seen to be deficient by Anaximenes in that the concept of the Boundless made it impossible to say anything about it or to account for how movement of the primary substance could generate opposites. Therefore Anaximenes changed tack and instead of emphasising the physis of things, he asked: Why do different things behave differently? He had noted that when air is blown with the mouth wide open it is warm whereas air blown with the lips close together comes out cold. He concluded from this that air at low pressure is hot while compressed air is cold. In this way opposite qualities could be seen to derive from the same substance as a consequence of the density of the substance. Thus he answered the question, saying different

(1) Aristotle METAPHYSICS op.cit. 1015a 17-19

things behave differently not because of what they are made, but because whatever they are made of undergoes different arrangements. Anaximenes took his physis to be air which was seen to differentiate by rarefaction into fire and by progressive condensation into wind, cloud, water, earth and stone. However he still saw the world as an organism, and thought of air as not only the substance from which the world is made, but also as the integument which wraps around it and holds it together, saying: "Just as our soul, being air, holds us together, so do breath and air encompass the whole world." (1) Here it can be seen that the concept air, closely associated with breath, connotes the life bearing principle or soul.

In the face of the problem of accounting for the diversity of the world in terms of one ultimate source, a new direction was taken by Pythagoras. Pythagoras had studied arithmetic as a subject independent of commerce and had noted that the chief musical intervals are expressible in simple numerical ratios between the first four integers. On this basis Pythagoras rejected the attempt to explain things in terms of their physis and focussed instead upon their numerical form. He used the example of the numerical order of musical harmonies as an analogy for the whole universe. Since the musical scale depends simply upon the simple imposition of definite proportions on the indefinite continuum of sound between high and low. Pythagoras concluded that there is a basic dualism between Limit, expressible as a number and the Unlimited, and that consequently, all things are number. The Unlimited or the Boundless was thought to exist outside the heavens, and through inhaling this "boundless breath" the world was seen to be able to keep the arithmetical units seperate from each other. (2)

(1) Cited by Theophrastos in John Burnet EARLY GREEK PHILOSOPHY 4th ed. (1930) Adam and Charles Black, London, 1975, p.73.
(2) John Burnet EARLY GREEK PHILOSOPHY (1930) op. cit. p.108.

The analogy also served as the basis for a new understanding of the traditional opposites, since if an attunement between high and low can be obtained by observing the ratios, then this could also be the case with other opposites. This idea was so influential that John Burnet declared: "It is not too much to say that Greek philosophy was henceforth to be dominated by the notion of the perfectly tuned string." (1)

Following Pythagoras, the next important philosopher was Heraclitus. However the thought of Heraclitus was more influential through opposition which it created than in a positive way, and since Heraclitus is the father of process philosophy his thought will be dealt with later in this context. Parmenides on the other hand exerted a tremendous influence on Greek thought. He brought into sharp focus the problems confronted by the attempt to develop a consistent ontology by thinking through the basic assumptions of his predecessors to their logical conclusion.

Parmenides argued that only that which is can be thought, while that which is not, cannot, and then worked out the implications of this. He concluded:

> One path is left for us to speak of, namely that It is. In this path are very many tokens that what is is uncreated and indestructible; for it is complete, immovable, and without end. Nor was it ever, nor will it be; for now it is, all at once, a continuous one. For what kind of origin will thou look for? In what way and from what source could it have drawn its increase?...
>
> Nor is it divisible, since it is all alike, and there is no more of it in one place than in another, to hinder it from holding together, nor less of it, but everything is full of what is. Wherefore it is wholly continuous; for what is, is in contact with what is.
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> ...Wherefore it is not permitted to what is to be infinite; for it is in need of nothing; while, if it were infinite, it would stand in need of everything.

(1) ibid. p.112.

> The thing that can be thought and that for the sake of which the thought exists is the same; for you cannot find thought without something that is, as to which it is uttered. And there is not, and never shall be, anything besides what is, since fate has chained it so as to be whole and immovable. Wherefore all these things are but names which mortals have given believing them to be true - coming into being and passing away, being and not being, change of place and alteration of bright colour.
>
> Since, then, it has a furthest limit, it is complete on every side, like the mass of a rounded sphere, equally poised from the centre in every direction; for it cannot be greater or smaller in one place than in another. For there is no nothing that could keep it from reaching out equally, nor can aught that is be more here and less there than what is , since it is all inviolable. For the point from which it is equal in every direction tends equally to the limits. (1)

The most important point made by Parmenides in his short work was that if the universe is assumed to be a unitary whole, then there is no way in which diversity could be understood. This has since been known as the problem of the one and the many. Closely related to this he had pointed out the difficulty in conceiving of that which is as changing, setting up the opposition between being and becoming. Also by arguing that only that which is can be thought and arguing the impossibility of thinking about that which is becoming, Parmenides has raised the problem of the relationship between appearance and the real world. And by arguing that that which is, is finite he had both shown the problem involved in conceiving the universe as infinite and presented the problem of accounting for how it could be regarded as finite. If as Collingwood has argued: "The history of science, in so far as it is a history of scientific progress, consists not so much in the progressive accumulation of facts as in the progressive clarification of problems." (2) then this short work of Parmenides must be regarded as one of the greatest advances in the history of thought. All later Greek thinkers were challenged to overcome the problems indicated by Parmenides, and the new directions taken by these thinkers were inspired by this challenge

(1) Parmenides "The Way of Truth" in Burnet (1930) op. cit. p.174-176.
(2) Collingwood (1945) op. cit. p.42.

Some philosophers accepted Parmenides' position completely, and some rejected his arguments in toto as did the followers of Heraclitus. Others rejected some of Parmenides' arguments while accepting the rest, or attempted to transcend the assumptions on which Parmenides position was based. The atomists accepted most of Parmenides arguments, but in opposition to Parmenides allowed that 'nothing' or the void is real, and in this way attempted to account for the appearance of change. Most philosophers took the path of rejecting the assumption that all things are one, being led in this by Empedocles and Anaxagoras, while Plato rejected the assumption that that which is, is corporeal, to arrive at this conception of transcendent forms. However apart from Heraclitus all these philosophers were permeated by the ideas of Parmenides.

Empedocles accepted Parmenides basic arguments, but believed that there could be movement within a plenum. While this would make no difference if the plenum were composed of one matter only, it would make a great deal of difference if it were composed of a number of different types of matter which could be concentrated and arranged differently. He then proposed that fire, air, water and earth, identified with the opposites hot and cold, wet and dry,were the eternal, immutable 'roots' or elements of the world. But Empedocles now had the problem of explaining how motion within the plenum could occur and so argued that there were two additional elements: Strife or Hate which tended to separate the elements from each other, and Love which brought about an attraction between elements. As well as being efficient causes, Strife and Love were also thought to be extended and corporeal. On the analogy of the world as a breathing organism, Empedocles thought of the sphere of the universe as being originally in a state of harmony with the four elements and Love being mixed together. But this was seen as being surrounded and encompassed on every side by Strife which enters into the sphere, driving out Love and causing the elements to separate. The reverse process then takesplace, producing a cosmic systole and diastole. Empedocles described how the features of the world emerged during this process of differentiation brought about by Strife's conflict with Love. He argued that the four elements combined in different proportions gave rise to such things as bones and flesh, and then went on to give an account of the emergence of life, beginning with plants, and its evolution by natural selection through the survival of the fittest. While much of Empedocles cosmology was simply an elaboration of the Ionian philosophers, he added two new dimensions. He accepted Parmenides argument that body would not move itself, and so drew a distinction between that out of which things are composed and the forces which move them. And secondly he attempted to account for things in the world as emergent phenomena produced by a combination of a small number of unchanging elements.

Anaxagoras also accepted the basic arguments of Parmenides and then accepted Empedocles idea that the appearance of coming into being and of passing away can be understood as mixture and separation. But Anaxagoras rejected Empedocles idea that such qualities as dry and wet, hot and cold are separate things, arguing instead that there is a portion of all opposites in everything, and however much each thing is divided, each part will contain an equal number of portions. Thus what is hot is to a certain extent cold and what is white is to a certain extent black. Though the world is conceived to be infinitely divisible, Anaxagoras referred to the constituents of an entity as its 'seeds'. Change was thought to be possible because while each thing contains a portion of everything else, these are in different proportions. Things appear to be that of which there is most in them. Thus air is that in which there is most cold, fire in which there is most heat and so on. While formation of the cosmos occurs through separation as in Empedocles, this is a separation of those ideas in which a portion of some quality prevails.

Anaxagoras also maintained the division between that which is moved and the force which moves it, but replaced the opposites: Strife and Love, by Mind or Nous. Nous is unmixed and does not contain a portion of everything else and like the Strife and Love of Empedocles, was thought to be corporeal and extended in space. It was regarded as having power over all those things which have life and as that which sets them in motion. However not all things contain Nous, so there must be a distinction between the animate and the inanimate world. Since the Nous in all living creatures is the same, it follows that different levels of intelligence must be accounted for in terms of the different bodily structures of organisms allowing for different degrees of control by Nous.

In the atomism of Leucippus and Democritus the pluralism of Empedocles was accepted without the recourse to an external force moving things. Instead these thinkers rejected Parmenides arguments against the existence of the void and postulated that there are an infinite number of atoms of different shapes and sizes separated from each other and moving within the void. Each atom was understood to be an impenetrable and imperishable Parmenidian plenum while at the same time being a Pythagorean form with mathematical properties such as size and shape. This involved a division of qualities of things into those which are measurable and therefore real and those such as colour and taste which are mere appearances. Since all atoms are of the same substance, all differences in things must be accounted for by the shape and arrangement of atoms, while change must be accounted for in terms of the motion of, collisions between and the intertwining of atoms. In this scheme of things there is neither an intrinsic cause of motion nor an extrinsic force moving things. The atoms have always been in motion in the void and this motion is passed on from one to another by collision. Motion as such is thus extrinsic to the atoms which are themselves inert. Such a world is completely determined by the motions and interactions between these inert atoms. As Leucippus wrote: "Naught happens for nothing, but everything from a ground and of necessity." (1)

The most obvious difficulties with this conception of being is the affirmation of the existence of the void and the treatment of nothing as though it were something. Thus the void which is nothing is seen to be extended. But more importantly atomism reveals most clearly those problems associated with a pluralistic conception of being. If the atoms are each conceived to be self-subsistent beings or substances then how can interaction between them be intelligible? In what sense can a self-subsistent being be said to be in motion except in relation to the void which is nothing, or in relation to other self-subsistent beings which are by definition totally unrelated? This problem was only fully confronted by Leibniz whose pluralism involved no interaction between substances.

Plato, as a follower of Socrates, represents a reaction to the tendency to explain everything mechanistically. In its place he argued for the importance of intelligence or Nous developing the suggestion of Anaxagoras. Thus Plato has Socrates saying:

> I once heard a man reading a book, as he said, of Anaxagoras, and saying it was Mind that ordered the world and was the cause of all things... I was delighted to hear of this cause and I thought he really was right...But my extravagant expectations were all dashed to the ground when I went on and found that the man made no use of Mind at all. He ascribed no casual power whatever to it in the ordering of things, but to airs, and aethers, and waters, and a host of other strange things. (2)

(1) Cited by John Burnet (1930) op.cit. p.340.
(2) Plato PHAEDO 97 b 8, cited by Burnet op.cit. p.267.

But Plato was also influenced by the Heraclitean Cratylus who had concluded that since the world was in a state of flux, nothing could be said at all, and by the arguments of Parmenides and his followers. To overcome these problems and to give a place to mind and reason in the world, Plato developed a version of Pythagorean philosophy. On the analogy of the relationship between mathematics and the perceptible world, Plato assumed that there were other non-mathematical forms and that these structured the perceptible world. But while the Pythagoreans thought of the mathematical forms as corporeal, Plato considered the relationship between an artisan's product such as a bowl and the idea on which this was modelled, and used this as an analogy to think of the forms as transcending the perceptible world. These then served as the true world as described by Parmenides: unchanging, eternal and perfectly rational. But rather than seeing the perceptible world and our beliefs about it as totally illusory as Parmenides had done, or as an unarticulatable flux as Cratylus had done, he saw things in the perceptible world as partly comprehensible through having been fashioned in the likeness of forms. In other words, the corporeal world of extended space which we perceive has form through its being fashioned in imitation of the eternal forms.

Within the world, intermediate between the eternal forms and the perceptible world are souls (psyche) which are capable of apprehending the forms and then governing things in accordance with reason (Nous). This is based on the analogy of the way our own souls are able to govern our bodies to imitate intelligible forms such as beauty and the Good. The most important of these is the world soul which governs the world, itself conceived of as an organism. The soul is the source of movement of this, and this accounts for the orderly nature of motion, especially in the heavens. These souls are fashioned by the Demiurge.

Conceiving of the forms as eternal Plato had a problem with the concept of time. The spatial receptacle pre-existed the formation of the world so there was no problem with space, but time could only have come into being with the creation of the world. But the world could only be fashioned on the model of the forms which were eternal. To overcome this problem Plato conceived of the world as "a moving likeness of eternity." (1) What this means is that while beings in the intelligible realm of forms exist atemporally all at once as a triangle has three sides eternally, beings in the world are such as to require a lapse of time to realize all their properties. Thus a star is not a circle all at once but requiries time to trace out a circle, and an animal is not young and mature at the same time but must first be one and then the other.

The problem with the idea of transcendent forms is that as transcendent, it is difficult to account for the relationship between the forms and the material world. As a consequence of this Plato retreated to a conception of forms as both transcendent and immanent and Aristotle returned to a conception of forms as immanent in the world, understanding this relationship on the analogy of the growth of organisms to realise their adult form. But whether forms were regarded as transcendent or immanent this conception of being involved an ontological dualism between any particular form and its particular embodiments, and this must lead to the problem of the meaning of being in the different realms. This problem surfaced in the Middle Ages in the debate between the nominalists and the realists. Another problem involving what to include in the realm of forms, for instance whether to include relations, relations between relations and so on ad infinitum, whether to include such trivial forms as hair, mud and excreta, and whether to include such hypothetical entities as unicorns. Finally

(1) Plato TIMAEUS tr. John Warrington, Dent ,London 1965, 37 p.30.

formism leaves the problem of why the forms actualized in the world have been so actualized rather than others and why any particular form is actualized at one place and time rather than at another.

THE RISE OF MATERIALISM AND ITS PROBLEMS

The replacement of the formist conception of being by materialism was described in Chapter 1. However in this section my concern will not be with the history of this development as such but with the way in which the development of materialism was a struggle to overcome the problems in developing a coherent conception of being. Through a study of this struggle I will then be able to evaluate the success of these efforts and reveal the weaknesses in the materialist position which justify the attempts to develop alternative conceptions of being.

While Greek thought was dominated by the analogy of an intelligent organism the materialism which developed in the seventeenth century was dominated by the analogy of a mechanism. However while the analogy of mechanism played an essential part in the development of materialism, it was the revival of Pythagoreanism and associated with this a return to various forms of atomism which paved the way for this development. This Pythagorean revival was undertaken in an effort to transcend the problems of Aristotelian formism. But it was not simply a return to old ideas but involved new formulations of Pythagorean atomism in an effort to overcome the criticisms originally levelled against it. In other words the intellectual revolution which resulted in the replacement of Aristotelian formism by materialism was a continuation of the intellectual efforts to develop a coherent conception of being which began with the Greeks.

The beginning of this intellectual revolution was Cusanus' development of a conception of the world as an indeterminate mathematical structure and Bruno's development of this position. (1)

(1) Ivor Leclerc in THE NATURE OF PHYSICAL EXISTENCE, George Allen & Unwin, London, 1972 Part III has traced the development of ontological ideas leading to Newton's conception of the universe.

Bruno argued that the universe is infinite and that entities are composed of indivisible atoms. Other thinkers took over this atomism but began to think of matter as inert and characterized only by motion. These ideas gave rise to a number of problems, notably those concerning the relationship between mathematics, matter and place. Where mathematics was identified with the universe it became impossible to account for the discreteness and indivisibility of matter. Where matter was conceived solely in terms of motion it was necessary to have some concept of place to which and from which a body could be said to move and any attempt to account for this came up against Aristotle's argument against the existence of the void, namely, that what does not exist cannot be extended.

One of the most important developments in the concept of place was that made by Scaliger and Telesio. (1) Aristotle had conceived of place as the interior bounding surface of a body and the void as that between the surfaces of bodies. Scaliger suggested that the extent in which a body is, is something distinct from the extent of the body, namely the extent of the void. While Telesio rejected Scaliger's identification of void with place, he accepted and emphasised Scaliger's point that the extent of place is distinct from the body itself and that therefore there must be places without body in them.

Bruno accepted this new conception of place, but recognized that it still did not answer Aristotle's argument that a void cannot be extended. (2) He overcame this problem by conceiving of the universe as infinitely extended non-corporeal and active matter which is contracted to form body. But it does not follow from this that universal matter

(1) ibid. p. 157f.
(2) ibid. p. 159f.

is everywhere contracted to body, and where it is not so contracted there exist vacant extents of matter or the universe itself. To avoid the connotations of the concept of matter, Bruno then referred to extent purely as such as 'spatium'.

However Bruno was less successful in solving the problems associated with the identification of the physical and the mathematical. (1) Bruno accepted the position that observed entities are composite and therefore that there must be atoms from which they are composed. But if the mathematical is identified with the physical then its extension must be infinitely divisible. Aristotle had avoided this problem by maintaining that the continuum pertains only to potentiality and not to actuality, but this way out was not available where atoms were conceived of as devoid of such potentiality. So to overcome the problem Bruno attempted to develop a concept of the continuum as composed of 'minimums' conceived to be more than simply points. He then attempted to develop a geometrical theory on such an atomic basis, but in this Bruno was not successful and if he had been he would have contradicted his conception of the universe as an undivided continuum.

Galileo, who also accepted the identification of the mathematical and the physical, was no more successful at resolving the problem of the continuum than Bruno. (2) Galileo rejected Bruno's concept of matter and accepted the seventeenth century notion of it as not only an independent existent or substance as in Bruno, but also as the physical existent.

The fundamental feature of this matter was for Galileo its mathematical structure and consequently its fundemental attribute, its geometrical extension. The atoms were then conceived of as infinitely small, that is,

(1) ibid. p.169ff.
(2) ibid. p.177ff.

as geometrical points. Since points have no dimensions, this overcame the problem of the interstices which could now be regarded as being filled without remainder, and accounted for locomotion since such matter would be completely fluid. However this left the physical without any content over and above the mathematical, and since it is impossible for atoms without size to have any bulk, even mass became inconceivable. This left the problem of the nature of body.

To overcome these problems, Gassendi suggested that a clear and definite separation must be made between the physical and the mathematical and then attempted to maintain a theory of corporeal atomism. (1) For him atoms had solid bulk as in the tradition of Epicurus rather than as in the Pythagorean conception of them. Geometry on the other hand was conceived of as a speculative science having its truths in itself and was not seen to imply anything about the real world. However this left Gassendi with a number of problems which he was not able to overcome. First,he still had not answered Aristotle's argument against the void. And having separated the mathematical from the physical, Gassendi was left with the problem of accounting for there being any relationship between them at allIn fact Gassendi was not consistent on this point since he defined atoms as extended, which implies that they are ipso facto geometrical. Since they were conceived of geometrically, there could be no grounds for denying their infinite divisibility. Finally, since the void was also conceived of as geometrically extensive, Bruno was faced with the problem of the ontological status of this extensiveness.

In the face of these difficulties, Descartes concluded that the tradition of Cusanus in which the physical and the mathematical were identified, was correct. (2)

(1) ibid. p.181ff.
(2) ibid. p.186ff.

To overcome the problems faced by Galileo in developing an adequate conception of body on this basis, Descartes concluded that a separation must be made between the physical and the corporeal. This meant that the physical was seen as mathematical rather than as corporeal, and corporeal matter was no longer conceived of as the fundamental physical existent. This physical existent, the _res extensa_ was then understood as being indeterminate and infinitely divisible. Bodies were seen to be ontologically derived from the _res extensa_ and through this were seen to derive their mathematical character. However Descartes had fully adopted the mechanistic conception of the world with its implication that matter is devoid of any inherent principle of agency. That which was capable of acting as an agent, the _res cogitans_ was held by Descartes to have an independent ontological status. Without the conception of ensouled matter, the derivation of corporeality could not be seen as the contraction of matter as it had been in the philosophy of Bruno. Rather Descartes could account for body only in terms of the differential motion of the _res extensa_ effected through the agency of God. However since physical and mathematical extension neither entails nor requires motion, there can be no principle to account for bodies being distinct and distinguishable from each other, and the required motion is arbitrarily introduced and explained by a _deus ex machina._ Another problem arose from Descartes' rejection of the notion that place has a status independent of body. This left the problem of defining space other than that which is occupied since with the universe being indeterminate the only reference points to define the place to which a body is moving are other bodies. But these were conceived by Descartes to be always in motion, which meant that he was left with a complete relativity in the notion of place, and consequently of motion. The consequent imprecision in the concept of motion is extremely important in Descartes' philosophy since the distinction between bodies was defined through their motion. Finally Descartes philosophy was unsatisfactory from the point of view of the rapidly developing science of the motion of bodies. For Descartes, pure mathematics was seen to be the primary science and the science of motion could only be regarded as derivative, and furthermore, Descartes had no way of accounting for the hardness and impenetrability of bodies required to explain collisions.

Henry More attempted to overcome the problems in Descartes' philosophy by accepting that matter is corporeal, but then arguing that it is not only matter which is extended. (1) In Bruno's doctrine, the extensiveness of the universe was seen as an attribute of ensouled matter. More accepted Descartes' division between matter devoid of internal change and soul as the active principle, but then attributed corporeality to matter and infinite extensiveness to the world soul, the _spiritus mundi_. As one, unitary, infinite, and immovable, and as the principle of activity within all matter, this _spiritus mundi_ or _spiritus naturae_ was conceived to be extended everywhere, penetrating matter completely. In this way More was able to provide an ontological foundation for unoccupied place: the extended _spiritus mundi_ could serve as an absolute reference point for motion as change of place distinct from and not dependent upon matter or body. It also provided an immanent conception of God to account for the external motion of matter without having to have recourse to a _deus ex machina_. With the separate characterization of matter as hard, solid and impenetrable, and soul as extended this provided a perfect framework for the new physics involving the mathematical analysis of the motion of bodies. It was on this basis that More's ideas were appropriated by Newton.

More had taken over the correlation of matter with the extension of matter from Descartes without facing up to the problems this presented.

(1) ibid. p.199ff.

Newton's advance over More consisted of adding to the characteristics which More had ascribed to the spiritus naturae the mathematical ones, and by then explaining the mathematical properties of matter as deriving from its occupation of the particular places constituted by the continuous activity of the infinitely extended mathematical entity, God, rather than being intrinsic to it. (1) Because the mathematical character of the bodies of matter were concieved to be derivative, their infinite divisibility was no longer entailed. With these modifications, More's philosophy provided the ontological foundations of Newton's physics. The conception of space as an independent mathematical existent provided the foundation for measurement requisite for a mathematical physics concerned with the analysis of the motion of bodies. By regarding the infinitely extended as spiritual, Newton was able to identify the infinitude of space and mathematics where Descartes had the problem of a conflict between the mathematics of space implying infinite extension and matter implying definite size. With the spiritus naturae as an active principle, Newton was also able to provide some explanation for there being motion in the first place, for gravitational attraction and for the attractive and repulsive forces operative in the "Relexions and Inflexions of the Rays of Light", (2) for the particles of bodies sticking together, and for the continuation of motion in the universe after collisions between inelastic particles.

Such a dualism between inert matter and the active principle left the problem of accounting for how the active principle interacted with the matter. And Newton still had not provided a solution to the problem of the relationship between mind and body. But even with

(1) Newton gave a sketchy account of his ontology in the General Scholium in the PRINCIPIA, but was generally reticent in expounding his ideas on this subject. The version of his ideas presented here derives from Leclerc's reconstruction on the basis of Newton's intellectual milieu and the writings of his followers at Cambridge. This position is argued for ibid. Chapter 18.
(2) Isaac Newton OPTICK'S. op.cit. p.395

these problems, Newton's natural philosophy as it has been reconstructed was more satisfactory than the ontology which later came to be accepted.

The conception of nature which has dominated down to the present was a post-Newtonian development, being a conflation of Newton's ideas with those of a number of other thinkers. Such a development away from Newton's natural philosophy was facilitated by the Definitions given by Newton in the Scholium which introduced his PHILOSOPHIAE NATURALIS PRINCIPIA MATHEMATICA. These were abstractions from his philosophical position. In this conception of nature, Newton's concept of space was fused with Descartes' concept of 'res extensa' to form a conception of space as a self-subsistent entity. Time also came to be thought of in this way, while the notion of matter was revised. Defined as solid, impenetrable and capable only of motion, matter could not be thought of as elastic and so colliding bodies would not rebound from one another. Huygens overcame this problem by ascribing an independent ontological status to motion which he conceived of as always being conserved, this being expressed in physics as the law of the conservation of momentum. Newton explained motion in terms of God's activity, while Leibniz argued that the active principle must be found in matter itself. Both Huygen's ascription of an independent status to motion and Leibniz's conception of matter as having a power or force within it came to be accepted, though Leibniz's philosophy generally was rejected, and the agency of matter was not seen as a spiritual activity as in Leibniz. The new concept of matter was an arbitrary combination of the Newtonian and Leibnizian conceptions, being one of extended bodies having the additional properties of an ability to repel other bodies on collision and the ability to attract bodies at a distance. This conception of nature completely excluded soul and mind from the world, and complexity was thought to be capable of being entirely understood in terms of the laws governing the parts.

Apart from the problems of accounting for life and mind, this conception of being involved the acceptance of four distinct self-subsistent substances: space, time, matter and motion. This made it impossible to provide an account of the relationship between them. And with the conception of matter as extended bodies the ascription to it of force could only be regarded as incoherent and inexplicable.

In this section I will consider the work of two of the most important opponents of materialism, Leibniz and Hegel. By indicating both the achievements and problems in the conceptions of being developed by these philosophers I will try to show the requirements for a successful challenge to the materialist world-view.

Leibniz came to the conclusion that "The source of our difficulties with the composition of the continuum comes from the fact that we think of matter and space as substances." (1) and then attempted to develop a conception of being in which extension, matter and body could be seen to be deriviative. In opposition to the conception of inert matter located in space and time as the self-subsistent being in terms of which all else had to be understood, Leibniz argued that: "We cannot dispense with this active principle or ground of activity, for accidental or changing active forces and their motions are themselves certain modificiations of some substantial thing, but forces and actions cannot be modificiations of a merely passive thing such as matter." (2) The conclusion to be drawn from all this is that "If nothing is active in its own nature, there will be nothing active at all..." (3) Therefore primary being or that which is self-subsistent must be inherently active.

Leibniz referred to that which is a primary being as a monad. Since he accepted the argument that since there are composite bodies, there must be elements from which they are composed, Leibniz postulated the existence of a plurality of these monads. Each monad was thought to be continuously active with the law or pattern of all its future changes inherent in it from the beginning. The active tendency to pass through a series of

(1) Gottfried Wilhelm Leibniz PHILOSOPHICAL PAPERS AND LETTERS tr. ed. Leroy E. Loemker, 2nd ed. D. Reidel, Dordrecht, 1976, p.531.
(2) ibid. p.517.
(3) ibid. p.p.534.

immanent changes Leibniz referred to as force. Of force, Leibniz wrote that it: "contains a certain act or entelechy and is thus midway between the faculty of acting and the act itself and involves a conatus. It is thus carried into action by itself and needs no help but only the removal of an impediment." (1) Leibniz held that this conception of force was equivalent to the Aristotelian conception of substantial forms.

These monads were understood on the analogy of mind, that is, as non-extensive res cogitans. (2) As Leibniz wrote "I found that their nature consists of force and that there follows from this something analogous to sense and appetite, so that we must think of them in terms similar to the concept which we have of souls." (3) Originally Leibniz had thought of these as points, but realising that the notion of a point is drivative from extension, he rejected this characterization. The monads were thought to be of different grades characterized by the definiteness of their perception, from bare monads with unconscious perception and blind appetition to God who clearly perceives everything. Since each monad was thought to be different, they had to be differentiated from each other implying that within the unity of each simple substance there is a manifoldness constituting its specific nature, and this condition Leibniz referred to as Perception, with the internal principle bringing out a change from one perception to another being referred to as Appetition. Such perception was thought to be inexplicable in terms of mechanical causes. Since each monad is a self-subsistent substance, there can be no causal realtionships between them. Only through the mediation of God who created the universe of monads to harmonize with each other are passive or lower types of monads adapted to the active monads. Yet despite this lack of causal relationship, each of the infinite number of monads was thought to mirror the

(1) ibid. p.433.
(2) This is most clearly evident in "The Monadology" in ibid. pp643-652.
(3) ibid. p.454.

whole universe, though with different degrees of clarity, each from a different perspective. Through the intercommunication, each monad had to be seen as responding to all that has happened, is happening and will happen in the universe. (1) Thus each monad expresses the whole universe.

Having rejected extension as an attribute of primary being, it was necessary for Leibniz to show how extensive properties arose. Since it could not pertain to a single entity or substance, it had to be conceived of as a relation between substances. The same was true of time. Thus Leibniz wrote: "For space is nothing but the order of existence of things possible at the same time, while time is the order of existence of things possible successively." (2) In other words, space and time were seen in the terms of the potential relationships between monads. By conceiving them in this way it was possible to understand them as continuous while maintaining that actual things are discrete. As Leibniz put it: "in actual bodies there is only a discrete quantity, that is, a multitude of monads or simple substances...But a continuous quantity is something ideal which pertains to possibles and to actualities only in so far as they are possible. A continuum, that is, involves indeterminate parts, while on the other hand, there is nothing indefinite in actual things, in which every division is made that can be made." (3)

A body must be understood as an aggregate of substances acting in accordance with each other through a pre-established harmony. The force pertaining to bodies must be seen as deriving from the primary forces of the monads. Motion then is a consequence of this derivative force

(1) ibid. p.649.
(2) ibid. p.536.
(3) ibid. p.539.

since action on the part of the monads changes the situation of the monads, and consequently of bodies, relative to each other. As such motion is a relative concept and can only pertain to a number of entities relative to each other. But apart from a primitive active force, Leibniz also postulated a "primitive force of suffering or of resisting"(1) which manifests itself as impenetrability or antitypy. It is by virtue of this "that one body is not penetrated by another but opposes an obstacle to it and is at the same time possessed of a kind of laziness, so to speak, or a repugnance to motion, and so does not allow itself to be set in motion without somewhat breaking the force of the body acting upon it." (2) The concept of mass involes extension since it only pertains to a body or plurality, and antitypy and inertia in that mass is the quantititative measure of inertia which is constituted by antitypy. Thus all the characteristics that we ascribe to matter or body such as impenetrability, extension, and inertia along with motion are seen to be constituted by the activity of a plurality of monads.

Leibniz also developed a theory of organisms on the basis of this ontology. An organism was said to be a natural machine having an infinite number of organs with every part of itself being a machine. Each natural machine is dominated by one monad which being in pre-established harmony with the rest of the monads making up the machine can "act in accordance with the laws of final causes through their desires, ends and means." (3) while its body acts "in accordance with the laws of efficient causes or motion". (4) Furthermore, every monad in the organism of a given ruling monad must itself rule an organism of subordinate monads, and so on without end. Thus Leibniz wrote:

(1)ibid. p.437.
(2)loc. cit.
(3) ibid. p.65?.
(4) loc. cit.

> Each part of matter can be thought of as a garden full of plants or as a pond full of fish. But each branch of a plant, each member of the animal, each drop of its humours, is also such a garden or such a pond...Thus there is nothing fallow, sterile or dead in the universe; no chaos, no confusions, save in appearance. (1)

However there is another aspect to Leibniz's philosophy which has not yet been drawn out. This follows from his pan-psychism and conception of monads as without relation to each other. On this basis the meaning of the concepts described above changes significantly. For instance the concept of force cannot be understood in its usual way when it is taken to be simply that which leads from one perceptual state to another. And not only are secondary qualities such as colour and taste merely appearances, but so also are all the primary qualities. While Leibniz argues for a relational theory of space and time, in fact he is ultimately committed to the position that space and time are mere appearances. As C.D. Broad wrote:

> "If there can be no relations there can be no spatial relations; and, if all position is relative, it cannot be literally true that one monad had a position relatively to another...the real basis of the phenomenon of spatial position is certain pure qualities in the substance which appear to stand in spatial relations to each other. It now appears that the pure qualities are the points of view of the monads in those groups which are misperceived as extended and spatially interrelated bodies." (2)

Similarly motion as the change of spatial relations between bodies must be only phenomena founded on changes of quality in the monads of the groups which are misperceived as those bodies. This outlook which is very similar to the philosophy of Berkeley, though arrived at through ontological rather than epistemological considerations has not been found to be plausible by other thinkers.

This is not to say that Leibniz has had no influence. Most of the opponents of materialism have derived inspiration either directly or indirectly from Leibniz's thought. But almost universally the

(1) ibid. p.650.
(2) C.D.Broad LEIBNIZ: AN INTRODUCTION ed. C. Lewy, Cambridge Uni. Press, Cambridge, 1975, p.103f.

conception of being as a plurality of substances having no causal relationships, but acting in accordance with each other through a pre-established harmony has been rejected. Thus Kant in his pre-critical writings accepted Leibniz's contention that being must be inherently active, but rejected the idea that force could be understood as 'perceiving' and argued that acting must be more than inward change; it must be outward directed, an acting on another. He also accepted that space must be thought of as relative, but argued that:

> there would be no space and no extension if substances did not have the power to act beyond themselves. For without this power there is no connection or relation, without this no order, and without this finally no space. (1)

and "without external connection, situations and relations there is no place." (2) And he accepted Leibniz's doctrine that a monad could not be thought of as extended, but then did not draw the conclusion from this that a monad has no assignable place. Instead he argued that:

> The monad determines the little space of its present not through a plurality of its substantial parts, but through a sphere of activity by which it keeps at a distance those external and present on both sides of itself and from a closer approach. (3)

Correlating with this repulsive force to define the limits of each monad's sphere of activity Kant postulated an attractive force, since; "through the power of impenetrability alone a body would not enjoy a definite volume , if there were not in addition an inherent equal attraction, both together defining the limits of extension." (4) By defining elementary substances in terms of their activity in this way Kant along with Boscovich laid the foundations of dynamism which, as developed by Faraday, Maxwell and Einstein into field theory has strongly challenged materialism in physics.

(1) Cited from I.Kant "Living Forces" s.9 by Leclerc op.cit. p.278.
(2) Cited from ibid. s.7 in Leclerc. p.278f.
(3) Cited from "Monadologia physica" Sec. 1 Scholium to Prop.IV ibid. p.281.
(4) Cited from ibid. Sec.II, Prop. X in ibid. p.292.

However while dynamism and field theory have not provided a foundation for overcoming the problem of the relationship between mental phenomena and the physical world, it was pointed out in the introduction that Leibniz's thought has had a tremendous influence on the way the human order has been understood. In the field of psychology the emphasis on the active role of consciousness in perception and thought as opposed to the mechanical model developed under the influence of empiricism can be seen to ultimately derive from the thought of Leibniz. Then the notion of entities as actively unfolding an inner essence, that is, as actualizing themselves, was taken over by Herder in his attempt to understand societies and civilizations, and through Herder, this way of conceiving of people, societies and humanity as a whole came to form the foundation of the Romantic movement in Germany. This conception of the human order has formed the basis of the major movements within the human sciences in opposition to positivistic reductionism up to the present. The philosopher who made the greatest effort to develop a complete conception of being to accommodate the idea of humans as self-actualizing was Hegel, and it is through Hegel that this view has had its greatest influence. I will therefore examine his system.

Hegel thought of the world as one monad, variously referred to as the Absolute, Spirit or God, which is in the process of actualizing itself to become fully conscious of itself. The analogy on which this monad was understood was that of the psychological development of a man to the stage where he attains a full understanding of himself, and integrates himself as a person in the process. The circumstances which had to be overcome by him in this process, and which had therefore appeared to be alien to his personality, are then seen by him to have been necessary for his full development. This analogy was developed by Hegel to give an overall view of the world.

As noted earlier it was Hegel who argued that if a philosophical system is to be developed without implicit assumptions, it must be developed in the form of a circle, and it was in this way that Hegel developed his ideas in the ENCYCLOPAEDIA. This consists of three parts: the Logic, the Philosophy of Nature and the Philosophy of Mind. Each one of these must be seen as part of the system, with each part being dependent upon the other.

The Logic is the science of the Idea in and for itself. The Idea is the true. But what Hegel means by true is that which is concrete, and by this he means that which is grasped in its full context with all its interrelations. It is the opposite of the abstract which is that which is drawn out of its context. This Idea is not simply in men's heads but is the structure or form of reality together with men's awareness of it. It is the union of the essential features of objective reality with the human world of thought. Thus the logic is an attempt to deduce the categories which cover the whole domain of the Absolute while retaining the character of universality. The totality of reality must be expressible from this point of view. Logic is the science of the pure universal principles by which the Absolute moves and lives in a uniformly coherent intelligible system. Such a system forms the network of notions which holds together and constitutes the essence of all there is. It is the ground-plan of the whole of reality. Thus logic "shows forth God as he is in his eternal essence before the creation of Nature and Finite Spirit." (1)

(1) HEGEL'S SCIENCE OF LOGIC tr. W.H. Johnston & L.G. Struthers. Vol.1, Allen & Unwin, London, 1929, p. 60.

Taking as his starting point 'Being' which can be taken on its own evidence only, but which when considered by itself is a mere abstraction, Hegel deduced the categories to deal with inert matter, life and mind. The philosopher is himself included in this scheme, and his putting this puzzle together is his construction of himself. The full development of the categories enables Being to be grasped in a concrete way in the Concept which is a universal, self-conscious and self-identical inner principle of the diverse totality of Being.

But the Logic is the Absolute in the abstract. While Hegel talks of the Logic as the Absolute in its essence before the creation of nature and finite spirit, this is not to be understood as though the categories of logic could exist independently of Nature and Spirit. 'Before' is not meant temporally. What is meant is that the categories while being immanent in Nature also transcend it and are thus in a sense outside it. The Logic demands the positing of Nature and presupposes Nature as its being. Nature is then the Absolute in its otherness, or the Absolute self-externalized.

The PHILOSOPHY OF NATURE then is the science of the Idea in its otherness. Since Nature is Spirit estranged from itself and thus unmindful of itself, the study of Nature is required to liberate the Spirit in Nature. Hegel says of Nature that: "implicitly she is Reason, but it is through Spirit that Reason as such first emerges from Nature into existence." (1)

(1) G.W.F. Hegel: HEGEL'S PHILOSOPHY OF NATURE, tr. A.V. Miller, Clarendon, Oxford, 1970, s 246 Zusatz, p. 13.

The realm of Nature is the realm of contingency, an endless array of particulars. But every part and element of Nature is an event, that is, a unitary focus of time and space. But Nature makes a whole by itself and the wholeness of Nature is once again the unity of the Absolute. This makes possible an intelligible system of Nature, the PHILOSOPHY OF NATURE.

Nature includes the inorganic and the organic. It is only in life that the beginnings of a counter to the externality of nature appear. The living being is a triumph over diversity, and this involves the beginnings of the emergence of subjectivity. Out of this emerges Spirit as the truth of Nature; the negation of Nature's negativity. However these developments in Nature are not to be thought of as an evolution in time. This is specifically rejected by Hegel who only allows that Spirit can develop in time. (1) Nature on the other hand "is the development of the Idea in Space." (2) Though Spirit emerges from Nature, as the goal of Nature it is logically prior to it. Nature is posited by Spirit as that against which it must work to attain full self-consciousness. Nature is required for there to be Spirit, which is presupposed by, and develops out of Nature in order to cognize the Logical Idea in Nature and thus raise Nature to its essence.

Spirit is treated in the PHILOSOPHY OF MIND which has been described in the following way:

(1) Ibid, Remark to s.249.
(2) G.W.F. Hegel REASON IN HISTORY (1837) tr. R.S. Hartman, Bobbs-Merrill, 1953, p. 87.

> Its subject is the moral as opposed to the physical aspect of reality: the inner and ideal as opposed to the merely external and real materials of it: the world of intelligence and humanity. It displays Man in the several stages of that process by which he expresses the full meaning of Nature, or discharges the burden of that task which is implicit in him from the first. It traces the steps of that growth by which what was no better than a fragment of nature - an intelligence located (as it seemed) in one piece of matter - comes to realize the truth of it and of himself ... Thus the philosophy of mind, beginning with man as a sentient organism, the focus on which the universe gets its first dim confused expression through mere feeling, shows how he "erects himself above himself" and realizes what ancient thinkers called his kindred with the divine. (1)

The PHILOSOPHY OF MIND is divided into three parts: Subjective Spirit, Objective Spirit and Absolute Spirit. With Spirit there is history: the history of the World Spirit becoming conscious of itself. Subjective Spirit struggles to overcome the vestiges of a natural heritage with its bonds of individualism. Objective Spirit battles to construct and maintain objective institutions: the family, civil society and the State. These then provide the ground upon which Spirit stands to get an unobstructed view of itself as Absolute Spirit through Art, Revealed Religion and Philosophy. That is, the development of a rational social order is the precondition for Hegel to be able to develop his philosophy - to be able to construct the LOGIC and to be aware that this has been the goal of history from the beginning. The rational society is the precondition for this development since it is in the rational society that the individual is truly free, and this is required to achieve this philosophical vision.

In this way a return is made to the starting point, but Hegel has not

(1) Quoted by Frederick G. Weiss ed. HEGEL: THE ESSENTIAL WRITINGS, Harper & Row, N.Y., 1974, p. 193f.

simply returned to the same point. The starting point was abstract Being. Having passed through the Logic, the Philosophy of Nature and the Philosophy of Mind the totality of being has been grasped by the most general and the most concrete act of thinking in which the philosopher has achieved a vision of the totality in all its diversity together with an understanding of his place within this totality.

Hegel's system represents one of the most thorough attempts to confront and resolve all those problems presented by the entire tradition of philosophy and theology from the Greeks to those of the present era including those problems deriving from the rise of the physical sciences and the problems of morality associated with living in the tumultuous era following the French revolution, in terms of one coherent perspective. He was particularly concerned with the problem of the relation between nature and the human realm and with developing an adequate conception of humanity. In relation to this he tried to resolve the Enlightenment ideal of autonomy of the self achieved through acting rationally which had been most fully developed by Roussean and Kant with the ideal of expressive unity in man aimed at by the German Romantics under the influence of Herder. To solve these problems Hegel's ontology begins with the assumption of a unity of Being and Becoming, of the One and the Many, of the identity of Subject and Object, of Thought and Being, and of the Real and the Rational. The problems within Hegel's system can all be seen to derive from the assumption of these identities.

The assumption of the unity of being and becoming and of the one and the many have resulted in an ambiguity in Hegel's treatment of time. In Hegel's system the world is regarded as a unified whole which maintains this unity through an endless multiplicity of individuals. It is neither a mere process, nor a static reality, but a process that is self-contained, and so as a whole at rest with itself. Thus Hegel writes:

> ...eternity is not before or after time, not before the creation of the world , nor when it perishes; rather is eternity the absolute present, the Now, without before and after. The world is created, is now being created, and has eternally been created; this presents itself in the form of the preservation of the world. Creating is the activity of the absolute Idea; the Idea of Nature, like the Idea as such, is eternal. (1)

and following from this: "Philosophy is timeless comprehension, of time too and of all things generally in their eternal mode." (2) This must be seen as an attempt to overcome the argument between Heraclitus and Parmenides and is of essentially the same form as that offered by Plato who conceived of Time as "a moving likeness of eternity." (3) However this way of thinking makes it difficult to understand development. As we have seen Hegel rejected evolution in Nature, but with the emergence of Humans there was thought to be a history in which Spirit was seen to be raising itself to truth by becoming self-conscious in philosophic thought. This achievement was thought to involve the thinking out of the categories of Logic. These categories were supposed to be timeless. But the categories must also note the categories involved in the process of the Spirit's development. Thus there is an opposition between the progressive categories and the ideal categories. This contradiction is reflected in the way philosophy is understood in relation to history. On the one hand history can be thought to have come to an end with Hegel in the

(1) HEGEL'S PHILOSOPHY OF NATURE, (1970), op. cit. Zusatz p. 15.
(2) Ibid., s247 Zusatz p. 16.
(3) Plato TIMAEUS tr. John Warrington, Dent, London, 1965, 37d. p.30

sense that its aim has been achieved and philosophers are now able to contemplate the eternal truth, or history can be thought to be still in the process of becoming. The first viewpoint was adopted by the conservative Old Hegelians, but changes in the world have rendered this interpretation implausible. The second was adopted by the Young Hegelians whose ideas are still alive in the works of some modern Marxists. However this makes problematic the status of Hegel's logic which was a central feature of the system and which was claimed to be deductive and therefore complete.

A closely associated problem arises in relation to how the individual is to be understood in relation to the Absolute. Hegel believed that by achieving a vision of the spiritual reality underlying the world in the form of a cosmic subject, and by relating oneself to the rational development of this subject, one could attain both expressive unity by seeing oneself as part of the whole, and rational autonomy by understanding the rationality of this subject. For Hegel the forms of life of a given historical community are constituted by the principles which structure human interaction. The society presents the developing individual with a system of social practices and _if_ the system is rational, then the individual accepting these restraints actualizes his rational potential and becomes fully self-determining. Thus "Man is an end in himself only by virtue of the divine in him - that which we designated at the outset as _Reason_, or, insofar as it has activity and power of self-determination, as _Freedom._" (1) The forms of life

(1) G.W.F. Hegel REASON IN HISTORY op. cit. p. 45.

develop through history, and Hegel's account of the forces whereby arbitrary choice is limited and rational freedom or right is actualized is at the same time his account of reason in history. To identify the historical forms of these objective restraints that humanity has made for itself is to locate reason in history. These objective restraints appear collectively as the body of 'right' in which human subjectivity appears as an object, that is as Objective Spirit. Historically these restraints represent the attempts of a nation or a people to realize their freedom as a system of reason, as a moral whole. The imperfections of such a system of right or reason is seen as the contradiction between the possibility of a life of freedom under universal law and the repressive forms of social relations. This is the negative force which leads forms of social relations to succeed one another, propelling human civilization forward to a final actualization of reason in the form of the rational state. The rational state is then the completely developed ethical or moral whole in which the antinomy of freedom and necessity are overcome.

In line with Hegel's assumption of the identity of the one and the many, the significance of the individual is continuously emphasized. Thus he wrote: "action is always individual; it is always I who act ... the universal must be actualised through the particular." (1) However the development of Objective Spirit as a manifestation of Absolute Spirit's struggle for self consciousness is necessary, and this necessity is only known when it has reached a level from which philosophers can become conscious that the aim of all history has been the Absolute's becoming conscious of itself. The historical actors who bring this about are not doing so deliberately but are 'used' by the Absolute. Thus Hegel writes:

(1) Ibid., p. 35.

> It is not the general Idea that involves itself in opposition and combat and exposes itself to danger; it remains in the background, untouched and uninjured. This may be called the cunning of Reason - that it sets the passions to work for itself, while that through which it develops itself pays the penalty and suffers the loss ... The particular in most cases is too trifling as compared with the universal; the individuals are sacrificed and abandoned. (1)

The World-Spirit grants to man all his particular passions and interests, but what comes about is the realization of the purpose of this Spirit, and this is something other than that aimed at by these men. Only at the end of history when the Absolute has attained consciousness of itself, and then only by the philosopher, is the rationality underlying people's behaviour understood.

How then is the individual to understand his place in the world? Hegel thought of the individual as being in a social context with an objective ethical order in which decisions about how to live and act are generally unproblematic to the individual. Thus he wrote:

> If men are to act, they must not only intend the good but must know whether this or that particualr course is good. What special course of action is good or not, right or wrong, is determined, for the ordinary circumstances of private life, by the laws and customs of a state. It is not too difficult to know them... The morality of the individual, then, consists in his fulfilling the duties of his social position. And it is an easy matter to know what these duties are; they are determined by this position. (2)

Hegel made a distinction between rectitude which is the simple conformity to the duties of one's situation and virtue which can transcend rectitude, but he thought of virtue as over-rated and generally only of

(1) Ibid., p. 43f.
(2) Ibid., p. 37.

significance when obligations conflict. (1) It is only in exceptional circumstances, where the ethical order has broken down and "become faithless to the will of better men [so] that will fails to find itself in the duties there recognized ..." (2) that the individual must try to find principles in the ideal world of the inner life involving a commitment to absolute universality, and Hegel thinks that such a conscience founded on formal subjectivity is "on the verge of slipping into evil...". (3) But Hegel provides no basis for judging the ethical order or for working out such an ideal morality and philosophy is regarded as of no use in such situations, being merely able to interpret the hidden rationality underlying any era "when actuality is already cut and dried after its process of formation has been completed." (4) The world historical individuals who advance society towards its goal "have no consciousness of the Idea as such." (5) So the individual is ultimately left in the lurch by philosophy and must see himself not as a being who by acting rationally can help to actualize the World-Spirit, but as driven by passions to fulfil a role that he is incapable of understanding. Philosophy then only serves to reassure the individual that despite the appearance of evil, we live in the best of all possible worlds. Thus we can see the justice in Kierkegaard's complaint that Hegel might have constructed palaces for ideas but he kept people in shacks outside. (6)

(1) HEGEL'S PHILOSOPHY OF RIGHT tr. T.M. Knox, Clarendon, Oxford, 1952, s150 p. 107f.
(2) Ibid., s138 add. p.92.
(3) Ibid., s.139 add. p.92.
(4) Ibid., Preface, p. 12f.
(5) G.W.F. Hegel REASON IN HISTORY op.cit. p.40.
(6) See Karel Kosik DIALECTICS OF THE CONCRETE, Reidel, Dordrecht, 1976, p. 104.

While these difficulties which arose for Hegel in his attempt to understand the human order in a way which would overcome such problems as the relation between what is and what ought to be, between freedom and necessity and between society and the individual, his social philosophy still represented a major advance over the thought of his predecessors and it is through Hegel that the ideas of the German Romantic movement achieved wide recognition. Even those thinkers who reacted against Hegel's ideas about humanity such as Kierkegaard and Marx did so only after appropriating Hegel's insights, and virtually every major social theorist involved in the reaction against the positivistic reductionist conception of humans has been in Hegel's debt. But Hegel's attempt to overcome the dualism between the human order and the realm of nature by assuming the identity of subject and object, thought and being has not only not been accepted, but was used to justify the separation of science from philosophy.

Hegel's philosophy of Nature was a development of the Romantic conceptions of the Naturphilosophen, particularly those of Schelling. This was anti-mechanistic and organismic with both the subject and the object of contemplation being seen as organic entities. For Schelling nature was an organic structure composed of polarities and contradictions, but unified into a harmonic whole. And the abstract analytic approach to the study of nature was rejected in favour of concrete, direct, intuitive approach emphasising wholeness in cognition. However Hegel understood Nature from the point of view of an idealist, as has already been pointed out, rejecting the idea of evolution in Nature and seeing Nature as the self-externalization of Spirit. On this basis Nature was seen as a system of 'Notions' which can be derived by pure thought.

In the development of the notions of Nature, Hegel considered mechanics, physics and organics. In his mechanics Hegel anticipated many of the conceptual developments of relativity theory. He argued for the inter-relationship between time and space, defining place as the Spatial Now, and defining matter as the real aspect of space and time. He rejected the dichotomy in Newton's physics between inertial motion and falling motion, and Newton's "notionless reflection" which "thinks of what it calls forces, as being implanted in matter, and therefore as originally external to it." so that "The very identity of time and space which hovers vaguely before this reflectional determination of force, and which constitutes the true essence of matter, is consequently posited as something alien and contingent to it, and as brought into it from without." (1) As S. Sambursky pointed out, these considerations of Hegel are " a remarkable foreshadowing of a development which eventually led to Einstein's general relativity." (2)

In his organics, Hegel greatly clarified our conception of living beings and what distinguishes them from inanimate processes. (3) He defined teleology in biology as self-maintenance, identified as purpose, of which the aim is the organism itself, and made the distinction between chemical processes which get lost in the environment and organism which maintains itself by adaptation to, and self-assertion against, its surroundings. He argued that

(1) HEGEL'S PHILOSOPHY OF NATURE tr. M.J.Petry, 3 volumes, Vol.1, George Allen & Unwin, London, 1970, S261, Remark, p.238.
(2) S.Sambursky "Hegel's Philosophy of Nature" in THE INTERACTION BETWEEN SCIENCE AND PHILOSOPHY ed. Y.Elkana, Humanities Press, Atlantic Highlands, N.J. 1974, pp.143-149, p.149.
(3) Errol E.Harris "Hegel and the Natural Sciences" in BEYOND EPISTEMOLOGY: NEW STUDIES IN THE PHILOSOPHY OF HEGEL, ed. Frederick G. Weiss, Martinus Nijhoff, The Hague, 1974, pp. 129-153, p.140.

structure and function only have intelligible meaning as moments of the living reality. Such ideas as these and the problems they confront are now being recognized as important by biologists involved in the debate between holists and reductionists.

However Hegel's commitment to the idea that there is an identity between thought and being, with Nature being posited by Spirit led him to believe that Nature has a logical structure. As a consequence of this he could assume that the results of the empirical sciences could be deduced on a purely logical basis. Thus in the Remark to s246 he wrote:

> Not only must philosophy be in agreement with our empirical knowledge of Nature, but the origin and formation of the Philosophy of Nature presupposes and is conditioned by empirical physics. However, the course of a science's origin and the preliminaries of its construction are one thing, while the science itself is another. In the latter, the former can no longer appear as the foundation of the science; here, the foundation must be the necessity of the Notion.
>
> It has already been mentioned that, in the progress of philosophical knowledge, we must not only give an account of the object as determined by its Notion, but we must also name the empirical appearance corresponding to it, and we must show that the appearance does, in fact, correspond to its Notion. However, this is not an appeal to experience in regard to the necessity of the content. (1)

This involves the rejection of the idea that science can advance indefinitely, and this led Hegel to adopt an extremely conservative or reactionary view towards science. This conservative orientation is manifest in the way in which he rejected the tendency of scientists to opt for completely new perspectives in the face of insurmountable difficulties in the old approaches, (2) ignored the achievements of

(1) HEGEL'S PHILOSOPHY OF NATURE op. cit. s246 Remark p. 6f.
(2) This is argued by Sambursky (1974) op.cit. esp. p. 154. See HEGEL'S LOGIC op.cit. s231, p.289.

Newton and argued for the superiority of Kepler's system, sarcastically dismissed the suggestion that there are more than seven planets, and dogmatically rejected the possibility of evolution in Nature.

Finally the assumption of the identity between subject and object in which the world is seen as both substance and subject, and Nature is seen as posited by Spirit has come to appear highly implausible with the widespread acceptance of evolutionary theory. The notion that life and mind have evolved from the inanimate realm of Nature presents insuperable difficulties for an idealism committed to explaining Nature in terms of Spirit which in Hegel only has being through humans. If evolutionary theory is to be accepted then the higher forms of being must be understood to have derived from the lower forms. The lower forms cannot be thought of as deriving from the higher.

Thus despite Hegel's fruitful ideas in science, his philosophy of Nature has generally been rejected by scientists. Sambursky concluded his essentially sympathetic analysis of Hegel's work on the following note:

> Summing up one may say that Hegel's philosophy of nature is ingenious but sterile, fascinating but not productive; some of its statements are splendid formulations of results already arrived at by science, even occasionally rising to brilliant foreshadowings of future developments, without however furthering the cognition of nature as a whole.
>
> Above all Hegel's method has done such immense damage in that it drove the scientists of the 19th century into the arms of positivism and the equally untenable position of the other extreme, the hostility to metaphysics. (1)

This failure to develop an adequate philosophy of Nature meant that Hegel's system failed to overcome the dichotomy between the physical

(1) Ibid., p. 153f.

world, as understood by scientists, and the realm of mind. As pointed out in the Introduction, the effect of this has been disastrous. While up until the 1920's thinkers such as Marx, Dilthey, Simmel, Durkheim and Weber whose basic ideas derived from the Romantic tradition with its emphasis on meaning, understanding and human creativity dominated the field of social theory, since then positivistic reductionist approaches basing their claim to legitimacy on their supposed concurrence with the physical sciences have increasingly pushed this Romantic tradition into a marginal position.

PRELIMINARY REASONS FOR ADOPTING THE ONTOLOGY OF PROCESS PHILOSOPHY

Given these analyses of the efforts to develop a coherent conception of being it is now possible to draw some conclusions as to what sort of ontology is required to provide the basis of a coherent world-view. Firstly it must be able to come to terms with the achievements of materialism but at the same time be able to account for life and mind. This has been the outstanding problem associated with the rise of science. But apart from this it was seen that materialism does not solve those problems in developing a conception of being revealed by the Greek thinkers, and a successful ontology should also be able to resolve these problems. Most notably it should be developed so as to account for the relationship between what is and its motion or change, the forces involved in its behaviour, and space and time, and between discreteness and continuity.

It is possible to take leads from Leibniz and Hegel in this. Leibniz's assumption that what is in the primary sense is essentially active overcomes the problem of the relationship between what is and its motion and force, and it enables space and time to be construed as derivative. It also overcomes the problem of the relationship between the discreteness of being and the continuity of space and time since this continuity is then seen to be only potential and not actual. But the conception of this activity as psychic, with the world conceived of as consisting of an infinite number of indestructable and self-subsistent psychic entities largely undermines these achievements, since on such an analogy force and efficient causality cannot be comprehended, and relations between the psychic entities dissolve into nothing but appearances. Furthermore panpsychism still does not solve the problem of the relation between the mind and the body. If the constituents of a compound being are conceived to have psychic properties one has still no satisfactory way of explaining how the compound being can have such properties, and since purely psychic beings cannot causally effect one another, the relationship between a living being as a functioning, conscious whole is even more problematic than when this composite being is conceived of as composed of elementary particles of matter.

Hegel's conception of being as in the process of self-actualization in which it is struggling to attain self-consciousness through the efforts of humanity has provided the framework within which it has been possible to develop a far deeper understanding of the nature of the human order than was possible in terms of materialism. In particular Hegel's emphasis on the unity of the whole has served to reveal the dependence of the individual for his being on the social order. And seeing this in relation to the historical process involving the struggle for freedom and rationality has in turn revealed a great deal about the nature of social dynamics. But giving priority to the subject or Spirit makes it impossible to do justice to the physical world. And the assumption of the unity of the one and the many eventually undermines the significance of individuals who are ultimately subservient to the totality.

It can be surmised from the achievements and problems of Leibniz and Hegel that primary being should be understood as essentially active, but that it should not be understood as psychic or as a subject, and that being should be understood to be prior to Spirit and thought. As to whether being should be thought of as one unified whole or as a plurality of self-subsistent beings, the dichotomy itself should be overcome. If being is a unified whole then inevitably the world must be thought of as a Parmenidian plenum since there is no way that such a unitary being could differentiate itself, while if there exist a plurality of self-subsistent beings, then like Leibniz's monads, these beings would have to be conceived of as incapable of influencing each other. What is required is a conception of being which allows that out of the whole it is possible for there to develop beings which only exist by virtue of their place within the whole yet which have a real autonomy from the whole. Such autonomy cannot be explained by postulating the existence of forms because this leaves the problem of understanding the relationship between these forms and what is formed. Rather what is required is a conception of activities which differentiate themselves from the rest of being and order themselves.

This conception of being as essentially active and consisting of self-ordering activities with a relative autonomy from their environment makes possible the development of a conception of emergence. If beings are self-ordering activities, then it is possible to think of emergent beings which are a self-ordering of self-ordering activities. Since self-ordering activities are not entirely autonomous but are dependent upon their environment, a modification of the environment can alter the self-ordering activities by further ordering them. This further ordering of a number of ordered activities can be such as to form the modified environment of each one of them, thus perpetuating this new ordering. This implies the emergence of a new ordering which is more than the sum of the constituent orderings.

Accepting this conception of being leads to a rejection of the unity between being and becoming. Since there is always the possibility that new beings might emerge in the world, and since these cannot be thought of simply as a manifestation of what already is, the world must be seen as an unfinished process of becoming. It is only particular beings in the world which fully achieve all their potentiality, but they can only be said to have done this when they have fully become and ceased to exist.

If the world is a process of becoming consisting of beings with some autonomy from their environments then it is possible to conceive of space and time as derivative rather than as independent self subsistent beings. As an unfinished process of becoming there is an order of potential interactions between the active semi-autonomous beings of the universe, and this can be regarded as the order of space and time. On the other hand what has already formed is an order of extensive duration in which space and time are not something over and above their content. What has already formed can be thought to be discrete, with each being having formed a pattern of extensive duration,while the order of potential relations can be regarded as continuous. On this view of space and time there is no reason to think of the beings of the universe as juxtaposed and external to each other.

Given that this ontology makes it possible to conceive of emergence there are good grounds for believing that it can be developed to give an account of the human order as an emergent phenomenon. Since what is is always in process of becoming the conception of the human order developed on this ontology would be largely in accordance with the ideas of the Romantic tradition as these were developed by Hegel. However there would be some differences. Firstly there would be no reason to believe in a pre-existing end which humans are in the process of actualizing; secondly while individuals would be seen as only becoming so through their social environment, there would not be the same tendency to see them as ultimately nothing but manifestations of the World Spirit.

However these are simply directions for the construction of an ontology, and it is necessary to develop it before it is possible to judge whether such a construction is possible. To do this it is necessary to see what efforts have already been made in this direction, what achievements have been made and what problems have arisen. The ontology generally associated with this line of thinking is process philosophy, and I will now give an account of its place in the history of ideas.

THE HISTORICAL BACKGROUND OF PROCESS PHILOSOPHY

The father of process philosophy is generally taken to be Heraclitus. However the basic ideas of process philosophy have generally been anathema to philosophers who since Parmenides have been searching for a real, unchanging world behind the changing world of appearances. Thus Nietzsche wrote:

> You ask me about the idiosyncracies of philosophers?..There is their lack of historical sense, their hatred of even the idea of becoming, their Egyptianism. They think they are doing a thing honour when they dehistoricise it, sub specie aeterni - when they make a mummy of it. All that philosophers have handled for millennia has been conceptual mummies; nothing actual has escaped from their hands alive. They kill, they stuff, when they worship, these conceptual idolaters - they become a mortal danger to everything when they worship. Death, change, age, as well as procreation and growth, are for them objections - refutations even. What is, does not become; what becomes is not ... Now they all believe, even to the point of despair, in that which is. (1)

Nietzsche "set apart with high reverence the name of Heraclitus " (2) from this general condemnation of philosophers. John Dewey made a similar point when he showed that it has been a common conviction of philosophies which have differed on almost everything else that the ultimately real is fixed and unchanging:

> The idealist has found (the fixed and unchanging) in a realm of rational ideas; the materialist in the laws of matter. The mechanist pins his faith to eternal atoms and to unmoving space. The teleologist finds that all change is subservient to fixed ends and final goals, which are the one steadfast thing in the universe, conferring upon changing things whatever meaning and value they possess. The typical realist attributes to unchanging essences a greater degree of reality than belongs to existences; the modern mathematical realist finds the stability his heart desires in the immunity of the realm of possibilities from vicissitude. Although classic rationalism looked askance at experience and empirical things because of their continual subjection to alteration, yet strangely enough traditional sensational empiricism relegated time to a secondary

(1) Friedrich Nietzsche TWILIGHT OF THE IDOLS (1889) tr.R.J.Hollingdale, Penguin Books, Harmondsworth, 1968, p. 35.
(2) Ibid., p. 36.

> role. Sensations appeared and disappeared but in their own nature they were as fixed as Newtonian atoms. (1)

Secondly philosophers have been committed to the view that what is higher cannot develop from that which is lower, or as Nietzsche expressed it:

> The other idiosyncrasy of philosophers is no less perilous: it consists in mistaking the last for the first. They put that which comes at the end - unfortunately! for it ought not to come at all! - the 'highest concepts', that is to say the most general, the emptiest concepts, the last fumes of evaporating reality, at the beginning *as* the beginning. It is again only the expression of their way of doing reverence: the higher must not be *allowed* to grow out of the lower, must not be *allowed* to grow at all ... (2)

It can be seen from these comments that process philosophy is against the whole tradition of Western philosophy. Nevertheless there have been marginal figures in the history of philosophy who have rejected the assumptions of this tradition and who have attempted to develop thought along the lines suggested by Heraclitus.

Heraclitus was younger than Pythagoras and older than Parmenides. He emphasises that everything is changing, and to him is attributed the saying "All things are passing and nothing abides" (3) and "Nothing is, everything is becoming." (4) In accordance with this Heraclitus argued that the physis or nature of the universe is fire. Thus among the cosmic fragments of Heraclitus is found the statement: "This world, which is the same for all, no one of gods or men has made; but

(1) John Dewey, "Time and Individuality" in PHILOSOPHERS OF PROCESS ed. Douglas Browning, Random House, N.Y. 1965, p. 209.
(2) Nietzsche (1889) op.cit. p. 37.
(3) Plato CRATYLUS 402 a 8 Cited by Burnet (1930) op.cit. p.146.
(4) Plato THEAETETUS 152 e 1 Cited loc.cit.

it was ever, is now, and ever shall be an ever-living Fire, with measures of it kindling, and measures going out." (1) To emphasise the changing nature of the world he drew an analogy with water, the implications drawn being summed up in the saying "all things are flowing" (2) while another fragment states: "You cannot step twice into the same river; for fresh waters are ever flowing in upon you." (3) These ideas form the basis of process philosophy.

Heraclitus also confronted the problem of the one and the many. Heraclitus accepted that all things are one, writing: "All things are an exchange for Fire, and Fire for all things ..." (4) but then tried to account for the diversity or differentiation of fire not in terms of fire but in terms of the relationship between the diverse beings of the world. Thus Heraclitus emphasised the importance of strife by which diverse things maintain themselves, writing: "Homer was wrong in saying: 'Would that strife might perish from among the gods and men!' He did not see that he was praying for the destruction of the universe; for, if his prayer were heard, all things would pass away," (5) and "We must know that war is common to all and strife is justice, and that all things come into being and pass away through strife." (6) Thus the diverse beings of the world are not self-subsistent entities but exist by virtue of a dynamic opposition

(1) Fr. 20 Cited ibid. p. 134.
(2) Plato CRATYLUS 404 c Cited ibid. p. 146.
(3) Fr. 41, 42, Cited ibid. p. 136.
(4) Fr. 22, Cited ibid. p. 135.
(5) Fr. 43 Cited ibid. p. 136.
(6) Fr. 62 Cited ibid. p. 137.

to other beings. But this dynamic opposition must be balanced if one being is not to reduce all others to itself. The nature of this in one situation is described in what is clearly a Heraclitean passage:

> And in turn each (fire and water) prevails and is prevailed over to the greatest and least degree that is possible. For neither can prevail together for the following reasons. If fire advances towards the utmost limit of the water, its nourishment fails it. It retires, then, to a place where it can get nourishment. And if water advances towards the utmost limit of the fire, movement fails it. At that point, then, it stands still; and, when it has come to a stand, it has no longer power to resist, but is consumed as nourishment for the fire that falls upon it. For these reasons neither can prevail altogether. But if at any time either should be in any way overcome, then none of the things that exist would be as they are now. So long as things are as they are, fire and water will always be too, and neither will ever fail. (1)

From this it can be seen that the beings of the world are maintained by a balance of opposing tendencies which Heraclitus expressed as an attunement of opposite tensions: "Men do not know how what is at variance agrees with itself. It is an attunement of opposite tensions, like that of the bow and the lyre." (2) His basic position is then summed up in Fr. 59: "Couples are things whole and things not whole, what is drawn together and what is drawn asunder, the harmonious and discordant. The one is made up of all things, and all things issue from the one." (3)

Heraclitus was revered by the Stoics, but they interpreted his ideas in accordance with their own philosophy. Adopting Plato's own definition of being as "anything that is so constituted as to possess any sort of power either to produce a change in anything else or to be affected, however slightly, even by the most inconsiderable agent..." (4),

(1) Cited ibid. p. 156.
(2) Fr. 45, Cited ibid. p. 136.
(3) Fr. 59, Cited ibid. 137.
(4) Plato, "The Sophist" in PARMENIDES, THE AITETOS, THE SOPHIST, THE STATESMAN, tr. John Warrington, Dent, London, 1969 247 d p. 196.

the Stoic physicists regarded the active principle 'force' as everywhere coextensive with that which is acted upon, i.e. matter, pervading and permeating it and together with it occupying and filling space. This in turn led to an emphasis on continuity and the lawful determination of everything that happens, resulting in a conception of being in which particulars came to be seen as manifestations of the whole. This can better be thought of as a field theory than as a version of process philosophy.

It wasn't until the Naturphilosophen of the German Romantic movement inspired by Herder who had appropriated Leibniz's conception of being as essentially active that a process conception of Being was again defended. The most notable figures in this movement were Goethe and Schelling. However their ideas generally lost out to the advance of reductionist materialism. It was only with the acceptance of Darwinian evolutionary theory that process philosophy again achieved recognition.

The post-Darwinian philosophers who are most important for process philosophy are Bergson and Whitehead. Bergson consistently attacked all elements of pre-evolutionary thought in philosophers such as Spencer and did most to develop an analogy which would adequately come to terms with the world conceived of as in the process of becoming. He showed the misleading nature of visualized spatial metaphors when used to conceive the temporal order, and in opposition to these, developed an auditory analogy. Originally he did this to develop an adequate conception of consciousness, but then generalized the concepts developed on this basis to the physical world, and was thus able to anticipate much of the later advances in physics and to provide an interpretation for them. (1) Whitehead is important in the history of process philosophy for his analysis of developments in science, for his thorough critical investigation of the sssumptions of scientific materialism, and for having developed more rigorously than any other process philosopher a coherent set of categories.

Apart from Bergson and Whitehead, C.S. Peirce, William James, John Dewey and George Herbert Mead in America, and Samuel Alexander and R.G. Collingwood in Britain also made substantial contributions to process philosophy during the late nineteenth and early twentieth centuries. But since then process philosophy has not been a major force in philosophy despite the efforts of such people as Milič Čapek, Ivor Leclerc, Paul Weiss and Charles Hartshorne. This has not been due to the failure of the arguments of these philosophers but to the success of positivism and analytical philosophy in ruling out ontology as a respectable subject of enquiry. But while the influence of process philosophy has waned in philosophy, its importance for science has increased proportionately. Thus in physics David Bohm, one of the most original thinkers in the field of quantum theory has attempted to develop his ideas into a general process philosophy, Ilya Prigogine in thermodynamics has developed ideas in accordance with the ideas of Bergson and in opposition to the materialist ontology, and C. H. Waddington, one of the most important biologists of the century has acknowledged

(1) This has been analysed by Milič Čapek in BERGSON AND MODERN PHYSICS, Reidel, Dordrecht, 1971, esp. Part III.

Whitehead as his mentor. (1)

Alongside process philosophy, general systems theory has been developed in opposition to the prevailing materialism over the last fifty years. This is largely consistent with process philosophy, with its most significant proponent, Ludwig von Bertalanffy acknowledging Heraclitus as the original exponent of his basic position. (2) For this reason, many of the ideas of this school of thought can be appropriated by process philosophers. Systems theory differs from process philosophy in that having been developed largely through the struggle against reductionism in biology, it has focussed on a narrower range of ideas. There is a tendency to ignore that which is not highly ordered and the basic concepts have not been thought through as radically as have those of process philosophy. This has led to the use of concepts such as space and time deriving from materialism and to the assimilation of mechanistic notions such as cybernetics to systems theory which when applied to the human order have led to reductionist tendencies.

My own own version of process philosophy should be seen as an attempt to advance this tradition. However, I will not attempt to analyse the achievements of the more recent process philosophers or systems theorists, nor will I define my own views in relation to theirs, though I will be drawing on their work in an attempt to develop a consistent position.

(1) C.H.Waddington "The Practical Consequences of Metaphysical Beliefs on a Biologist's Work: an Autobiographical Note" in TOWARDS A THEORETICAL BIOLOGY 2 SKETCHES Edinburgh Uni. Press, Edinburgh, 1969, pp. 72-81.
(2) Ludwig von Bertalanffy PROBLEMS OF LIFE: AN EVALUATION OF MODERN BIOLOGICAL THOUGHT, Watts & Co., London, 1952, p. 194.

BASIC ANALOGY FOR A PROCESS PHILOSOPHY

It has already been noted that ontologies are developed by articulating analogies to form a unified conception of the world. Various analogies have been developed in attempts to characterize the world as process, notably Heraclitus' conception of the world as fire and his use of water as an analogy for a world in which everything flows. To think of a world within which processes emerge which are dependent upon their environment yet which develop with some autonomy from it, the analogy of flowing water with eddies forming in it is a promising starting point. However flowing water implies the existence of a channel through which it flows and does not come to terms with the all encompassing nature of becoming of a world of processes. To deal with this aspect of becoming visual analogies are impotent and it is necessary to investigate analogies based on other sensory modalities, in particular that of hearing. That auditory analogies would be more appropriate means of understanding the world than visual analogies was suggested by Bergson and has been further supported by Milic Capek. I will now attempt to work out what is implied by conceiving the world on the analogy of music.

To do this it is first necessary to show how ideas deriving from visual analogies dominate our thought. In fact the development of the thought of the pre-Socratic philosophers can be understood as largely the refinement of purely visual analogies so that everything came to be seen in terms of spatial relationships. The first consequence of the use of spatial metaphors is that it leads to substantialism. Visualizing something in space it is impossible not to think of 'change' in any other way than as change occurring to something which remains unchanged in the process. That which remains unchanged is the substance, while whatever changes are the substance's accidental attributes. The second consequence is that things are thought to be impenetrable and external to each other, so that no two bodies can occupy the same place at the same time. Bergson pointed this out when he wrote:

> Try to picture one body penetrating another; you will at once assume that there are empty spaces in the one which will be occupied by the particles of the other; and our thought will prolong this operation indefinitely in preference to picturing two bodies in the same place. (1)

It can be seen from this that if one also accepts that there is only one type of being and if non-being or the void cannot exist, then all the conclusions drawn by Parmenides must logically follow. Parmenides ideas must then be regarded as not ideas which are eternally true but what one must be led to accept if one takes visual analogies to their ultimate conclusion.

Materialism can then be understood as the attempt to come to terms with change while still adhering as much as possible to the spatial metaphor. The end result of this was the conception of space as an independent existence understood purely in static visual terms, and matter understood on the same analogy located within this space. Then time also came to be understood in the same way so that all objects could be thought to be simply located within four dimensions. This

(1) Henri Bergson TIME AND FREE WILL tr. F.L. Pogson, George Allen & Unwin, London, 1910, p. 88.

allows motion to be conceptualized spatially as a line within these dimensions. Only the attribution of forces of attraction and repulsion to matter is inconsistent with this visual analogy. By giving the laws of such interaction a positivistic interpretation, seeing them as nothing but descriptions by which predictions could be made eliminates even this non-visual element from the materialist ontology. In such a world everything is determined as everything has its place in the four dimensional spatial block, resulting in what William James referred to as the 'iron block universe'. The relationship between this deterministic universe and the attempt to understand it in purely visual terms is evident in the famous statement of Laplace:

> An intellect which at a given instant knew all the forces with which nature is animated, and the respective situations of the beings that compose nature - supposing the said intellect were vast enough to subject these data to analysis - would embrace in the same formula the motions of the greatest bodies in the universe and those of the slightest atom: nothing would be uncertain for it, and the future, like the past, would be present to its eyes. (1)

From this it can be seen that atomistic materialism overcomes the problem of motion by conceiving of the universe as a four dimensional plenum rather than the three dimensional plenum of Parmenides.

While Parmenides argued that such a being is indivisible, this is not what is implied by a spatial metaphor. Visualized space implies an infinitely divisible continuum with each part of the continuum being

(1) Cited by Henri Bergson in CREATIVE EVOLUTION (1907) tr. Arthur Mitchell, (1911), Greenwood Press, Westport, 1975, p. 43f.

qualitatively the same as the whole. Thus while an atom has the properties of impenetrability, inertia and so on, so also does each part of the atom. The same principle applies also to space, time and motion. Furthermore each part of any continuum is external to every other part. Thus while the universe as a whole is thought of as a block or plenum, this itself must be seen as being made up of an infinite number of externally related parts. This is the conclusion reached by Russell who approvingly quoted Poincare's statement:

> The continuum thus conceived is nothing but a collection of individuals arranged in a certain order, infinite in number it is true, but external to each other. This is not the ordinary conception, in which there is supposed to be, between the elements of the continuum, a sort of intimate bond which makes a whole of them, in which the point is not prior to the line, but the line to the point. Of the famous formula, the continuum is unity in multiplicity, the multiplicity alone subsists, the unity has disappeared. (1)

This then justifies an analytical approach to anything understood in visual terms, with the whole being thought of as nothing but the sum of the constituents.

Traditional logic and mathematics are highly developed spatial analogies, and the implications drawn from logic and mathematics about the world reflect this analogical underpinning. Traditional logic has been

(1) Cited by Milič Čapek BERGSON AND MODERN PHYSICS Boston Studies in the Philosophy of Science, Vol. VII Reidel, Dordrecht, 1971, p. 75.

formulated in terms of classes in which things are totally contained in, partially contained in or not contained at all in other classes of things. Such class inclusion is here clearly thinking in spatial terms. Propositions formulated in this way are then either true or false, and such a two valued logic does not have any place for beings in the process of becoming or for internal relations whereby that which is related is not something over and above its relations.

The underlying spatiality of mathematics is revealed by the reconstruction of mathematics on the foundation of set theory. It is also revealed by Piaget's description of how the concept of number is built up. (1) This involves seeing classes (sets) of classes of things whose qualitative differences have been ignored in serial order so that the things are differentiated only by their order of enumeration. Such serialization implies seeing things as stretched out in a line so that A is seen to be before B, B before C and so on. The classes serialized are: the thing that has no predecessor, that which has one, and so on. Having acquired the concept of number the world can then be seen as a multiplicity of denumerable but otherwise unrelated objects.

On the basis of set theory it is possible to construe mathematics as an axiomatic system in which every mathematical proposition can be deduced from a small number of postulates. Where science uses mathematics metaphorically, it takes over this ideal of knowledge

(1) Jean Piaget PSYCHOLOGY AND EPISTEMOLOGY: TOWARDS A THEORY OF KNOWLEDGE tr. P.A. Wells, Penguin University Books, Harmondsworth, 1972, pp. 8010 and p. 20ff.

as an axiomatic structure dealing with discretely distinct objects, and this inevitably leads to a conception of the universe as incapable of producing novelty and as strictly determined. This conception is set forth as a mathematical ideal by Du Bois-Reymond:

> We can imagine the knowledge of nature arrived at a point where the universal process of the world might be represented by a single mathematical formula, by one immense system of simultaneous differential equations, from which could be deduced, for each moment, the position, direction, and velocity of every atom in the world. (1)

So long as science remains wedded to this arithromorphic ideal based as it is on purely spatial relations, then it is committed to the same materialist conception of the world. Thus Georgescu-Roegen argued that:

> physics, in spite of the stochastic form of its laws and the indeterminancy of the instrumental observations, is still a mechanistic science if this term is given a broader meaning that retains the crucial article of the classical faith. In this sense, a science is mechanistic if, first, it assumes only a finite number of qualitatively different elements, and if, second, it assumes only a finite number of fundamental laws relating these elements to everything else in the same phenomenal domain. (2)

Finally, vision distances the subject from the world and it is impossible to conceive of consciousness in terms of a spatial analogy. As Descartes recognized, if the physical world is conceived of as *res extensa*, mind must be of an entirely different order. The domination of thought by visual analogies thus leads either to a conception of the subject of experience as a detached spectator on the world, being no part of it,

(1) Cited by Bergson (1907) op.cit. p. 44.
(2) Nicholas Georgescu-Roegen THE ENTROPY LAW AND THE ECONOMIC PROCESS, Harvard Uni. Press, Cambridge, Mass., 1971 p. 115.

or to the view that the subject is an illusion.

Auditory analogies imply a quite different conception of the world. This is revealed by considering what is involved in the perception of a piece of music. Thus Bergson wrote:

> Let us listen to a melody, allowing ourselves to be lulled by it: do we not have the clear perception of a movement which is not attached to a mobile, of a change without anything changing? This change is enough, it is the thing itself. And even if it takes time, it is still indivisible; if the melody stopped sooner it would no longer be the same sonorous whole, it would be another, equally indivisible... If we do not dwell on... spatial images, pure change remains, sufficient unto itself, in no way divided, in no way attached to a "thing" which changes. (1)

This indicates that there is no tendency towards substantialism in auditory analogies. In music "there are changes, but there are underneath the change no things which change... There are movements but there is no inert or invariable object which moves." (2)

The passage by Bergson also suggests a different conception of time. Where change is the thing itself, it is a process of becoming and requires a duration to manifest itself. In this there is no place for time as an infinitely divisible container of happenings in which there is a complete symmetry in the relationship between the present and the past and the present and the future. To be a whole melody it must be continuous, but this continuity is different from the

(1) Henri Bergson THE CREATIVE MIND tr. Mabelle L. Andison, Philosophical Library, N.Y. 1946, p. 174.
(2) Ibid., p. 173.

mathematical continuity which is infinitely divisible. Any attempt to divide a melody and it will no longer be the same melody; it will not even be part of the original melody but something different. Melodies require an indivisible duration to become and there can be no place for mathematical instants in this. And as a melody is played the past merges with the present to form the unity of the melody, while at the same time it is experienced at each moment as incomplete, intimating a future full of potentiality. Such a development is directional, and the past which is that which is formed is completely different from the future which is not yet actualized. Thus in place of a spatialized conception of time, Bergson developed the notion of duration which he described as:

> not merely one instant replacing another; if it were, there would never be anything but the present - no prolonging of the past into the actual, no evolution, no concrete duration. Duration is the continuous progress of the past which gnaws into the future and which swells as it advances. (1)

Music also suggests that diversity should be understood in a different way than that implied by spatial analogies. The continuity of the melody involves a diversity which is entirely different from arithmetical multiplicity. Here successive phases of the melody cohere to form a whole without ceasing to be diverse, while in spatial forms of understanding diversity was seen to involve an exteriority of the diverse units. This means that auditory analogies require a

(1) Bergson (1907) op. cit. p.6f.

different conception of an individual than is implied by visual analogies. Individuals can no longer be thought of as denumerable things isolated from each other in space and persisting through time. An individual tone perishes after a short duration and is indissociable from the total melody. Even a single, isolated tone is not completely independent of its context as it takes its form against the background of an antecedent silence. But at the same time the tone, whether it is sounded alone or as a part of a melody retains an individuality, making its own individual contribution to the silence or to the total Gestalt of the melody, even after the tone has stopped sounding. The musical analogy, by allowing diversity within an indivisible whole overcomes the antithesis between being an individual and being part of a continuous context.

The substantialism implied by visual analogies leads to a dichotomy between agents of activity and active forces, and as these analogies are refined, the concept of force increasingly loses its meaning. In a completely silent, purely spatial world, laws of motion become nothing but descriptions of constant conjunctions between events. But with music there is no substance, and the existence of anything is identical to its activity. As Zuckerkandl put it: "agent and acting force merge in each other; no reasonable distinction between them is possible." (1) It is therefore impossible to exclude the concept of force which manifests itself in the present as an oriented tension

(1) Victor Zuckerkandl SOUND AND SYMBOL: MUSIC AND THE EXTERNAL WORLD tr. Willard R. Trask, Princeton University Press, Princeton, 1973, p. 207.

eliciting the future into being. Thus Zuckerkandl concluded:

> in music there would be hardly anything left to describe if force had to be excluded from the discussion. Force is as real as music itself. Thus it appears that though, strangely enough, the reality of force can be doubted in a physical world, it is certain beyond any doubt in a world that contains, besides bodies, tones. (1)

Such active force implies causality, but in a different form than is usually thought. Firstly the causality involved cannot be thought of in terms of instants with the state of being at one instant determining the state of being at another instant. Rather it is the whole melody as an unfinished process of becoming which has to be thought of as the causal agent. The presence of the whole in relation to the parts is described by Zuckerkandl:

> What a melody is on a small scale, the total course of a musical work is on a large scale - a whole that unfolds in time and is so constituted that, though its individual members appear one after another, the whole, in order to be present, does not have to wait for member to be added to member, but is, so to speak, always already there, not factually, as with the spatial Gestalt, but as a direction, as oriented tension. (2)

And this oriented tension is experienced as the causal efficacy. The second feature of such causality is that it does not determine the future. While there is always causal continuity and the future is constrained by what has already taken place, it is still possible for novelty to emerge which could not be predicted from what preceded it. The process of becoming of a melody implies a creative element.

(1) Ibid. p. 372f.
(2) Ibid. p. 236f.

The implications of auditory analogies for the understanding of space are more complex. The perception of a simple melody appears to be of no relevance to the extensive character of the world, but a closer examination of what is involved in listening to music reveals that music does have spatial characteristics, but of a much different kind than the spatial characteristics of that which is visualized. Thus Zuckerkandl wrote: "Far from taking us out of space - as common opinion holds - music discloses to us a mode of being of spatiality that, except through music, is accessible only with difficulty and indirectly." (1) The space of music is not something which exists passively as the container of its content but is something which comes into being with the music as a dynamic, flowing field of interaction between tones. This means that extensiveness is an indissociable aspect of the process of becoming of a melody rather than something existing in its own right. This emergence of spatiality is described by Geza Revesz:

> If, with eyes closed and in a state of repose, we are exposed to a tone or a tonal complex, it seems to us as if the space around us were suddenly filled with life. It is as if the space in which we find ourselves emerged from its indefiniteness... from its potentiality, and, through the sound, received a definite directionality and a certain extension. (2)

But this spatiality of sound is not a space of places external to each other but is given primarily as an undivided totality. Tones do not

(1) Ibid. p. 339.
(2) Quoted by Zuckerkandl, op. cit. p. 277.

draw boundaries in space but each tone is fully extended throughout the whole of space. At this basic level, the idea of divisibility of space is meaningless. The differentiation of space emerges with more complex forms of music as in a polyphony. The nature of this has been described by Milič Čapek:

> In a contrapuntal composition two or several melodically independent movements, whether harmonious or dissonant, are going on. The component melodic patterns, besides being each unfolded successively, are also contempory or alongside each other; and this relation of 'alongside' or 'beside' is clearly analogous to the relation of 'beside' in space, as the French psychologist Theodore Ribot observed a long time ago... The spatial relation of juxtaposition implies a complete mutual externality of static elements, whereas in polyphonic movements the component melodies not only proceed, so to speak, parallel to each other - 'in the direction of the future', but also overlap 'transversally' without, however, losing their melodic individuality ... Thus the polyphonic pattern is a concrete exemplification of what Whitehead called by the term, significantly borrowed from the language of music also, "unison of becoming" and Bergson "the simultaneity of the fluxes." (1)

With a polyphony, especially where there is dissonance, the concept of place takes on meaning as the ear locates the source of the different movements. However, even with the emergence of place, this does not imply complete externality as does the place of visual analogies.

The final feature of auditory analogies is that contrary to visual analogies which imply an exclusion of the subject of experience from the world, auditory analogies imply an involvement of the subject. Sound or tone "comes toward us, reaches us and seizes us, passes by, occupies and integrates space," (2) while things visualized are always

(1) Milič Čapek (1971) op.cit. 325f.
(2) Quoted from Erwin Straus by Zuckerkandl,op.cit. p. 276.

entirely outside the subject. Since the subject experiences the world through interacting with it, his or her knowledge is always a situated knowledge unlike that of the detached spectator, and this suggests that one cannot take a perspective from outside the world but that objectivity is attained only by acknowledging the possibility of the world being experienced from diverse situations within it.

The use of music or sounds as a basic analogy to describe being would seem to imply a certain fuzziness of reality as opposed to the sharply delineated conception of being developed by means of spatial analogies. The question then arises as to how an auditory analogy is to compete with the immense achievements of the traditional conceptions of being, especially when it is acknowledged that mathematics is a development of the visualized spatial analogy. The important thing about a basic analogy is not that it is exclusive but that every other analogy used to understand specific features of the world should be seen as secondary to the basic analogy. The adoption of the auditory analogy thus does not rule out the use of visual analogies such as mathematics but requires that these be understood in relation to the auditory analogy. This implies that where mathematics is used it should be seen as incapable of grasping the world completely in a set of formulae, but should be regarded as dealing with those relatively enduring aspects of the world which have crystallized on the surface of the flux of becoming. Furthermore the mathematics used should be that which assumes least in the way of order so that all the more ordered aspects of reality can be seen as such rather than being taken for granted. It will be shown in the next chapter that topology serves this function best.

The adoption of an auditory analogy as the basis of an ontology can now be seen to suggest an infinite diversity within an organic moving totality of nature. This is in accordance with the suggestions made in an earlier section as to what is required for a coherent ontology. But the ontology can only be justified through its ability to interpret specific features of the world, and to do this it is first necessary to articulate the analogy into a scheme of basic concepts or categories in terms of which all specific domains of enquiry can be put into perspective.

CATEGORIES FOR A PROCESS PHILOSOPHY

A category is a basic concept developed from a basic analogy which is indispensibly relevant for interpreting every aspect of the world. In this thesis categories are not understood as setting the limits of meaning as in Aristotle, Kant and analytical philosophy, but in the tradition of Hegel are understood as the fundamental concepts of a system of philosophy. Since the categorial scheme of this thesis will be explicitly developed as an articulation of the auditory analogy described above, and since it is always possible to adopt different analogies, this way of conceiving the world must be regarded as only one possible way of understanding the world. The commitment to this scheme can only be provisional. The categories cannot be justified by transcendental deduction, but can only be shown to be superior to alternative sets of categories through their ability to interpret all aspects of the world in a coherent manner.

But before going on to develop the categorial scheme for a process philosophy it is first necessary to ensure that it is possible to develop this in a logically coherent form. Incoherence is manifest when a statement contradicting a basic assumption of a system can be shown to be implied by this assumption. On such grounds it has been argued that it is impossible to coherently conceive of a world entirely composed of change. (1) The first argument along these lines is that change always is, and must be understood in terms of that which is permanent, and this contradicts the original assumption. Thus all

(1) James K. Feibleman "Why Whitehead is not a 'Process Philosopher'" in TULANE STUDIES IN PHILOSOPHY Vol. XXIII 1974, p. 51f.

process philosophers have fallen back on something which does not change to define their position. With Hercalitus there was the Logos, with Bergson, the élan vital, and with Whitehead, eternal objects, actual entities and permanent interconnections. Cratylus, who did reject the attribution of permanence to everything, eventually ceased talking. However this argument assumes that if the world is changing then it must be doing so uniformly so only that which is permanent can serve as a reference point within the flux. But as long as there are enduring orders like eddies in a flowing stream, these can provide provisional reference points, even though they are subject to change.

The second argument is that "everything does not change: the character of change itself does not..." (1) But if new types of order are constantly coming into being, then it can be assumed that the character of change does in fact change. And if the statement means that if everything is changing, then eventually the fact that there is change must change, then it can simply be said that process philosophy does not go this far. It can be affirmed about being that everything in it changes or can change without implying that the fact that there is change must change since the latter statement is a metastatement and is not entailed by the former.

Aristotle held against the view that everything changes that it must violate the principle of non-contradiction as things conceived to be in the process of becoming must both be and not be. Heraclitus himself

(1) Ibid., p.51.

accepts this when he writes (Fr. 81) "We step and do not step into the same river; we are and are not." (1) This would seem to imply that such a world is unintelligible. But all Aristotle has really shown is that his two valued logic which embodies substantialism is not capable of dealing with the world if it is subject to fundamental change. Attempts have been made to develop multi-valued logics to deal with the temporal aspects of being which are stressed by process philosophy. (2)

Another problem with process philosophy is how is it possible to use static concepts to interpret a world which is always changing. However it has already been argued that since our understanding of the world is itself developing, concepts must be open textured and capable of being developed, and they must be open to replacement. If concepts must be open textured and provisional on epistemological grounds, they can also be this way on ontological grounds. This means that if the world evolves completely new types of being, then the concepts can be changed to accommodate these developments.

In a richly diverse world of becoming in which it is accepted that completely new types of order can develop it is difficult to decide which are the categories conceptualizing universal features of nature and which the subcategories which are derivable from these. For this reason it becomes somewhat arbitrary how detailed the set of

(1) John Burnet (1930) op.cit. p.139.
(2) Gotthard Gunther "Time, Timeless Logic and Self-Referential Systems" in ANNALS OF THE NEW YORK ACADEMY OF SCIENCES Vol.138, Feb.1967, Art, 2, pp. 396-405.

categories should be. This means that it can be demanded that the list be kept short so that they can be easily grasped by the intellect. As Andrew Reck has argued, a simple list: "is indispensible to logical inference and empirical testing; and its value for speculation is inestimable. Simplicity of theory, spelled out in a manageable list of categories, activates the creative imagination. The philosopher whose theory is simple is better able to keep before his mind the considerations relevant to his categories and their extrapolations." (1) Reck suggested five or six categories as the ideal and criticised Whitehead whose categorial scheme contains forty-five categories. (2)

My list will contain the following categories: process, structure and event; activity and order; cause; and space-time. I will attempt to define these in a general way, though this will present considerable problems. As the most basic concepts of the ontology, each is presupposed by the other concepts, so it is impossible to begin by defining any one concept without some understanding of the other categories to be defined. No effort will be made to logicall; unfold concepts out of each other as Hegel attempted in his LOGIC. Rather it will be assumed that some understanding of the ontology to be developed has been gained through the consideration and criticism of opposing ontologies through the account of Heraclitus' philosophy and through the description of the auditory analogy on which this process conception of being is to be based. The categories will not be completely defined one by one, but the first will be defined in terms of the others which will not yet have been defined. The meaning of the first categories should then become progressively clearer as the other categories are defined. However while the meaning of these concepts can be grasped to some extent through seeing them in relation to the analogy of which they are the articulation, in relation to each other

(1) Andrew J. Reck "Process Philosophy, a Categorial Analysis" in TULANE STUDIES IN PHILOSOPHY, Vol.24, 1975, p.64.
(2) Ibid., p. 63.

and by comparison with concepts of different ontologies, the full meaning can only be attained through their application in the interpretation of concrete situations. My aim here will therefore not be to give precise meanings to the categories,since as categories they should be the most open textured of concepts, and their meanings should be refined not simply through carefull analysis in abstraction, but in relation to efforts to understand the world.

PROCESS, STRUCTURE AND EVENT

The thesis I am defending is that what being is, is processes, structures and events. A process can be defined as a self-ordering activity. A structure is the ordered potential of a process, the power maintained by it to be causally effective. An event is a contingent feature of an activity and must always be understood in relation to processes. The creation of a process, a contingent interaction between processes and the destruction of a process are events. The universe is an unfinished process of becoming consisting of a multiplicity of processes, each of which has some autonomy from its environment and/or its constituent processes, while being dependent upon these for its existence. Processes require a duration to manifest themselves, and as unfinished they have a structure which may be made manifest in the appropriate circumstances. The universe as a whole and many of its constituent processes are creative, continually giving rise to new processes with their own semi-autonomous dynamics, and this gives rise to events which are impossible to entirely predict.

As a self-ordering activity, a constituent process of the universe must differentiate itself from and maintain its integrity against its environment. For instance an electron which forms along with a proton from a neutron by mutual differentiation must be seen as the activity which spreads out with rapidly diminishing intensity at the speed of light of repelling all other negatively charged entities, and in the case in which it interacts with protons, as the activity of forming a standing wave which prevents it from recombining with the protons to which it is attracted. There are also ordering activities integrally related to the self-maintaining activities of a process, though irrelevant to this maintenance, and these must also be regarded as part of the process. For instance a crystal which must be regarded as the self-maintaining activity by which the constituent atoms are ordered to resist dissolution in the face of opposing forces, is also the activity of diffracting and refracting electro-magnetic radiation.

What defines processes is that they are immanent causes of their own being, and as such, they can be in complex relationships to each other. One of the simpler forms of relationships is hierarchical ordering. Since no process with the exception of the universe as a whole are entirely independent of its environment and its existence and behaviour is dependent upon what happens in its environment, then if a group of processes interact in such a way as to constitute an environment which so constrains the particular processes that the interaction is maintained, then this is the emergence of a new proces over and above the processes which constitute it. The emergent process is an ordering of the constituent processes through the determination of their environment, and these constituent processes in interaction are ordered to participate in the becoming of the emergent process of which they are part. As such the higher level emergent process is more than simply the sum of its constituents as its constituents are modified by it. Using different terminology, this is the position defended by Whitehead in SCIENCE AND THE MODERN WORLD where he wrote:

> The concrete enduring entities are organisms, so that the plan of the whole influences the very characters of the various subordinate organisms which enter into it... Thus an electron within a living body is different from an electron outside it, by reason of the plan of the body. The electron blindly runs either within or without the body; but it runs within the body in accordance with the general plan of the body, and this plan includes the mental state. (1)

This position becomes intelligible only when the constituents are no longer conceived of as self-subsistent beings. With this process conception of being it also becomes possible to conceive of processes in a state of mutual dependence where each process provides some of the environment and constituent required for the other, yet in which each is a distinct, self-sustaining process irreducible to the other; and of innumerable more complex types of inter-relationships.

It is because processes are durational, and all existing processes are unfinished, with a potentiality to act and be acted upon that it is necessary

(1) Alfred North Whitehead, SCIENCE AND THE MODERN WORLD (1925) Mentor, N.Y. 1948 p. 76.

to introduce the notion of structure as a basic category. A structure can be defined as the ordered potentiality of a process for causation. This potential includes the power of process to maintain itself and the power to affect other processes, both constituent and non-constituent. It is important to avoid reifying structures and treating them as properties of 'things' by virtue of which these things have causal powers. It is not by virtue of a stucture that a process can affect other processes the way it does; its potential to affect other processes in such a way <u>is</u> its structure. For instance the spatial structure of a process is not an actuality by virtue of which the process is rigid, resists penetration and so on, but <u>is</u> the potential to constrain the freedom of action of constituents over a range of environmental conditions, thus resisting deformation, penetration, and so on. The shape of a process which is usually taken as a passive property of a thing, should then, from the point of view being developed here, be seen as part of the maintained potential of a process. Similarly with non-spatial structures. Social structures should not be seen as the properties of societies but as the potentials of social processes to order their members' behaviour in certain ways.

If the universe were one unified process with no semi-autonomous processes, all activity would be ordered and there would be no contingency. If the universe were a plurality of indestructible processes, the same conclusion might be drawn despite the appearance of contingency. But in a universe in which new processes emerge and old processes disintegrate, contingency must be admitted. This is because if a process orders itself, it cannot be completely determined by its environment or constituents but must be seen as an additional causation in the universe, and this means that while the conditions under which a process will emerge or become so unstable as to disintegrate can be characterized, the precise point at which an emergent process begins to exert its own power or the point at which it loses this power cannot be predicted and must involve an element of contingency. This is evident in the case of the destruction of unstable atoms or sub-atomic particles. Such contingency means that interactions thoughout the universe between processes are influenced by contingencies and so must be themselves to some extent contingent. So it is necessary to have the concept of 'event' implying an activity which is not itself completely ordered as a basic category to describe such features as the creation and destruction of and contingent interactions between processes.

As already noted, events must always be understood in relation to processes. Processes themselves cannot be thought of as simply the sum of a multiplicity of events, even when the interactions between their constituent processes can be thought of as events. This can be illustrated by considering a bubble of gas in a liquid. The constituent molecules of this gas collide with each other, and such collisions in which the motions of the molecules involved are modified, can be thought of as events. But the power of the gas as a whole to constrain its constituent molecules to travel on average at a high velocity so that the molecules do not congregate to form a liquid or a solid, so that the bubble resists compression and so that the bubble has certain thermodynamic properties and transmits sound and light, cannot be thought of as simply the consequence of the sum of all these events. To focus on events is to fail to note that while each collision is contingent, the probability of such collisions is a feature of the ordering of the whole. For this reason, to understand the behaviour of the gas as a whole it is necessary to ignore particular events and to think in terms of the probabilities of the aggregate.

Processes, to the extent that they are autonomous, are the causes of their own being and have causal effects on other processes, and causality is attributable to processes alone. And processes do not exist in space and time but are generative of the order of extensive duration of which space-time is derivative. Consequently the answer to the question, What is being? is processes, structures and events, where structures are not actualities but potentialities of processes and events can only be conceived of in relation to processes. However this does not simply answer the question, which by the way it is formulated implies that there is either one self-subsistent being or many self-subsistent beings, and that the universe is complete. The way the question is posed must be regarded as at least partly responsible for the tendency to deny or underplay the reality of creative change and temporality in the world. If the world consists of processes, structures and events, then it is neither a unified being since its constituents are partially autonomous, nor is it a plurality of self-subsistent beings since all the constituent processes of the universe are dependent upon their environments for their existence. Neither is it complete, but as the auditory analogy implies, it is an unfinished process of becoming to which all constituent processes are making their own unique contributions.

ACTIVITY AND ORDER

'Process' was defined as 'self-ordering activity', which leads to the question, What is activity and what is order? The categories of 'activity' and 'order' approximate the concepts of 'matter' and 'form' in Aristotle's philosophy. As with these two concepts, 'activity' and 'order' do not imply entities existing independently of each other since all activity is ordered in some way and it is always some activity which is ordered. However the union of these two aspects of being is even greater than that implied by Aristotle's concepts since what is causally efficaceous is activity ordering itself. Ordering is more basic than order, and 'activity' and 'order' must be understood as abstractions designed to elucidate the nature of processes, and should never be considered as separate entities. This contrasts with Aristotle who argued that forms are immanent, yet ascribed separate causation to form and matter. Furthermore the description of being as self-ordering activity implies an even greater emphasis on the temporality of being than in Aristotle's philosophy. It is to avoid the tendency to hypostatisation and to emphasize the durational nature of being that I have not used the traditional terms for my categories.

The category of activity is meant to imply that in process philosophy it is flux or change which is paradigmatic. In the development from

Aristotelianism to materialism to field theory to process philosophy, what is taken as paradigmatic is more abstract with less being assumed in each case. Aristotle took the observable order of everyday life as basic and motion with respect to the earth and growth as paradigmatic while Newton took inert particles at rest or in uniform motion in an infinite space as paradigmatic in terms of which everyday phenomena must be explained. Field theory implies that objects like atoms are not basic and that they must be understood in terms of the abstract concept of fields. However this assumes the existence of a continuous space-time order in terms of which everything else can be understood. Process philosophy as I have described it aims to do away with any assumption of order so that any order - spatial or temporal or whatever must be explained and accounted for. Avoiding the assumption of any order avoids the attempt to explain all the diverse types of order in the world in terms of any one particular type of order.

Activity is that which can order itself in different ways and is not some substratum or passive 'stuff' which is acted upon or which has order imposed upon it. In physics it corresponds to the concept of 'energy' or 'mass-energy'. This is not something which is extended in space or which endures through time. Space and time are not to be conceived of as separate from process but are types of order produced and maintained by the ordering activity. As such, activity is the ground for there being space and time. Since our language is permeated by substantialism, this concept is difficult to grasp and can only be fully understood in terms of the auditory analogy in which music can be seen as a changing pattern of activity without any substratum, and the sense of space and time of music derives from the patterning of the activity.

The category of order is difficult to define because it is so fundamental to our understanding of the world that it is impossible to view it at a distance. As David Bohm, who has done more than anyone else to characterize the nature of order, wrote:

> ...order is something that is more fundamental and more universal than most of what has previously been generally regarded as basic in our thinking. This is because order is common not only to physics and biology, but also to all that we can know and all that we can perceive. Thus, there is the order of events in time, the order of cause and effect, and the manifold of topological orders that constitute the essence of what is meant by space (e.g. cycles etc.). Without this vast totality of topological orders, there would be no meaning to measuring intervals of time and space, nor even to the idea of continuity and discontinuity of these intervals. And then there are the directly perceived orders of warm and cold, hard and soft, and shades of colour, as well as the tremendous possibilities for orders in the notes of the scale which are the basic content of music. There is the order of words (both temporal and syntactical) that makes communication possible and the order of feelings that is an inseparable part of the meaning of communications (e.g. pleasure and pain, interest and boredom, etc.). Indeed wherever one looks whether outwardly at nature, or inwardly at the thoughts and feelings that are the expressions of the operation of the mind, one finds that the essence of things is always one kind of order or another. (1)

Order is more fundamental than what are usually taken as basic concepts or categories. For instance the existence of anything quantifiable implies that there is some enduring order; qualities presuppose

(1) David Bohm "Some Remarks on the Notion of Order" in TOWARDS A THEORETICAL BIOLOGY 2 SKETCHES, an IUBS Symposium ed. C.H. Waddington, Edin. U.P., Edinburgh, 1969 pp.18-40, p.18.

different types of order; relationships are only possible within a totality of common or similar orders; and before there can be classes, there must be types of order to be classed. Thus order must be seen as a more basic concept than the concepts 'quantity', 'quality', 'relation' or 'class'.

This means that the notion of order cannot be defined in terms of these concepts. Instead it is necessary to refer back to the basic analogy of process philosophy. The feature of music which characterizes it as ordered in some way is that there are differences in that which is heard, for instance in notes, pitch, timbre, loudness or whatever, and these differences do not change arbitrarily but have some similarity to each other. This can be complicated as there can then be similarly different similarities between differences, and so on. Consequently, along with David Bohm, I will define order as "basically a set of similar differences." (1)

In music, what is involved is a process of becoming in which ordering is an essential feature of this becoming, with ordering being essentially temporal in nature. It will be argued in a later section that continuous space should not be taken as basic but as founded on more primitive orders of extension which are inseparable from duration. Continuous space must then be seen as a composite order

(1) Ibid., p.19.

sustained by the enduring processes of becoming of the universe. Nevertheless, space is one of the most important types of order in the universe, and since it is highly amenable to analysis, I will now try to refine the concept of order through an examination of the order of space.

Order as similar differences is illustrated by a geometric curve which is in some way an ordered set of points. If this curve be approximated by linear chords of equal length, then we can see that if a regular curve is to be described rather than an arbitrary set of points, the differences between the chords must be similar. The simplest curve is a straight line in which successive chords have the similar (in fact the same) direction but differ only in position. Since the whole curve is determined by the first chord it can be referred to as a curve of the first order. The next simplest curve is a circle in which the successive chords differ both in position and angle, but successive differences in angle are similar (and in fact equal). Since a circle is determined by the first two curves it can be referred to as a curve of the second order. The next curve is a spiral in which the planes determined by successive pairs of chords are different, but in which the angle between the planes is similar (and in fact the same) producing a three dimensional curve. Being determined by the first three chords, this would be a third order curve. And so on up to curves of infinite order which could be regarded as random.

What is important in these descriptions is that the similar differences are constitutive of the orders described. Distinctive differences on the other hand, being definitions of how one order can be distinguished from another are external to the elements related. It is possible to relate the constitutive differences to the distinctive differences in another order as when a curve is related to a coordinate system. This then focusses attention upon the distinctive differences between the chords, but to do this it is first necessary to introduce the notion of constitutive differences in the coordinate curves themselves.

Furthermore it is still necessary to work out the intrinsic properties of curves independent of the coordinate frame to which it is referred. So when constitutive differences are related to distinctive differences by means of another referential order, this is not an explanation of one in terms of the other but is only descriptive. In other words, the constitutive differences must always be regarded as basic. By recognizing this it is possible to avoid the tendency of mathematics to lead to the assumption that all order is at one level only, and that the only order is external to the elements themselves and refers only to the way in which the elements are distinct from each other and yet related. Avoiding this then enables a hierarchical conception of order to be developed.

To understand the nature of hierarchical ordering it is best to refer back to the musical analogy. The characteristic of the hierarchical ordering in a melody is that the breaks or changes in the order of the elementary sounds are themselves formed into a higher order. Bohm himself has illustrated this:

> Thus, there may be a short set of notes in a given order. This order changes, then changes again. But all the changes of order form a yet higher order, which constitutes a part of the development of the over-all theme. Each order of development itself changes in an ordered way to form a still higher order of development. And to the possibilities of going on with this process there is in principle no limit. (1)

By accepting the primacy of constitutive differences in mathematics it is possible to think of hierarchical orders as constitutive differences of constitutive differences, ~~though such a transposition to spatial analogies without acknowledgement of the secondary nature of these would lead to a failure to grasp the dynamic nature of such order~~.

Given this definition of order it becomes possible to characterize an indefinite number of types of order. It can then be seen how the physical sciences have tended to constrict themselves by adhering to a very limited range of such types and then attempting to explain everything else in terms of these. For instance Newton's laws of motion begins by considering a body as moving at a uniform speed in a straight line. This is an assertion of similar differences implying a certain linear order of change. In the presence of forces it is necessary to go on to second differences whose similarities define the acceleration of the system. Attempts are made to understand everything else in terms of this very simple order.

The need for new conceptions of order is illustrated in statistical mechanics, in quantum theory and in evolutionary theory. In statistical mechanics, anything which does not conform to the simple mechanical conception of order is taken to be random and as such,

(1) Ibid., p. 25.

equivalent to disorder. But the random movement of molecules should not be regarded as simply 'disordered' but should be thought of as being a different type of order, and it should be admitted that there are different types of order between randomness of motion and movement in a simple curve or straight line. The failure to face these problems has led to difficulties in the treatment of entropy increase in terms of statistics in which this increase has been equated with increase in disorder. The result of this is that proofs of the increase of entropy always encounter contradictions and paradoxes. (1) In quantum theory one discovers types of order which are unintelligible so long as it is believed that only the simple order of Newtonian mechanics and the order of continuous wave motion are possible. Notable in this regard, there are the discrete features of quantum phenomena which occur when electrons jump orbits without occupying the intervening positions, order describable only in terms of probability, and beings which behave like particles in some instances and waves in others with the two aspects in reciprocal relationship as to sharpness of definition. What seems to be required here is entirely new conceptions of order. Finally evolutionary theory involves the emergence of new types of order in a systematic way, and explanations of this entirely in reductionist,mechanistic terms contradicts itself by not accepting the reality of that which is to be explained. Evolution can only be understood when the possibility of hierarchical ordering is allowed. Such ordering has been described by Bohm, again in terms of the musical analogy:

(1) Ibid., p.29.

> ...in music there can be a variation on a given theme. But then there can be a basic change of order of the whole theme. And then there can be something yet more - an ordered series of such changes in this theme. This latter order is not only new relative to what was there before, but it is also evidently of a higher order. Likewise, we can think of the evolutionary process by considering not merely a set of variations on a particular kind of structure of organism, but also the coming into being of new orders, along with an ordering of the changes of order in the whole process. (1)

It is not possible to give an exhaustive list of the types of order that are possible or even of the types of order that have and will exist. Nor is there any point at this stage in attempting to characterize or delimit all the types of order either possible or actual within the world. With this analysis of the category of order, its meaning should be sufficiently clear to guide particular analyses of the world and to proceed with a characterization of the meaning of the category of process of which 'order' is an abstraction, and this is all that is required.

(1) Ibid., p. 26.

CAUSALITY

The main difficulty about defining the category of causality is the tremendous confusion surrounding its normal usage. I will try to unravel this before indicating how the concept should be understood in the context of process philosophy. The reason that confusion has arisen is that the concept has been analysed in hypostatised form without any reference to the metaphysical systems and basic metaphors from which the different conceptions of causality derive. I will therefore attempt to show the origins of the different conceptions of causality in their metaphysical contexts which will at the same time indicate the difference between the concept when defined from the point of view of process philosophy than when defined in terms of different metaphysical systems.

The concept of cause derives from the Latin 'causa', the standard translation of the Greek 'aiton' and 'aita' meaning the voluntary action of an agent for which s/he could be held responsible. This was originally used in legal contexts but was generalized to mean any action performed to bring about an event or state of affairs in nature or in another agent. The cause is then either the agent or his actions and the effect is whatever is brought about. To cause something is then synonymous with 'produce' or 'bring about' and implies an exercise of power on the part of the agent.

On the analogy of human action, the notion of causality was extended to nature in situations where natural events stand in the same relation to other events or states of affairs as human action stands to the effect which it produces. 'Causality' is used in this sense primarily in situations where people want to effect changes in the world by getting things in nature to do things for them. Thus we use fire to boil water and the fire is then referred to as the cause which brings about the increase in the temperature of the water. Practical sciences are particularly concerned with causes insofar as they can be used to effect changes in the world. Thus in medicine, what the medical practitioner is interested in when s/he is searching for the cause of a disease are those factors which s/he can alter so as to bring about a cure. The concepts of 'producing' and 'compelling' which belong naturally to causality understood as human agency are retained in this extension of the notion. This conception of causality is then used independently of all human action as a form of explanation as when fire is seen to be caused by lightning.

This notion of causality was developed more systematically by Aristotle who conceived of science as the search for causes within nature. He divided causes into four types: the formal cause being the pattern or shape of that which was caused so that the shape of a statue was seen as the formal cause of its being made; the material cause being the 'matter' or potential from which it was made so that brass would be seen as the material cause of the statue; the efficient cause being the agent producing the change as exemplified by the sculptor who made the statue; and the final cause being the purpose of the change, in the case of the statue, the reason why it was made. All nature was interpreted to fit into this scheme with purposes or final causes being attributed to everything that happened. For instance the final cause of a thing's coming to rest from a state of motions was seen as the aim of the thing to be in its natural resting place.

With the scientific revolution which gave rise to modern science there was a turning away from the Aristotelian metaphysics with its foundations in the analogy of the purposeful activity of organisms to the tradition of Pythagoras and Plato. In relation to causality this was effected mainly by Kepler and Galileo and was developed to a conclusion by Newton. According to the Pythagorean tradition, to explain a phenomenon is to discover the laws which it obeys. Kepler equated 'causes' with 'reasons' and regarded the cause of planetary motion to be the set of laws from which the observed phenomena could be deduced. This introduced the idea of necessity in which the compulsion to obey God's laws was equated with the logical necessity which relates premisses to conclusions. Galileo consolidated the shift from explanations in terms of efficient causes to explanations in terms of laws. He discredited the use of final causes as a legitimate form of explanation and substituted exact descriptions in mathematical form for the search for causes as the ideal to which science should aim. Thus scientific explanation came to be thought of as the functional correlation between variables, and an explanation was said to be made when regularities exemplified in a phenomenon were incorporated into a system of laws. Not only final causes, but also efficient causes and agency had disappeared from this ideal. This was associated with the development of the conception of matter as inert and devoid of qualitative features allowing science to be concerned exclusively with the position and motion of bits of matter, justifying a purely quantitative approach to nature. Although Newton framed his ideas in the terminology of efficient causes, his system of laws of motion correlating by means of differential equations the total state of an isolated system at one time with the total state at any other time fulfilled this ideal of scientific explanation. Since the laws of mechanics hold both forwards and backwards in time, there is no becoming and it is pointless to divide the system into an earlier and later phase. This is a complete domination of spatial analogies in terms of which force and creative change are unintelligible.

The real confusion about the concept of cause arises in relation to the mechanistic conception of the world where the idea of cause as agency is combined with causality understood as lawfulness of behaviour to form a hybrid notion. Mechanisms are thought to be efficient causes which produce effects, but these mechanisms are thought to be composed of bits of matter moving in accordance with the laws of motion. In this sense the effect is seen as the necessary consequence of the cause, conflating logical necessity with efficient causality. Cause is taken to be the state of a situation which necessarily results in the effect being produced. This idea of causality is present in Hobbes' definition of cause as:

> the aggregate of all the accidents both of the agents how many so ever they be, and of the patient, put together; which when they are all supposed to be present, it cannot be understood but that the effect is produced at the same instant: and if any one of them be wanting, it cannot be understood but that the effect is not produced ... (1)

Here the cause is both the producer of the effect and the necessary

(1) THE ENGLISH WORKS OF THOMAS HOBBES ed.Sir William Molesworth, John Bohn, London 1839 Vol. 1, p.121f.

and sufficient conditions for the effect to be produced. But these are contradictory. 'Production' involves the becoming of the effect which involves a temporal dimension. Where the relation is a logical one the cause and the effect must be contemporaneous since if the cause has any duration, it cannot be sufficient to produce its effect except at the last instant of the duration, since only then does the effect occur. It follows from this that all causes and effects will be contemporaneous and there will be no time at all.

Hume tried to unravel these problems by developing a conception of causality through his epistemology. On this basis he rejected the idea that causality could be thought of as logical necessity, but accepted the materialist elimination of causal agents from reality. He then tried to understand causality in terms of the relationship between events. But to do this he had to deny the infinite divisibility of space and time, conceiving time as a sequence of moments and the world as a sequence of discrete events. (1)
He then rejected the idea of there being any real connection between events, necessary or otherwise, writing:

> ...there appears not, throughout all nature, any one instance of connection which is conceivable by us. All events seem entirely loose and separate. One event follows another, but we never can observe any tie between them. They seem conjoined, but never connected. (2)

(1) David Hume,A TREATISE ON HUMAN NATURE (1738) J.M. Dent & Sons, London, 1911, Vol.1, p.36ff.
(2) David Hume, AN INQUIRY CONCERNING HUMAN UNDERSTANDING (1748) Bobbs-Merrill, N.Y. 1955 p.85.

The only connection Hume allows is the psychological one that where there is always a constant conjunction between events, the appearance of an instance of the initial event will give rise to an expectation of the second event. On this view, night would have to be seen as the cause of day and vice versa, and the growth of a baby's hair the cause of its growth of teeth. Furthermore the theory requires a conception of what it is for events to be similar that they can be expected to give rise to similar consequences, and where the effects are produced simultaneously with the cause as when sunlight heats a stone, it is necessary to be able to provide criteria for distinguishing the cause from the effect. Neither of these problems has been satisfactorily resolved. Finally the conception of the world as nothing but atomic events makes it impossible for such a theory to take into account the context required for events to be causally efficaceous, and this renders the theory virtually useless.

However this notion of causality has been accepted by the positivists. Understood in terms of constant conjunctions, laws are no longer thought of as the reasons for the behaviour of anything but as descriptions which relate events to each other. It is thought that the requirement that such laws be formulated so as to order our experience in the simplest way possible overcomes the problem of distinguishing between which events cause what within a chaotic world of isolated atomic events. The truth of a law is then nothing but its ability to make predictions from one experienced event to another. When the laws of physics are understood in such terms, all remnants of the notion of causal efficacy are removed from science.

In contrast to materialist and positivist conceptions of causality, causality as understood in terms of auditory analogies implies the reintroduction of power and force into the world. It is the exclusion of sound from a visualized scene which gives the impression of of a world devoid of power, while pure sound gives an immediate impression of powers and forces However this is not the substantialist notion of causality where the agent is seen as something separate from its actions. In terms of the auditory analogy of process philosophy there is the power of self-ordering activities or processes forming themselves and creating, transforming and destroying other processes. Also the causality is of the process as a self-ordering activity and there is no separate contribution made by the order and the activity corresponding to Aristotle's formal and material causes. And there is no notion of purpose or final cause implied by the analogy, although this does not mean that purpose is unintelligible within this scheme, as in the case of materialist causality. It is simply not paradigmatic as it is in the Aristotlian system and therefore must be accounted for in terms of the causality of processes.

There are two aspects to the causality of processes: the conditional cause being the processes which make any particular process possible, and the immanent cause by which a process produces and maintains itself. These aspects can be further subdivided. The conditional cause is the creative cause: the conditions from which emerge a new process or processes; the environmental cause: the processes independent of the process, yet which are necessary for the maintenance of the process; and the material cause: the constituent processes or activities which must maintain themselves in order for the process to exist. The immanent cause is the supervening cause by which a process orders its constituents, and the efficient cause by which a process affects other processes with which it interacts contingently.

Admitting a creative aspect to the conditional cause of a process involves a radical break with previous notions of causality. In creative causation a new process is created which involves a new dynamics irreducible to the conditions which produced it. Such creativity may simply result in the formation of new processes from old as when elementary particles collide and form into different elementary particles, or when hydrogen atoms fuse to form heavier atoms. But the creativity may also involve the emergence of higher levels of ordering as when atoms combine to form molecules which then order the constituent atoms. The acknowledgement of such creativity involves the rejection of the widely held assumption that what is produced cannot be greater than what produced it; that the effect must be contained in the cause. The plausibility of this assumption derives from the domination of thought by visual analogies, while creative causality becomes comprehensible when thought of in terms of the analogy of music. Such creative causality can give rise to an ordered development of creative causation as occurs in an organism where successively higher levels of ordering develop out of lower levels to culminate in conscious behaviour. In this development, each level provides the conditions for the formation of the next level. Such an ordered development can have a fixed end as occurs in lower forms of life, but it can also be open ended as occurs in the ordering of the evolution of life itself, in higher forms of animals which are able to strive to develop new modes of adaptation, and particularly in the human order which is capable of indefinite development of its understanding, moral institutions, and so on.

While once a process has been established the conditional cause of its existen can usually be divided into the external processes which form the necessary environment for its existence and the constituent processes, the ordering of which constitute the process, this is not always the case. Where there is an exchange between the constituent processes and the environment as in open systems this distinction becomes blurred, and it becomes further blurred in th case of living organisms where the environment becomes a world for the organis In other cases where processes are mutually dependent yet irreducible to each other, these must be regarded as part of the conditional cause of each in a way which is frequently difficult to divide into environmental and material cause.

However what is most important from the point of view of process philosophy is that processes must be seen as immanent causes such that they produce and maintain themselves. This not only implies that there is no substantial agent independent of the activity ordering itself, but it also implies that while the duration of the cause is potentially divisible, the actual causal process cannot be analysed into a sequence of causally related events. Rather, as suggested by the analogy with music, the power by which a process forms itsel is exercised as a temporally and spatially indivisible whole. As Edward Pols who has developed a similar notion of causation put it:

> The power is exerted in and through a time-unit, and it cannot therefore be isolated as an exercise of power unless we take the whole time-unit into consideration. Any present moment of that time-unit is like a Bergsonian duree, carrying with it its past as qualifying it, and carrying it with it as a means to its own completion... The action transcends time in the non-mysterious sense that we cannot isolate it at a time and still have an exercise of power. The end of the action is already present in the beginning, and as the action develops, its beginning and all its past phases are carried with it. What exists at any moment of the action - any temporal 'point' in it - is an abstraction, for the time of the entity's action is not composed of discrete instants. And what exists in any period of the action short of the totality leaves us equally unable to isolate the action. (1)

Where enduring processes such as electrons or atoms are concerned, the exercise of power should not be regarded as being the whole duration of the processes, nor as a series of discrete durations, but as continuous and pulsational, with each pulse corresponding to the minimum duration required for the process to manifest itself. Where a process is not unchanging but developing as in an evolutionary process, then the full process is only manifest when the development is complete, the exercise of power taking the whole duratio

Where a process is an ordering of constituent processes, the immanent causality of this involves a supervening causality through which the constituents are constrained. It has already been pointed out that

(1) Edward Pols "Power and Agency" in INTERNATIONAL PHILOSOPHICAL QUARTERLY Vol. 11, 1971, pp.293-313, p.297.

such effects are achieved through providing the environment within which the parts function and this determination of the environment is again in the form of a spatio-temporally indivisible unit of action. But this causal action of the whole is nothing more than the ordered causal activities of the multiplicity of constituent processes. But to grasp the nature of the spatio-temporally extended whole it is always necessary to see the exercise of the causal powers of the parts which go to make up this whole as situated participants within the whole and not as separate causal activities. If for pragmatic reasons one does isolate one event as a cause and looks at another event as the effect of this, this must be always understood as an artificial abstraction which only has any meaning because the whole context of the self-stabilizing process within which this abstraction has been made has been taken for granted.

Where a process is modified or destroyed through interaction with another process, the other process must be regarded as producing this change and is the efficient cause of it. Such change can be mutual so that each process must be seen as the efficient cause of the change in the other while being modified by the other in turn. Where an electron is deflected by a magnet, the magnet is the efficient cause of the electron's deflection. Where two electrons repel each other, each is the efficient cause of the other's deflection. Where a crystal of salt is dissolved by water the water is the efficient cause of the dissolution of the crystal. However what is the efficient cause from the point of view of that which is changed is simply an exercise of the self-ordering activity of that which produces the change. The deflecting of electrons by a magnet is simply part of the ordering activity of the magnetic field. It is part of the ordering activity of water to constrain atoms to constitute a liquid state.

What distinguishes an efficient causation from a supervening causation is that the former is merely contingent rather than being an essential aspect of the self-maintaining activity of a process, and the effect is generally external to the process. However as with the distinction between environmental and material causation, the distinction between supervening and efficient causation becomes blurred in the case of open prcesses exchanging matter with their environment, particularly living processes and where processes are in more complex forms of interdependence.

When the world is understood in terms of these forms of causality, the views of causality which have been taken to have a central place must be seen as only derivative. Where a situation is analysed into cause-effect relations between events this must be seen as of no ontological importance but as a reflection of pragmatic interests. It is a way of conceptualizing the world to indicate in which ways agents can effect changes within it, and abstracts from the total context. When such a way of understanding the world is universalized, this must lead to a failure to grasp the dynamic interdependence of things and the way they stabilize themselves.

Also laws must be seen as descriptions of causal tendencies rather than as simply the means for making predictions from one observation to another. The discovery of regularities which can be described in terms of laws must then be seen as evidence for the existence of causal processes, and these must be understood to make the regularities intelligible. However such regularities are unlikely to be observed without human intervention except in cases of isolated processes such as the solar system, and even in this case the regularity is interfered with to some extent by outside forces. More often causal tendencies are only able to manifest themselves fully in ways which allow predictions to be made in situations which have been artificially contrived to isolate the processes. In a universe which a creative process of becoming continually giving rise to new processes it is absurd to think that it could be entirely described in terms of a limited set of laws. And more basic to descriptions in terms of laws must be descriptions of the types of processes involved and their conditions of stability which enable their causal tendencies to be described in terms of laws, and there is no reason to think that where processes are in complex relationships as in human societies that anything much is gained by formulating the causal tendencies of these processes as laws.

SPACE-TIME

While an auditory analogy is taken as basic, space and time cannot be thought of as the containers existing independently of the other entities in the universe. Rather the spatio-temporal order must be seen as one of the structures which come into being with processes of extensive becoming. However, being derivative, the spatio-temporal order must be regarded as considerably more complex than it has been thought to be by materialists.

The most basic extensive becoming is that of one process. This is an order of extensive duration where the extensiveness is understood as dynamic, flowing and placeless rather than a static order of relationships between parts, while the durational aspect of an existing process is an unfinished becoming in which there is an asymmetry between the relationship between the past and the present and the future and the present. The past has been formed, and this formation is cumulative, while the future is not simply determined and waiting for its appointed time for actualization but is open and yet to be established. Considering a process in isolation this extensive duration is unanalysable into parts and it makes no sense to talk of locations within this extensive duration.

However the universe consists of a multiplicity of co-becoming self-individuating processes and it is in terms of the potential relationships between these that the notion of location becomes significant. Where sub-processes differentiate themselves from each other within the extensive becoming of a process and take on an autonomy of their own there comes into being an order of potentialities for interaction and succession between these sub-processes. These are the orders of space and time respectively. However, space and time cannot be treated separately because they must both be defined in the same terms, that is, in terms of potentials for causation. Intervals of time must ultimately be defined in terms of the multiples of the minimum durations required for processes to produce themselves, and distances must ultimately be defined in terms of the time required for there to be an interaction between processes. The sub-processes can then be seen to be located within this internal spatio-temporal order of potentialities between constituents, the spatio-temporal structure of the supervening process.

On this basis it becomes possible to think of processes being located within space. But since the space within which processes are must be understood in terms of the extensiveness of the whole process within which they have differentiated themselves, it must be acknowledged that there are a multiplicity of spaces, from cosmic space within which galaxies co-exist, galactic space within which stars co-exist, solar space within which planets co-exist with each other and with the sun, geological space, ecological space, biological space, chemical space, to nuclear space, and so on. Since the space of processes does not always involve a juxtaposition but can involve interpenetration of processes, and since processes are in more complex relationships than simple hierarchical orderings, there must also be more complex types of space.

Being located in time is similarly complex. There are a multiplicity of processes in the universe requiring different durations to produce and manifest themselves. Thus an electron requires only the duration necessary for it to complete one oscillation in order to become an electron, an atom requires the duration required for its electrons to complete an orbit, a person requires a life time, while it is possible that the universe will never fully become. Thus the becoming of the universe must be seen as multilinear rather than unilinear with a process being 'in' the time defined in relation to the supervening process of which it is a constituent. Thus a crystal is an ordering of atoms so the activities of the atoms can be thought to take place within the temporal order constituted by the crystal as a whole. In the same way stellar changes can be conceived of as taking place 'in' cosmic time, geological changes 'in' stellar time, metabolic changes 'in' biological time, and so on. In each case, the process which defines the time must be considered outside this time since its duration is indivisible within the time defined in terms of it. The universe then cannot be conceived of as being 'in' time at all but is simply an unfinished process of extensive becoming.

This conception of temporality implies an ambiguity in the status of past activities. A 'pulse' of an individual process, where a pulse is conceived of as the minimum duration required for the process to manifest itself, can be said to have taken place within the time defined in terms of a supervening process. In this time the pulse has finished and no longer 'is'. But the pulse is a constituent of the higher process which is not temporally divisible in the same way. This means that the pulse is part of an indivisible duration which exists in the present defined in relation to a still higher process.

Ultimately all processes have an immortality as part of the universe as a whole. Thus it is necessary to view events in the past as both having ceased to exist and as a real part of the present. This is unintelligible so long as we think in terms of visual metaphors and unilinear concepts of time, but can be seen to make sense if we think about the relation between a movement in a symphony which has been played and the present in which the symphony is still playing.

CONCLUSION

In this chapter I have outlined the nature and tasks of metaphysics, at the same time justifying the approach taken in the development of this thesis. It was seen that the most important feature of a metaphysical system is the development of an ontology, and the nature of the problems involved in this were indicated through an analysis of the development of Greek philosophy, the development of materialism in the seventeenth century, and the attempts to overcome the problems of materialism by Leibniz and Hegel. It was argued on this basis that process philosophy is the ontology most able to resolve these problems, and a version of this was developed on the basis of an auditory analogy. But ultimately an ontology must be tested through its ability to interpret detailed aspects of the world. To succeed a new ontology must be able to do this more successfully than the prevailing ontology. It is generally thought that materialism has been most successful in the physical sciences, but that it is having increasing success in understanding the biological and human realms. I will now try to show how materialism has been superseded in the physical sciences and how process philosophy has the potential to lead to a far deeper understanding of phenomena in all domains of enquiry.

CHAPTER IV

THE PHYSICAL WORLD

> Ontology as the ground of ethics was the original tenet of philosophy. Their divorce, which is the divorce of the "objective" and "subjective" realms, is the modern destiny. Their union can be effected, if at all, only from the "objective" end, that is to say, through a revision of the idea of nature.
>
> Hans Jonas
> THE PHENOMENON OF LIFE

Having outlined my ontology I will now try to justify if by showing its efficacy for interpreting the world generally. In this chapter I will show to what extent it can form the basis of an understanding of the physical world. To be considered successful an ontology must be able to accommodate the achievements made on the basis of alternative ways of conceiving the world. But it should be able to do more than this. It should indicate ways in which problems can be overcome and point the way towards new dimensions of being incomprehensible in terms of other ontologies.

It is in the physical sciences that materialism is supposed to have been so successful and it has been this supposed success which has made materialism the dominant ontology. I will briefly indicate the nature of this success. But it will be pointed out that a large amount of this success has been mythical and that in one place after another the physical sciences have broken out of the materialist framework of concepts. In particular it will be pointed out that atomism has been increasingly displaced by field theory which is not a set of ideas which can be developed in conjunction with materialism but which is fundamentally opposed to it. With the developments of the theories of relativity the ontology of field theory must now be regarded as the dominant ontology in physics.

However it will be argued that the lack of attention paid to ontological issues following the positivistic influence on science has led to a situation in which the inadequacies of both materialism and field theory are blurred by the use in each case of concepts deriving from the opposing ontology. It will be argued that relativity theory has in fact revealed the inadequacy of field theories as well as materialism and requires the development of a different ontology. I will then attempt to show that the theories of relativity can better be understood from the point of view of process philosophy, and furthermore, that process philosophy suggests new ways in which the theories might be developed. Quantum theory will then be considered and it will be shown how in this domain field theory and materialism confront each other most clearly. It will be argued that the complementary theory which attempts to reconcile these two ontologies is unsatisfactory, yet neither ontology is capable of interpreting all quantum phenomena. It will then be argued that attempts to overcome the problems of quantum theory on the basis of process philosophy in terms of which both the field-like aspects and the particle-like aspects of the domain can be understood, are most likely to be successful.

Having considered process philosophy in relation to the most macroscopic and the most microscopic aspects of the universe I will then examine the intermediate levels of being, giving some indication of the various types of process there are and the sorts of relationships between them. I will be particularly concerned with those types of processes which are unintelligible in terms of materialism and field theory, but which are entirely comprehensible in terms of process philosophy. These include hierarchical processes and the self-animating processes which develop in situations which are far from thermodynamic equilibrium. Also I will point out the implications of the process view of the physical world in relation to such problems as the nature of time, causality, reductionism and determinism.

Apart from being able to interpret what has been achieved in science on the basis of alternative ontologies and showing how problems within the corpus of these achievements can be overcome, process philosophy will also be seen to indicate the need for new types of investigation. Most notably, while materialism has focussed attention on the constituents of things and their relationships, the perspective of process philosophy suggests that it is also necessary to focus attention on the way in which processes emerge from their environments, how they maintain themselves against the vicissitudes of these environments and how processes constrain their constituents. Process philosophy also focusses attention on the diversity of types of order in the world and the need to study each of these in their own right. As it was pointed out in the last chapter, where activity is taken as paradigmatic rather than a particular type of order, all order in the world becomes problematic and needs to be understood in its own terms and accounted for.

Associated with the adoption of activity as paradigmatic it will be seen that physics has required the development of mathematical expressions which assume less order until it has been able to assume only the most basic invariances. I will end this chapter with a consideration of the relationship between mathematics and ontology and show how the appropriate mathematics for process philosophy is topology.

Since science has developed on the basis of ontologies other than process philosophy, from the point of view of process philosophy the achievements of science must be regarded as fragmentary and incomplete. It would be possible to speculate on the basis of process philosophy as to what sort of theories should be developed in the future. For instance the dualism between particles and fields and the problems of developing a unified field theory in traditional science are generally not considered together, but from the point of view of process philosophy they should be. What are understood as fields should be understood as the activities of processes, while what are understood as particles should be understood as centres of self-stabilizing orderings of such activities, that is, as the centres of processes. That there are different fields which are maintained in existence should be regarded as a problem to be accounted for not in terms of the fields, but in terms of the self-stabilizing processes. The fields should be seen as the different types of activities in which processes differentiate and maintain themselves by what Heraclitus would have referred to as a tension of opposites. If this were the case the relationship between fields could only be fully understood in terms of the self-stabilizing activities or processes. The focus would then shift to the problem of how these processes maintain themselves. However such speculations as these cannot achieve much in themselves and would only be of significance if they were worked out in detail with appropriate mathematics. Consequently I will confine myself to interpreting existing scientific theories in terms of process philosophy so as to indicate their problems and how these might be overcome if the theories were developed in accordance with process philosophy.

MATERIALISM

The central assumption of materialism is that there exists an irreducible, brute matter characterized by the property of simple location in space and time scattered throughout space in a flux of configurations. All other assumptions are based on this. Various facets of the history and nature of materialism have been described in each of the previous three chapters and so I will give only a brief outline of materialism and its problems in this section.

The greatest single achievement of materialism was Newton's development of mechanics. Newton's physics can be seen as the culmination of a reaction against the pre-eminence given to the experienced concrete processes of nature in Aristotle's physics. The reaction began with Cusanus, but was consolidated when Copernicus rejected the central position of the earth in order to conceive the movements of the sun and the planets in a more simple and unified way. Then Galileo reverted to the line already mapped out by Plato and began with an ideally isolated frame of reference. He sacrificed the possibility of applying the laws directly to natural events as they were experienced and worked with the mathematical formulation of the limit. For instance he asked how a body would fall in a vacuum and how a body would move on a frictionless surface though these situations could not be produced in an experiment. Rather he extrapolated backwards from experimental situations and then explained these in terms of the limit. Newton completed this development when he united the two entirely separate realms of experience: the movement of stars and planets and the movement of bodies on earth, deducing these from a set of abstract laws characterizing the motion of matter.

Newton conceived matter to have only the properties of extension in space, impenetrability, indestructability and inertia, that is,the property of retaining a given state of motion. In other words only that which is measurable was deemed to have real existence, while qualities such as colour, bitterness and pitch were seen as mind dependent, the consequence of the inexplicable intrusion into the world of sensible beings. Matter was thought to be corpuscular in form, the ultimate indivisible corpuscles being atoms. Wholes were thought to be nothing but the sum of their parts, and complexity was thought to be capable of being entirely understood in terms of the laws governing the parts. Thus Newton wrote: "the extension, hardness, impenetrability, mobility and forces of inertia of the whole, result from the extension, hardness, impenetrability, mobility and forces of inertia of the parts." (1)

Apart from the forces of inertia and the effect of interaction between bodies in contact, Newton also had to allow for action at a distance. He dealt mostly with gravitation, but also acknowledged electricity as a force and postulated a force which acts at very close distances to account for the solidity of large bodies. As was seen in the last chapter Newton conceived of this as evidence of the deity acting through space, but in his exposition of mechanics he abstracted from this ontology and made no such claim. After the initial misgivings, the scientific

(1) Quoted by W. Heisenberg in THE PHYSICIST"S CONCEPTION OF NATURE, tr. Arnold J. Pomerans, Hutchison, London, 1959, p. 116f. from Newton, THE MATHEMATICAL PRINCIPLES OF NATURAL PHILOSOPHY Book III.

followers of Newton came to accept that there is simply action at a distance.

The motion of matter was understood to take place within space and time, each of which were defined in the Scholium as having an existence independent of each other and of their content. Thus Newton wrote: "Absolute space, in its own nature, without relation to anything external, remains always similar and immovable." (1) and "Absolute, true, and mathematical time, of itself, and from its own nature, flows equably without relation to anything external..." (2) It was overlooked that it was necessary to conceive of space as being immutable through time. The uniformity and unilinearity of time stood as counterparts to the immutability of space. While the basic spacial relation was seen as juxtaposition with points in space beside one another,the basic temporal relation was seen as succession with instants following one another. This provided the framework within which motion could be understood as "the translation of a body from one absolute place into another" (3) through time where a place was conceived as "a part of space with a body takes up..." (4) Since matter was conceived of as being impenetrable, when the paths of two atoms intersected, it was necessary that there be a collision, the impact of which would change the direction of their movements with the final state of motion being completely determined by the original

(1) I. Newton THE MATHEMATICAL PRINCIPLES OF NATURAL PHILOSOPHY, A. Motte's translation, revised by Florian Cajori, Uni. of California Press, Berkeley, 1947, p. 6.
(2) Loc.cit.
(3) Ibid., p. 7.
(4) Ibid., p. 6.

state of motion.

However Newton's conceptual framework was in competition with a number of others, notably those of Descartes and Leibniz. These two frameworks were themselves in competition, and Cartesians themselves divided into two groups, one emphasising mathematical formalizability competing with the Leibnizians while the other, the matter theorists opposed the idea of action at a distance and directed their arguments against the Newtonians. It was seen in the last chapter that the ontology which came to underlie the materialist conception of the world was a fusion of the ideas of these different groups, and consequently lacked the coherence of any one of them.

Despite this incoherence, materialism successfully accounted for a large number of phenomena. Apart from mechanics, kinetics and the explanation of gases, it has been most successful in the field of chemistry, eventually giving rise to the theory of elements which in turn were explained as composites of electrons, protons and neutrons. This success has led to the situation in which materialism is virtually dogma in chemistry to this day. However in physics materialism has proved to be increasingly inadequate. Newton's corpuscular theory of light was eventually overthrown by the wave theory. To overcome this problem an ether permeating all space was postulated to exist which could carry the light vibrations. This was nothing but an ad hoc hypothesis to save the conceptual framework. Finding that these waves are transmitted in discrete quanta does not make light more assimilable to materialism but makes it even more incomprehensible. Accounting for electricity in terms of the flow of electrons would seem to be a victory for materialism. But the theory of electricity led to the rise of the concept of field in opposition to materialism which has since become the dominant concept in this domain. The failure of materialism to give an adequate account of electrical phenomena was further manifest when it was realized that electrons behave like waves as well as like particles. Boltzmann's account of thermodynamics in terms of statistical mechanics seemed to be a victory for materialism in this field. But not only is Boltzmann's work full of difficulties which are generally not acknowledged by materialists, though they were largely responsible for Boltzmann's suicide, statistical thermodynamics involves the concept of irreversible processes which are unintelligible in terms of materialism. To materialists, the concept of entropy remains an enigma.

What these problems indicate is that materialism has not been as successful as it has been made out to be. This has had serious consequences in that problems in physics have not been honestly confronted. This has not only been so in the case of thermodynamics but also in quantum theory and more recently in elementary particle theory. Quantum theory for instance has so far only effectively accounted for the behaviour of hydrogen, and it is held on faith alone that if the mathematics were worked out the more complex atoms could be understood in the same terms. In elementary particle theory there is a persistent tendency to refer to particles even though the notion of 'particle' is totally unsatisfactory as a description of the phenomena involved. Thus James Dodd in his account of quark theory tells us that the notion of 'particles' is an unsatisfactory base for microphysics since elementary entities can be created and destroyed and are imagined by physicists to be "locally manifest energetic states" but he continues to speak of quarks as "the fundamental building blocks of...matter." (1) By speaking of these phenomena as particles the elementary particle theorists are then able to avoid facing the problem of how singularities within an energy field are capable of enduring.

Most importantly the domination of informal discussions by the language of materialism has hidden the fact that materialism has been replaced by field theory as the dominant ontology in physics. But using field theory while continuing to use the language of materialism has enabled field theory to develop without any serious questioning of its coherence. I will therefore examine the rise of field theory and attempt to show what it implies and the problems with which it is faced if it is to be regarded as a serious contender for the ontological foundation of science.

(1) James Dodd "Colouring in Quark Theory" in NEW SCIENTIST Vol. 81 1st March, 1979 pp.664-667, p.664.

FIELD THEORY AND THEORIES OF RELATIVITY

The successful rival to materialism and the ontology which now has pre-eminent place in modern physics is field theory. In contrast to materialism with its emphasis on discreteness and the priority given to parts, field theory emphasises continuity and gives priority to the whole. The parts cannot be separated from the whole of which they are part, and there is only one fundamental individual, present everywhere. The opposition to atomism is described by a contemporary field theorist in the following way:

> With the continuum view of field theory, the apparent discreteness of matter in the microscopic domain is, in reality, a high field concentration in a particular locality, while the field concentration in other localities would be sufficiently weak that they might appear with zero amplitude. This would be analogous to describing particles of matter like the ripples on the surface of a pond. With the atomistic view, any particular atom is separable from the rest of the system, while maintaining its individuality. On the other hand, in the pond example, one cannot remove a ripple and then study it under a microscope as an individual ripple! It is rather a manifestation of the whole pond. Still, one can study the motion of the individual ripple - its energy, momentum, location of its maximum amplitude as a function of time, etc. But this is an entity that is of the pond; it is a mode of behaviour of the entire pond that is in principle without parts. With the atomistic view, the whole is the sum of parts. With the continuous field view, there are not separate parts. Rather, there is only one closed system. (1)

Corresponding to these alternative ways of understanding the nature of being, there are different conceptual schemes. While both ontologies take continuous space and time as basic, the relationship between these

(1) Mendel Sachs IDEAS OF THE THEORY OF RELATIVITY Israel Universities Press, Jerusalem, 1974, p. 98.

is different. In the atomic scheme, velocity, acceleration (at a spatio-temporal point), positions and sets of locations, distances, torques and so on are the primary concepts used in description. In field theory what is important are the continuous distribution properties, and we speak of momentum and energy density, energy momentum and inertia tensors, currents, and various volume integrals of these quantities. Rather than interacting bits of matter, we speak of waves, continuous distributions of property values or fields, superposition and interference.

It is difficult to specify the origin of this ontology. It is possible to regard the earliest Greek philosophers, and in particular Anaximander, as precursors to this position. C.A. Hooker takes Parmenides as the original exponent of the holistic view, (1) but Parmenides, working in the tradition of thought of the Milesians and conceiving the world as a whole consisting of one substance, came to the conclusion that there could be no change. This is not characteristic of field theory and rather indicates that Parmenides' position was something of a reductio ad absurdum of the field position which was already in existence. A similar opposition to that occurring in modern science between particle theory and field theory developed after the third century B.C. between the Epicurean atomists and the Stoics whose emphasis on continuity and the primacy of the whole led them to examine for the first time such phenomena as the propogation of waves. (2)

(1) C.A. Hooker, "Metaphysics and Modern Physics: A Prolegomenon to the Understanding of Quantum Theory" in CONTEMPORY RESEARCH IN THE FOUNDATIONS AND PHILOSOPHY OF QUANTUM THEORY ed. C.A. Hooker, D. Reidel, Dordrecht, 1973, p. 209.
(2) S. Sambursky THE PHYSICAL WORLD OF THE GREEKS Routledge & Kegan Paul, London, 2nd ed. 1960, Chapter VI, "The World of the Continuum".

In modern science the first successful attempt to deal with continuous phenomena was Euler whose hydrodynamics was a mathematically expressed account of the field of motion of a fluid. (1) This made it possible to describe the transmission of action through a continuous field medium. The mathematical concept of a field which originated in Euler's hydrodynamics is that of a region of space in which each point is characterized by some quantity or quantities which are functions of the space coordinates and of time. The properties of the field are then defined by partial differential equations in which the quantities are dependent variables and the space and time coordinates are independent variables. This hydrodynamic model then served as a metaphor for understanding other continuous phenomena such as the propagation of sound and of heat flow in a solid body.

However in these theories the field was essentially auxiliary to the underlying substratum in which the phenomena of waves or heat flow occurred. This began to change when in the first quarter of the nineteenth century light came to be understood in terms of a wave field which meant the existence of a field in empty space. Field theory began to take precedence over materialism when the fundamental description of reality was thought to be in terms of fields of force which are then more basic than what are taken to be things. The first steps in this direction were taken by Boscovitch and Kant in the eighteenth century. Boscovitch considered atoms to be nothing but points and described forces as being a function of the distance between

(1) Mary B. Hesse FORCES AND FIELDS (1962), Greenwood, Westport, 1970, p. 192.

atoms. In this way forces took priority over atoms, though it was still conceived of as action at a distance. Kant defined matter in terms of repulsive force, but drew a distinction between repulsive force and attractive force which acts at a distance. It was Faraday who, through his attempts to understand electricity and magnetism, first put forward the idea that what there really are, are fields of forces. As he wrote:

> matter fills all space, or, at least, all space to which gravitation extends...for gravitation is a property of matter dependent on a certain force, and it is this force which constitutes the matter... (1)

In such a world matter is seen as continuous, with atoms being elastic, deformable and mutually penetrable. Faraday was able to see electricity and magnetism as aspects of a single phenomenon, but was unable to explain gravity in the same terms. However he believed that it was necessary to develop a unified field theory which would incorporate all the known forces. (2)

Faraday's ideas were given mathematical form by Maxwell who saw these ideas as being based on analogies of fluid flow and breaking with normal mathematical methods by beginning with the whole and arriving at the parts by analysis. (3) By means of Maxwell's equations the

(1) Faraday, EXPERIMENTAL RESEARCHES IN ELECTRICITY AND MAGNETISM, London, Vol.II, 1844, p. 293, Cited Hesse (1962) op.cit. p.201.
(2) Mendel Sachs IDEAS OF THE THEORY OF RELATIVITY Israel Universities Press, Jerusalem 1974, p. 131.
(3) Mary Hesse (1962) op.cit. p. 210.

energy present at each point in space is mathematically represented without implying that any mechanical events are happening there. On the basis of these equations he then predicted the existence of electro-magnetic radiation, thus explaining light. With this development, the concept of field took preeminence over the postulated aether which was supposed to be the mechanical carrier of all waves.

But the notion of field was not embraced and the concept of an aether was clung to tenaciously as it satisfied the notion of substance embedded in the materialist mind-set. However, aether had its problem. The notion of an aether required that a particular inertial system be given preference: that of the aether at rest. This was in opposition to classical mechanics in which, according to Galilean relativity, all inertial systems are held to be equivalent. If there were an aether, Maxwell's equations would have to be different for different reference systems. The problems this gave rise to led Einstein to put forward his special theory of relativity according to which all inertial systems are equivalent and the velocity of light is invariant for all systems. This finally excludes the possibility of a mechanical explanation of the field.

The special theory of relativity undermined materialism and lent support to the ontology of field theory in a number of ways. The classical conceptions of matter, space and time were undermined. In materialism, matter is taken to be immutable, and this immutability is defined in terms of the constancy of mass of the elementary units. But in terms of the special theory of relativity mass is a function of velocity with inertial mass increasing with velocity. The classical picture of space and time as uniform and infinite in every direction, being the container of all the configurations of matter is also undermined. The simultaneity of distant events must now be seen as only relative to particular inertial systems, being different in each. This means that space and time cannot be treated separately.

It is implied by the special theory of relativity that the laws of nature must be in the form of continuous field variables defining points in the field in terms of the whole. (1) The view that the theory implies the primacy of the totality is reinforced by Minkowski's geometrical formulation of the theory. (2) In this, position in space specified by three coordinates is plotted against a time coordinate. The graph of an inertial system is then referred to as its 'world line'. The relationship between different inertial systems can be plotted on such a diagram, showing the interdependence of the space and time coordinates. This leads to the view of the universe as a four dimensional continuum, thought of as a four dimensional space. (3)

This four dimensional space is still conceived to be the container of its contents. However the geometrization of the special theory suggested to Einstein a way of interpreting fields in terms of non-Euclidean space in which the world lines could be seen as curved.

This idea was adopted in Einstein's general theory of relativity in

(1) Mendel Sachs, op.cit. p. 108.
(2) Cornelius Lanczos ALBERT EINSTEIN AND THE COSMIC WORLD ORDER, John Wiley & Sons, N.Y. 1964, p. 47ff.
(3) Albert Einstein RELATIVITY: THE SPECIAL AND THE GENERAL THEORY 15th ed. (1952) tr. Robert W. Lawson, Crown Publishers, Inc.N.Y., 1961, p.150.

which an attempt was made to put accelerating reference systems on the same footing as inertial systems. This involved taking into account inertia and gravity. Inertial mass and gravitational mass in Newtonian physics are numerically equal while serving totally different functions. Einstein accounted for this equality by conceiving of inertia as a special case of gravitation, and the law of gravitation as a generalized law of inertia. To do this he developed a gravitational field theory which attempted to incorporate Mach's principle in which inertia is explained in terms of the total distribution of matter in the universe. This gravitational field theory is novel in that space-time itself is taken as the field and gravitational potentials are associated with the geometrical character of space-time. This is made possible by using Reimannian geometry. This contrasts with classical field theories in which potential functions depend on coordinates in a previously given Euclidean space. In the gravitational field, inertial frames are called 'flat' while regions with non-uniform gravitational fields are 'curved'. In this scheme a free particle will move along the shortest path between two points, the geodesic, which in a gravitational field is determined by the metric of that field. Matter itself was then defined as a curvature in the space-time continuum, thus identifying matter and the space-time continuum and seeing it as a manifestation of the whole field.

This field implies undivided wholeness. Particles are taken to be an abstraction from the total field corresponding to regions of very intense field or singularities. To account for stable particle-like singularities, it is necessary to use non-linear equations, that is equations whose solutions cannot simply be added together to yield new solutions. (1) This means that there are no 'normal modes' of the field which can be regarded as moving independently of each other, and analyses into parts can have only limited validity. This means that it is not possible to analyse the field into extensionless particles or space-time points.

The most extreme view drawn from the theory of relativity is that all ideas of becoming must be excluded and that the universe must be seen as a single four dimensional plenum. In this vein Sir James Jeans wrote:

> time is interwoven with space (so) that it is impossible to divide it into past, present, and future in any absolute manner. This being so, the tapestry cannot consistently be divided into parts which are already woven and those which are still to be woven. Such a distinction can have no objective reality behind it...The shortest cut to logical consistency was to suppose that the tapestry is already woven throughout its full extent, so that the whole picture exists, although we only become conscious of it bit by bit - like separate flies crawling over a tapestry. (2)

It is in this form that field theory comes to approximate the views of Parmenides, and as such has been upheld by such diverse thinkers as D. Williams, Quine, Nelson Goodman, Strawson, Herman Weyl, Ernst Cassirer and Adolf Grünbaum.

Up until the end of his life Einstein tried to develop a unified field theory which would incorporate electromagnetism and quantum theory with gravitation, but he was not successful. In particular

(1) Mendel Sachs (1974) op.cit. p. 138ff.
(2) Cited by Milič Čapek in "The Myth of Frozen Passage: The Status of Becoming in the Physical World" in BOSTON STUDIES IN THE PHILOSOPHY OF SCIENCE Vol. 2 Humanities Press, 1965, p. 459.

quantum theory with its emphasis on discreteness has proved a major obstacle to such a theory. But quite apart from this the field laws for electro-magnetism and gravity break down for very great concentrations of energy, that is, where electric charges or matter are present. This is admitted in THE EVOLUTION OF PHYSICS by Einstein and Infeld revised by Infeld in 1961, in which it is stated: "At present we must still assume in all our actual theoretical constructions two realities: field and matter." (1) Furthermore there are difficulties between the two theories of relativity in that in the special theory of relativity a fundamental role is given to the possibility of signalling from one region point to another. Yet for this to be possible the source of the signal must be clearly separated from the region in which it is received in the sense that the two regions must be essentially autonomous in their behaviour. (2) But such autonomy is inconsistent with the emphasis on undivided wholeness of the general theory of relativity.

These problems indicate that while field theory has successfully undermined much of materialism; eliminating the idea of material substratum to account for the activity of the field, showing the inadequacy of the notion of immutable matter, and indicating the impossibility of a reductionist analysis of the world; it is not able to explain all that is in the world in terms of the whole. What is indicated is the

(1) Albert Einstein and Leopold Infeld THE EVOLUTION OF PHYSICS 2nd ed. 1961, Cambridge Uni. Press, Cambridge, 1971, p. 243.
(2) David Bohm "Quantum Theory as an Indication of a New Order in Physics. Part A. The Development of New Orders as Shown Through the History of Physics" in FOUNDATIONS OF PHYSICS, Vol. 1, No. 4, 1971, p.371.

need for an ontology which acknowledges the interdependence of every aspect of the world while recognizing the partial autonomy of processes within it, that is, process philosophy. This is most evident in the case of quantum theory in which field theory and particle theory come into direct confrontation. However before examining quantum theory and its ontological implications I will try to show how the theories of relativity can be more satisfactorily interpreted from the point of view of process philosophy than from a Parmenidean point of view.

RELATIVITY THEORY AND PROCESS PHILOSOPHY

According to my version of process philosophy the most basic category is process understood as self-ordering activity. Processes involve extensive becoming, and space-time is understood as being secondary to process rather than processes being in space-time. To interpret the theories of relativity in terms of process philosophy is to understand it in terms of these categories while at the same time using the theories to give the categories a more definite meaning.

The first category of my process philosphy relevant to relativity theory is that of activity. It was pointed out that relativity theory undermines the notion of immutable matter by making mass a function of velocity. The relationship between mass and energy is given by the famous formula $E=mc^2$ and rather than having separate conservation laws for mass and energy, relativity theory implies one law asserting the conservation of mass-energy. The interdependence of mass and energy is revealed not only in relation to the masses moving at large velocities but also in relationship to the energy given off in nuclear reactions. For instance when positrons and electrons collide, they annihilate each other, giving off gamma rays which dissipate in the surrounding environment, producing heat. Energy can no longer be thought of in terms of the motion of particles, but must be understood on its own terms. Now the question arises: What is energy?

Because there is a conservation of energy there is a tendency to think of it as a permanent substance, like fluid. But energy cannot be thought of in this way. Rather, energy appears as the invariant function in an activity of an isolated system. Thus in an isolated system of moving bodies $\frac{1}{2}mv^2$ is an invariant, while an electronic current I flowing through a coil of inductance L has energy $\frac{1}{2}LI^2$ which is conserved if there is no resistance. This can then be transformed into a corresponding quantity of mechanical energy or heat. It can be seen from this that energy is an invariant but transformable aspect of a system and never appears as an independently existing substance.

To understand energy a distinction must be drawn between two kinds of energy: energy of outward activity as for instance when a body changes its position, and energy of inward activity such as the thermal motions of constituent molecules which cancel out on the large scale. (1) These terms are relational since what is inward activity at one level is outward activity at the lower level of constituents. Potential energy is inward activity which can be converted to outward activity. For example the diminishing potential energy in a body accelerating in a gravitational field corresponds to decreasing inward activity of the body. With the distinction between inward and outward it is possible to understand mass and energy as related aspects of the same phenomenon: activity.

Conversely, all energy: that of inward and that of outward activity, contribute in the same way to the mass. Outward activity of a system increases the mass of the system in a straightforward way which is easily calculated from Einstein's equations. But the rest mass of a system

(1) David Bohm THE SPECIAL THEORY OF RELATIVITY, W.A. Benjamin, Inc. N.Y. 1965, p. 116 makes this distinction.

can also be regarded as due in part to the velocity of movement of its constituents. However, this leaves the problem of the nature of the rest mass of the most elementary entities. Before attempting to throw some light on this I will look at the opposite extreme: that of activity where there is no rest mass. If rest mass is defined as inner activity, then it must follow that where there is no rest mass, there is no inward activity and all activity is outward, involving displacement through space. This is so of all forms of radiation which then travels at speed c in all frames of reference, and so can never be considered as at rest. This indicates that for there to be a velocity at less than the speed of light which enables the activity to be treated as being at rest there must be reflecting of activity inward cancelling out the velocity of outward activity. This suggests that elementary particles or entities should be thought of as being an infolding of purely outward activity. The creation of a particle from radiation would then be seen as the setting up of a relatively invariant pattern of activity (1) which is not constituted of any substratum apart from this activity. For this to happen the pattern itself must in some way be self-maintaining. Thus an elementary particle can be thought of as a self-ordering activity, or a process.

Such an understanding of elementary particles is supported by modern relativistic quantum mechanical ideas concerning the movement of an electron. (2) For example Dirac's equations imply that an electron travels at the speed of light in trembling movements called Zitterbewegungen.

(1) Ibid., p. 119.
(2) David Bohm "A Proposed Topological Formulation of the Quantum Theory" in THE SCIENTIST SPECULATES ed. Irving John Good, Heinemann, London, 1962, p. 307.

The average velocity is then less than the speed of light and this corresponds to a circulation in a spiral path which gives rise to the phenomena associated with electron 'spin'. The annihilation of such a particle can be thought of as the breaking down of the order with the release of activity into a purely outward form, that is as radiation.

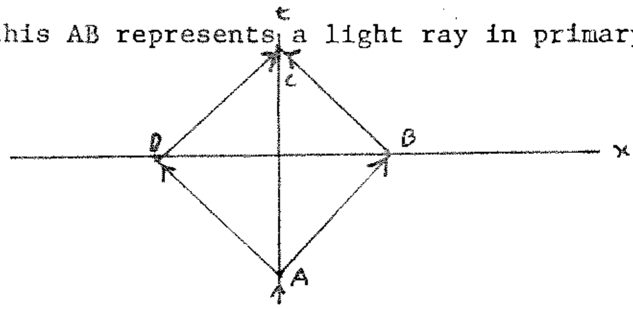
The rest mass of such an elementary process can be understood by means of one of Einstein's thought experiments. (1) He considered a box containing radiant electromagnetic energy in thermodynamic equilibrium with the walls. This energy produces a radiation pressure on the walls of the container which balances out so long as the box is at rest or in uniform motion. But if the box is accelerating then radiation which reflects off the rear wall will gain more momentum than the radiation which reflects of the front wall will lose. This produces a resistance to acceleration which is the characteristic manifestation of what is called 'mass'. An accelerating process can be thought of in the same terms and this accounts for its inertial mass.

There is little more that can be concluded about particular processes as such from relativity theory alone other than that if elementary particles are mutable, they must depend to some extent on the maintenance of a suitable environment for their continued existence. This points towards the need to understand every particular process in the universe in a broader context, even if the particular process cannot be reduced to a manifestation

(1) David Bohm (1965) op.cit. p. 94f.

of the whole.

When examined carefully, relativity theory has implications for the nature of space and time far beyond the recognition of their interdependence. It has been noted that since the world suffers a Lorenz contraction in the direction of relative motion in the ratio $\sqrt{1 - v^2/c^2}$, at the speed of light itself there is no spatial separation between the emission and absorption of a light quantum and no time at all will pass (1). This means that in a world in which activity was understood as entirely outwardly directed, space and time would have no meaning. Temporal and spatial features of the world come about through an ordering of such outward activity as can be understood from the following Minkowski diagram. In this AB represents a light ray in primary contact while ABC



and ADC represent second order contacts. Two primary contacts in the same direction combine to give a time-like interval AC while two oppositely directed contacts such as AD and AB give rise to a space-like interval DB. The ordering of activity into patterns of such relations produces temporal and spatial properties. All processes involving inward activity will

(1) David Bohm "A Proposed Topological Interpretation of Quantum Theory" (1962) op.cit. p. 304.

consist of such patterns, and by virtue of the indirect path of radiation, will travel at less than the speed of light. Such is the case with an electron as described earlier, and processes consisting of orderings of elementary processes or orderings of orderings must be understood in similar terms.

This implies that all action being ultimately composed of primary contacts is timeless while processes themselves must be thought of as processes of extensive becoming. Since spatio-temporality is a manifestation of the ordering of activity, it is no longer possible to conceive of spatio-temporal relationships in terms of location specified in terms of a set of continuous Cartesian co-ordinates. Rather the relationships must be seen as topological relationships, where things are understood in relation to each other rather than in terms of an external measuring system. (1) A most fundamental relationship of this kind is containment where one process is a constituent of another and is therefore contained within the extensive process of becoming of the superordinate process. A number of constituent processes ordered into such a process can then be understood as 'in' the spatio-temporal order of the whole process, but the spatial and temporal order in which they are 'in' is created by their ordered interaction. In the incomplete process of becoming

(1) The primacy of topological relationships is argued by David Bohm in "Classical and Non-Classical Concepts in the Quantum Theory" in THE BRITISH JOURNAL FOR THE PHILOSOPHY OF SCIENCE Vol. XII, No. 48, Feb.1962, p. 273ff.

of the superordinate process, space-time can be understood as the order of potentialities for interaction between the semi-autonomous sub-processes. On this view, the continuous space-time order of the universe comes into being through its articulation into a multiplicity of hierarchies of processes.

Given this topological account of space and time it can be seen that the superordinate causality by which the whole constrains the parts is temporally indivisible since it is only by virtue of the existence of the whole that there is a temporal order to speak of. The constituent processes, while not being reducible to the whole, express the whole by the way they are ordered, and often by their very being since it is often the case that constituent processes only exist in the context of the superordinate process. Since it is only through the power of the supervening process to affect the constituent processes in this way that an ordered spatio-temporal region comes into being, this effect cannot be thought of in terms of a linear sequence of events or the lawful movement of an immutable substance through time, but must be seen as an epochal immanent causation of the supervening process. This becomes more intelligible when it is remembered that activity as such is prior to time, or timeless

While this way of conceiving the world resolves many problems in relativity theory such as how there can be signals, it seems to contradict the interpretation suggested by the way space and time are conceived as a four dimensional continuum in the theory. However close examination of the theory suggests that the interpretation according to which time is simply reduced to a dimension of space and the world is conceived of as a four dimensional plenum, is not valid. Firstly it must be noted that the Minkowski diagram itself cannot be taken as implying that the universe is such a four dimensional plenum since the time axis is privileged. (1) Secondly, the most frequent argument adduced in support of the Parmenidian interpretation of relativity theory, that since there is no objective 'now', the objective distinction between past and present loses its meaning and so 'becoming' can no longer be regarded as real, is invalid. While relativity theory does imply that there is no absolute order of succession in the universe as a whole, causal succession represented by world lines or world tubes in the Minkowski diagram remains the same for all frames of reference. In other words, causal succession has an absolute status, independent of the choice of the system of reference. In fact the directed nature of the process of becoming represented by a world tube is highlighted since the past is separated from the future by a four dimensional wedge defining a region of causal independence, generally referred to as the 'absolute elsewhere'. This implies, as Milič Čapek has argued in a number of places, that the notion of extensive becoming must be taken as primary, and that it is the classical concept of space which is undermined. (2)

The implications of the theory of relativity for the unreality of the classical notion of space follow from the separation of the past from the future by the four dimensional wedge of the absolute elsewhere. Events are past if they can

(1) This is clearly shown by Bohm (1965) op.cit. p. 148ff.
(2) For example in Milič Čapek "The Myth of Frozen Passage: The Status of Becoming in the Physical World" in BOSTON STUDIES IN THE PHILOSOPHY OF SCIENCE Vol.2, Humanities Press, 1965, pp. 441-463.

at least in principle be found out by observation and events are future if we can at least in principle intervene in their course. In classical physics the past was separated from the future by an infinitely short interval called the present. It was then possible to conceive of the present as a simultaneous juxtaposition of points and this defined the classical concept of space. But in relativity theory the existence of an absolute elsewhere implies that apart from within a single system of reference there lies between the past and the future an interval, the duration of which is determined both by the position of the observer in relation to whom this past and this future are defined, and by the location of the events whose course in time is being investigated. Since there is no totality of simultaneous events, the notion of space conceived of as a simultaneous juxtaposition of points cannot exist.

Since the notion of a rigid body is dependent on that of the classical concept of space, this too must be rejected. Furthermore it is not possible to replace the notion of object by that of space-time point as a basic unit because this would imply the concentration of infinite energy. (1) So rather than rigid bodies or space-time points, it is necessary to take as a primary concept enduring patterns of activities or processes. There is no need to think of a passive and static space stretched out to contain these processes and their interactions. In relation to the future the notion of space survives as a characterization of the potentiality for forming causal relationships, and as such is

(1) Max Jammer CONCEPTS OF SPACE 2nd ed. Harvard Uni. Press, Cambridge, Mass. 1969, p. 188.

measured in terms of light years. In relation to the past there is an ordered pattern of activity which has constituted the extensiveness of the processes of becoming insofar as they are actualized. So, rather than leading to a spatialization of time,the special theory of relativity must be seen as leading to a dynamization of space. This indicates that an analysis of the relationship between time and space in the special theory of relativity leads to the same conclusion as was arrived at in relation to the relationship between mass and energy: the primacy of the concept of process.

When the spatial view of time is rejected and replaced by the notion of becoming it is easier to understand the paradox that if a rocket takes off from Earth and travels at a velocity one twenty thousandth lower than the speed of light a year and travels back at the same velocity, while two years will have elapsed on the rocket, two centuries will have elapsed on Earth. How this happens can be described in terms of the special theory of relativity by means of the Minkowski diagram, but it must be pointed out that the reason that the two frames of reference, that of the observer on the Earth and that of the rocket are not equivalent is because of the acceleration undergone by the rocket in relation to the rest of the universe. To understand acceleration it is necessary to turn to the general theory in terms of which it can be seen that acceleration produces a gravitational field of considerable intensity and it is this which accounts for the relative dilation of time. This is easily comprehensible if space-time is taken as being nothing over and above its changing content since then a dilation of time is nothing but a relative slowing down of the rhythm of change in an intense gravitational field. (1) Thus the temporality of the process of becoming of the universe consisting of a multiplicity of sub-processes can be understood as multilinear, and the paradox dissolves.

In the general theory of relativity it appeared that matter was fused with Reimannian geometry so that matter was thought to be nothing other than a curvature of space-time. I will now try to show that rather than seeing matter as nothing but geometric curves, the general theory of relativity should be understood as implying the fusion of space-time with its content. And given this, the theory can further clarify the idea that the universe must be understood as a process of becoming.

Firstly it should be realized that the use of Reimannian geometry is a substitute for Euclidean geometry in the Minkowski diagram. Therefore to understand the meaning of the general theory of relativity it is necessary to understand what Minkowski was doing when he gave a geometric interpretation to the special theory. It has already been argued that the diagram supports the primacy of the concept of process. The reason it is taken as supporting the primacy of space is that it presents a spatial picture of the universe. But the Minkowski diagram should not be taken as a picture of the universe but as a map, which on close inspection reveals the impossibility of such a spatial picture. (2) The

(1) M. Čapek THE PHILOSOPHICAL IMPACT OF CONTEMPORY PHYSICS, Van Nostrand, Princeton, 1961, p. 203f.
(2) Bohm (1965) op.cit., p. 180ff.

Minkowski diagram reveals the region of absolute elsewhere of any reference system, that is, the region which cannot be known or causally affected from this reference system. This indicates that the observer must be thought of as being part of the universe, and having a definite place in the total process of the universe, is related to this process by the laws he is trying to study. As a consequence of this there are definite limitations as to what can be known at any moment because to know the absolute elsewhere would require signals to be transmitted faster than light. And also, since the absolute elsewhere affects the future of the observer's frame of reference, relativity theory suggests the impossibility of completely knowing the future. This indicates the impossibility of picturing the universe as a totality as implied by a spatial picture.

If the geometrization of relativity theory is understood as a map rather than a picture of the universe, then the Reimannian geometry of the general theory should be understood as a way of mapping the process of becoming of the universe. Reimannian geometry is generally taken to mean that the universe should be pictured as an expanding four dimensional sphere. But on the understanding that Reimannian geometry functions as a map, rather than being interpreted as indicating a picturable totality, it should be simply understood to mean that if two photons travel in opposite directions, they will meet up again, and that measured in relation to a system of reference travelling at less than c, the longer the universe endures, the greater the number of light years required for such photons to meet up again. It should be noted at this point that the picture of the universe as originating in a big bang and evolving as a totality, since it implies one global time, is not strictly speaking compatible with the general theory of relativity but must be thought of as an approximation. (1) A full theory must be such as not to single out any particular time axis.

The expanding universe began from a singularity. What came before this is still subject to speculation, but it has been suggested by Remo Raffini that in order to account for the uniformity of the background radiation in the universe deriving from the big bang, it is necessary to postulate a stage before there was any matter. (2) In this stage there would only be gravity waves. If this were the case then all entities in the universe, from atoms to galaxies must be seen as having emerged in the process of becoming of the universe. On my understanding of processes these must be seen as semi-autonomous, but since they are mutable, dependent for their existence on the total environment of the universe from which they have emerged. This mutability is clearly evident in the case of electrons being annihilated by positrons. It is through the differentiation of the universe into various types of processes that spatio-temporal relations can be said to have developed. However, since these relationships are derivative from processes, it cannot be said that an object simply moves in space-time. Rather motion must be seen as a particular type of ordered activity rather than as an immutable entity moving through space over time. As Čapek wrote, a moving object is "an outer sign of some inward change which occurs within a moving body itself."(3) No distinction can be made between the thing moved and the motion.

(1) Mendel Sachs acknowledged this in reply to questions in op.cit (1974) p.165f.
(2) Remo Raffini, Professor of Theoretical Physics, University of Rome argued this in a public lecture in Perth, W.A. on April 5th, 1978.
(3) Čapek (1961) op.cit. p.274.

It can now be seen that if the theories of relativity are to be accepted, a fundamentally different conception of being must be adopted. Space and time have been shown to be indissociable and, fused with their content, and must be understood topologically. The content is no longer immutable matter but processes of becoming. Objects must be seen as types of stable processes embodied within the context of other processes. Motion of objects is not extrinsic to objects but another aspect of the ordering of process and intrinsic to it. All processes and their interactions contribute to the incomplete, extensive process of becoming of the universe as a whole. The best way to understand such a universe is on the analogy of an unfinished polyphonic piece of music of which we, the observers, are part.

QUANTUM THEORY

So far I have argued that the theories of relativity should be understood in terms of processes, with the universe as a whole being understood as an unfinished process of becoming in which have formed a multiplicity of sub-processes, and that time and space should be understood topologically in relation to these sub-processes. However apart from the process of becoming of the universe as a whole, the existence of processes can only be assumed by the relativity theories. It is necessary to focus on the processes themselves in order to understand them. The theoretical domain which is most important in this respect is that dealt with by quantum theory. Quantum theory suggests that radiation is characterized by a discreteness which contradicts field theory's emphasis on continuity, while the elementary particles of matter are characterized by wavelike properties and by mutability which in turn is incompatible with the ontology of materialism. That the theory implied a radical break with the past was emphasised by Henri Poincaré, who in 1912 wrote:

> It is well known to what hypothesis Planck was led by his researches on the laws of radiation. According to these the energy of radiation of light varies in a discontinuous manner. It is this hypothesis which is called the theory of quanta. It is hardly necessary to remark how these ideas differ from traditional conceptions; physical phenomena would cease to obey laws expressible by differential equations and this, undoubtedly, would be the greatest and most radical revolution in natural philosophy since the time of Newton. (1)

Yet it is extremely difficult to draw any simple conclusions from quantum theory. Attempts have been made to interpret the theory either purely

(1) Cited by Max Jammer in THE CONCEPTUAL DEVELOPMENT OF QUANTUM MECHANICS, McGraw-Hill, N.Y. 1966, p. 170.

as a field theory or purely as a particle theory, in each case explaining away aspects which do not fit into the preferred ontology; to interpret it so as to allow for the use of contradictory concepts, either through epistemological considerations or through the development of different types of logic; or to avoid all such problems by rejecting the ontological implications of the theory, retreating into the mathematical formalism and regarding only the success of this as important. The failure of scientists in general to face up to the problems engendered by quantum theory has led to the situation described by Ted Bastin in the editorial introduction to QUANTUM THEORY AND BEYOND where:

> One is...forced to contemplate a situation which must be unique in the history of science where the practitioners of a scientific theory which has reached the stage of being regarded as a finished product habitually work with a jumble of elements taken from a variety of different conceptual frameworks none of which, singly, is adequate to present the facts that are known, and each of which is partly or even largely incompatible with the rest. (1)

In order to deal with this confusion I will give an outline of the developments which have taken place in quantum theory. Through this, I will try to show how it is necessary to go beyond both materialism and field theory to process philosophy in terms of which the apparently contradictory features of the phenomena dealt with by quantum theory can be reconciled. I will finish this section by describing the developments in quantum theory which are moving in this direction.

Quantum theory had its origin in the inability of classical physics to

(1) Ted Bastin, "Introduction" to QUANTUM THEORY AND BEYOND Ted Bastin ed. Cambridge Uni. Press, Cambridge, 1971, p. 8f.

account for the energy distribution in the continuous spectrum of black body radiation. Planck showed that it was necessary to conceive of radiation as being emitted in discrete packets or quanta. Each quantum of radiation or 'photon' has its own wavelength and frequency. Drawing support from the photo-electric effect, Einstein argued that radiation continued as photons at all times. This meant that light must be seen as having a corpuscular character, though the photons only exist at the speed of light and have no rest mass. The energy of these photons is calculated by multiplying their frequency with Planck's constant, while the momentum is given by multiplying the wavelength by the constant. This meant conceiving of radiation as corpuscular as well as wave-like, not only because it is necessary to retain the wave conception to explain interference effects, but also because frequency and wavelength enter into the expressions for the energy and momentum of photons. The two contrasting pictures of radiation are indissociable.

Niels Bohr then used quantum theory to supplement the Rutherford model of the atom. The Bohr model of the hydrogen atom was able to account for the stability of the electron orbits and went a long way towards accounting for the empirical laws governing the spectra of the elements. (1) On the basis of this quantum model of the atom Einstein then showed how thermal radiation could be explained and formulated statistical rules for the occurrence of transitions between stationary states of the atom. In doing so he predicted that absorptions and emissions would occur not only when the atom was exposed to radiation, but that emissions would occur

(1) Niels Bohr ATOMIC PHYSICS AND HUMAN KNOWLEDGE John Wiley & Sons, N.Y. 1958, p. 34.

spontaneously with a certain probability.

The concept of quanta was applied to diverse areas of enquiry after this and was successful at resolving a large number of anomalies. (1) However prior to 1925 there was no logically consistent theory to unite the hodgepodge of hypotheses, theorems, principles and computational recipes, and the quantum conditions were applied to classical solutions rather than forming part of an autonomous conceptual scheme. (2) To overcome this problem two relatively coherent versions of quantum mechanics were developed: the matrix mechanics of Heisenberg and further developed by Born and Jordan, and the wave mechanics of Schrödinger which was inspired by the ideas of Louis de Broglie.

Heisenberg set out to replace the classical descriptions of motion by what Heisenberg regarded as observable magnitude to develop a kinematics of quantum theory. (3) Max Born realized that the mathematical approach used by Heisenberg was that of matrices. Born together with Jordan and Heisenberg and later with Wiener developed this mathematics to form a coherent theory. Born and Wiener generalized matrix mechanics into an operator calculus in which physical quantities such as coordinates or momenta were represented by operators. (4) A different approach to matrix mechanics was developed by P.A.M. Dirac who modified it into an algebraic algorithm. (5)

(1) Jammer (1966) op.cit. Chs. 3 and 4.
(2) Ibid., p. 196.
(3) Ibid., p. 197.
(4) Ibid., p. 223f.
(5) Ibid., p.228.

Wave mechanics had its origins in 1925 when de Broglie recognized that material particles such as electrons are also characterized by a wave-corpuscle duality. The existence of wave properties of electrons was proved by C.J. Davisson and G.P. Thomson. (1) This meant that electron orbits could be thought of as stationary waves, and since such waves were only possible at some multiple of the wavelength of the electrons, the properties of the quantum model of the atom could be accounted for. (2) It was this idea which was the starting point of wave mechanics.

These notions were developed in a more precise form by Schrödinger, whose equations enabled the calculation of energy levels in a wide variety of atomic systems and also allowed a continuous treatment from one energy level to another. Wave mechanics is a field theory in which an electron is thought of as a continuous distribution of charge, with wave intensity representing a charge density. Quantum transitions are conceived of as energy changes from one vibrational mode to another rather than as a jumping of electrons. As Schrödinger wrote: "The true mechanical process will be realized and represented appropriately by the wave processes in q space, and not by the motion of image points in this space." (3)

Matrix mechanics and wave mechanics, designed to cover the same range of experience, were radically different. They represented the first real confrontation between particle ontology and field ontology. As Max Jammer

(1) Ibid., pp.249-254.
(2) Louis de Broglie, "The Progress of Contempory Physics" in W. Heisenberg THE PHYSICIST'S CONCEPTION OF NATURE tr.Arnold J. Pomerans, Hutchinson, London, 1958, p. 170.
(3) Cited by Jammer (1966) op.cit. p.263.

has written:

> Heisenberg's was a mathematical calculus, involving noncommutative quantities and computational rules, rarely encountered before, which defied any pictorial interpretation; it was an algebraic approach which, proceeding from the observed discreteness of spectral lines, emphasized the element of discontinuity; in spite of its renunciation of classical description in space and time it was ultimately a theory whose basic conception was the corpuscle. Schrodinger's, in contrast, was based on the familiar apparatus of differential equations, akin to the classical mechanics of fluids and suggestive of an easily visualizable representation; it was an analytical approach which, proceeding from the classical laws of motion, stressed the element of continuity; and, as its name indicates, it was a theory whose basic conception was the wave. (1)

In spite of the repulsion felt by each of the protagonists of this conflict for the position of the other, Schrödinger was convinced that the two approaches were complementary and succeeded in proving their formal mathematical identity and that each formalism could be translated into the other. Because of the clarity of Schrödinger's formalism, and its intuitive appeal as an account of what is happening, this came to be preferred over matrix mechanics.

But if the formalism was more popular, Schrödinger's field interpretation of it was not so successful. Heisenberg had pointed out that since Schrödinger used multidimensional configuration space rather than real space, and computed wave velocity from the mutual potential energy of particles, his theory was not a consistent wave theory in de Broglie's sense. (2) Also since the wave function is a function in hypothetical multidimensional space, it cannot be regarded as an efficient cause of

(1) Ibid., p. 27ff.
(2) Ibid., p. 272.

radiation phenomena as Schrödinger proposed. (1) Finally Schrödinger's interpretation fell down when dealing with electrons in free space since the equations predicted that the electrons would spread out rapidly over space without limit, and this was manifestly not what happened.

While Max Born acknowledged the superiority of Schrodinger's formalism, he was convinced by experiments on electron collisions of the corpuscular nature of electrons. To reconcile the formalism with an atomist ontology, Born proposed that the wave be seen as representing a probability density; that is, the probability of finding an electron at any point. On this interpretation the spreading out in space of the wave was compatible with the finding of the electron at a particular place. In this, the wave was regarded as a "phantom field". However the probability in this theory was not merely a mathematical fiction representing a lack of knowledge. The probability wave was endowed with reality since it evolved in time and propagated in space according to Schrodinger's equations.(2) It differed from normal physical agents in not transmitting energy or momentum. The theory scored immediate success when applied to problems of the scattering of electrically charged particles by a charged scattering centre.

However this interpretation of the field cannot account for the interference effects produced in the double slit experiment where electrons are fired at a recording screen through a grating with two slits in it. This experiment can be carried out at such reduced radiation that only one

(1) Ibid., p. 283.
(2) Ibid., p. 286.

particle passes the apparatus at a time. Since it still produces interference patterns, it must be concluded that the psi-wave associated with each particle interferes with itself. (1) This is only possible if the wave has some reality.

The fact that four theories so different from one another as those of Heisenberg, Born-Wiener, Schrödinger, and Dirac gave the same results led to the development of transformation theory. This was the study of those transformations in quantum theory which leave the results of empirically significant formulas invariant. One of the implications of the transformation theories of Dirac and of Jordan was that conjugate variables could not be specified at the same time. (2) This fact provided the starting point for Heisenberg's indeterminancy principle.

Following a dispute between Schrodinger and Bohr over whether the world could be understood as continuous as required by field theory or whether one had to accept the reality of quantum jumps in which a particle like entity moved from one position to another without occupying the intermediate positions, Heisenberg tried to analyse the kinematic and mechanical conceptions implied by the formalism through a consideration of how the formalism must be understood in relation to empirical situations. Focussing on the conjugate variables, Heisenberg constructed a thought experiment in which the position of an electron was to be measured by a gamma-ray microscope. In a similar way the Stern-Gerlach experiment in

(1) Max Jammer THE PHILOSOPHY OF QUANTUM MECHANICS, John Wiley & Sons, N. Y. 1974, p. 44.
(2) Max Jammer (1966) op.cit. p.326.

which an atomic beam is passed through a strong magnetic field was analysed. From these thought experiments, Heisenberg arrived at his indeterminancy principle according to which it is not possible to measure together both the position and momentum, or both the energy and time at which the energy level occurred, of sub atomic particles with complete accuracy. The more accurate the measurement of one, the less accurate must be the measurement of the other. What is observed in such measurements is an irregular fluctuation from one observation to the next. These fluctuations are not predictable in isolation though together the mean behaviour can be predicted by the Schrödinger wave function. From this Heisenberg concluded:

> All the concepts that are used in the classical theory for the description of a mechanical system can also be defined exactly for atomic processes. But the experiments which lead to such definitions carry with them an uncertainty if they involve the simultaneous determination of two canonically conjugate quantities. (1)

Heisenberg's thought experiments showed the impossibility of explaining away the indeterminate nature of reality implied by quantum theory without a radical revision of the theory. However they also revealed something else which is perhaps more important. To begin with, Heisenberg tended to ascribe the indeterminancy to the knowledge that we can attain about the real world. This was partly because he placed the emphasis in his thought experiment with the gamma-ray microscope on the discontinuous change of momentum of an electron in its

(1) Cited by Jammer ibid. p. 329.

collision with a photon. This seems to imply that the indeterminancy follows from the interference of observer with what is observed. However the discontinuous change of momentum can be rigorously calculated, provided the direction of the reflected quantum is accurately known. (1) It is only because this direction cannot be ascertained more accurately than up to the finite angle of the aperture of the microscope that one has to speak of an uncontrollable interaction. This indicates that the experimental apparatus has to be considered as a whole. The form of the experimental conditions and the content of the experimental results have to be taken together so that the 'observed object' only has meaning in relation to the whole apparatus. It is no longer meaningful to talk of the interaction between the 'observed object' and the 'observing instrument'. (2)

From this brief history of the development of quantum theory it can be seen that there are four closely related features introduced by it. The first is the indivisibility of the quantum of action, implying that transitions between stationary states are discrete in that a system moves from one to another without passing through any intermediate states. Secondly, matter has a wave-particle duality, behaving sometimes more like a wave, at others more like a particle, but always in certain ways, like both together. Third, it is impossible to predict in detail what will happen in each individual observation, implying some degree of indeterminancy in the world. The last feature is that as in relativity theory, the

(1) Ibid., p. 331.
(2) David Bohm in "Science as Perception-Communication" in THE STRUCTURE OF SCIENTIFIC THEORIES, ed. Frederick Suppe (1974) op.cit. p. 382.

observational situation has to be taken into account. Different experimental arrangements actualize different and apparently contradictory characteristics of matter, and determine which of the conjugate variables will be measured more accurately. Interpretations of quantum theory must come to terms with all these features.

The interpretation of quantum theory which has been most widely accepted is the complementary interpretation of Bohr: the Copenhagen interpretation. Bohr argued that what quantum theory required was not the replacement of classical concepts, but a revision of what is meant by an explanation. In this vein he wrote in 1929: "We must, in general, be prepared to accept the fact that a complete elucidation of one and the same object may require diverse points of view which defy a unique description." (1) On this view the concepts of particle motion and wave motion are retained and are regarded as complementary descriptions of the phenomena. The application of one set of such concepts precludes the simultaneous use of the other set since they each require different experimental arrangements. The change from the conditions which allow the application of one set of concepts to the other has to be regarded as an unpredictable jump. This notion of complementarity is also applied to the duality of sets of variables such as position and momentum or time and energy, and Heisenberg's indeterminancy is interpreted as following from the necessity of using complementary concepts which cannot be defined together. A combination of wave and particle descriptions

(1) Cited by Max Jammer op.cit. (1974) p.97f.

into a unique and precisely defined whole is impossible since when the concepts of each are precisely defined, they contradict each other. This contradiction is avoided by rejecting the possibility of a precise definition of both types of description in any experimental arrangement. Bohr sums up his position when he writes:

> the impossibility of combining phenomena observed under different experimental arrangements into a single classical picture implies that such apparently contradictory phenomena must be regarded as complementary in the sense that, taken together, they exhaust all well-defined knowledge about atomic objects. (1)

The epistemological view adopted by Bohr which enables him to simply allow the opposing ontologies of materialism and field theory to co-exist is summed up in a statement he made to his assistant Aage Petersen:

> There is no quantum world. There is only an abstract quantum physical description. It is wrong to think that the task of physics is to find out how nature <u>is.</u> Physics concerns what we can say about nature. (2)

For this reason Bohr thought that the informal language in terms of which the experiments are described is what is most important, the formalism being a mere algorithm. (3)

However for the complementary theory to follow from this view, it is necessary to assume that the experimental facts which indicate such a duality are inviolable, and that the observational concepts in terms

(1) Niels Bohr ESSAYS 1958/1962 ON ATOMIC PHYSICS AND HUMAN KNOWLEDGE, John Wiley, N.Y. 1963, p. 25.
(2) Cited by Jammer (1974) op.cit. p. 204.
(3) Ibid., p. 104.

of which experimental situations are described are invariant. (1) The first assumption presupposes the second, since facts are propositions taken to be true. Since propositions are formulated in terms of conceptual frameworks, they are relative to these. Therefore it is only possible to assume the facts of an experimental situation are inviolable if concepts are invariant. But concepts, including the concepts associated with observation are not invariant. This was argued in Chapter II. The conceptual frameworks of mechanics and wave theory only replaced the Aristotelian-Thomist concepts used by natural philosophers in the late Middle Ages after a long intellectual struggle. This struggle is evident in the problems encountered in the development of the concept of acceleration. Acceleration could only be understood properly by use of a time coordinate which was almost incomprehensible in the intellectual environment of the time, dominated as it was by geometry. As N.R. Hanson noted: A 'time co-ordinate' would have had little significance for these natural philosophers, as little as would 'fragrance' or a 'beauty' co-ordinate." (2) It took Galileo thirty four years to adequately develop the concept of acceleration which is now taken as common sense, and it was only with the development of differential calculus that the idea could be fully clarified. (3) Classical phycics developed by replacing Aristotelian concepts by an entirely new set, and this new set of concepts became the new observational

(1) As noted by P.K. Feyerabend "Problems of Microphysics" in FRONTIERS OF SCIENCE AND PHILOSOPHY, Robert G. Colodny ed. University of Pittsburgh Press, 1962.
(2) Norwood Russel Hanson (1961) op.cit. p.40.
(3) Ibid., p. 48.

language. While Bohr's epistemology, with its emphasis on the impossibility of knowing the world as it is in itself independent of our efforts to understand and describe it is in accordance with the epistemology justified in Chapter 2, it does not justify such conceptual conservatism. That a theory indicates the need to use contradictory concepts should be regarded as a situation requiring the development of a new set of concepts. As Mary Hesse described the situation:

> If two models each turn out to be unsatisfactory in isolation, but usable when regarded as complementary to each other, it is curiously conservative to assert that no other models can be conceived, and to elevate the 'principle of complementary' to a quasi-metaphysical status, when it should rather be regarded as a consequence of the poverty of our imagination. (1)

Closely related to Bohr's approach is that of the quantum logicians. (2) Quantum logic succeeds in bringing the conceptual and mathematical structures of quantum theory into coherence at the expense of a coherent ontology. (3) The ontology implied by it is based on particle theory, but purports to accept a conception of particles which have position and no momentum at one moment, and momentum and no position the next. No notion of an individual is really constructable under these circumstances.

The difficulties of interpretation to which quantum theory has given rise has led to the widespread view that no interpretation is needed. On this view we have a well defined mathematical scheme which works, and this is all we need to know. Along these lines Dirac is reported to have

(1) Mary Hesse (1962) op.cit. p.270.
(2) Hooker (1974) op.cit. p.267.
(3) Ibid., p.266.

said that "all we really do is to connect one set of observations with another set of observations by some mathematical formalism which does not itself require any logical interpretation." (1) This is essentially a positivistic position, and as such is subject to the criticisms levelled against positivism in Chapter II. However quantum theory has special features which make such an approach attractive. As Eugene Wigner wrote:

> In my opinion, the restriction of quantum mechanical theory to the determination of the statistical correlations between subsequent observations reproduces most naturally the spirit of the theory...renouncing the definition of reality, is the most natural epistemology of quantum mechanics. (2)

For this reason it is necessary to examine the features of quantum theory which leads to such a view.

It is not only that the formalism of quantum theory was so highly developed while interpretations of this lagged that made a positivistic approach to quantum theory so attractive. The formalism was developed in such a way as to almost imply the validity of positivism. The first complete exposition of the general formalism of quantum mechanics presented in a logically consistent and axiomatic fashion was Dirac's PRINCIPLES OF QUANTUM MECHANICS. This was based on the notions of "observables" and "states" as primitives. (3) In this a single particle or photon is regarded as being in each of two states prior to observation while definitely being in one or the other state as the instantaneous result of observation. (4) The independent place given

(1) Ascribed by D.S.Linney in discussion in Ted Bastin ed.(1971) op. cit. p. 332.
(2) Eugene Wigner "Epistemological Perspective on Quantum Theory" in CONTEMPORARY RESEARCH IN THE FOUNDATIONS AND PHILOSOPHY OF QUANTUM THEORY, C.A. Hooker ed. Reidel, Dordrecht, 1973, p.377.
(3) Jammer (1966) op.cit. p.366.
(4) Ted Bastin in Bastin ed. (1971) p.7.

to observables without any interpretation being given for the effect of the observation on the state focusses attention on the observables as the only unproblematic part of the theory. It is for this reason that Dirac could adopt such a positivistic viewpoint.

Shortly after the publication of Dirac's work, von Neumann's more mathematically rigorous MATHEMATICAL FOUNDATIONS OF QUANTUM MECHANICS was published. This transformation theory, based on separable Hilbert space, has served as the foundation for nearly all later developments of quantum theory. Von Neumann tried to interpret his formalism in accordance with the Copenhagen interpretation. However his analysis of the quantum situation was really a new interpretation. In this, a sharp separation was made between the observing apparatus obeying classical laws and including the factor of human consciousness, and the observed object obeying quantum laws. (1) Between these two realms an arbitrary 'cut' was to be made and an interaction was thought to occur between the disjoint parts of the world. Von Neumann's approach led to two developments: that of measurement theories to deal with the nature of the interaction with the world involved in measurement, and of quantum logic to rule out as invalid those inferences which one normally draws from a theory about the nature of the world. (2) The implication von Neumann drew from his measurement theory was that "experience only makes statements of this type: an observer has made a certain (subjective) observation; and never any like this: a physical quantity has a certain value." (3) To finish off, von Neumann developed

(1) David Bohm "Science as Perception-Communication" (1974) op.cit.p.384.
(2) C.A. Hooker "Metaphysics and Modern Science" in Hooker ed.op.cit. p.264f.
(3) Cited by Jammer (1966) op.cit. p.373 from MATHEMATICAL FOUNDATIONS OF QUANTUM MECHANICS (1932), Princeton Uni. Press, Princeton, N.J. 1955 p. 420.

a completeness theorem according to which it is impossible to account for the statistical nature of quantum phenomena in terms of hidden variables without ruling that the present system of quantum mechanics is false. (1) Though von Neumann, unlike Dirac, had made some attempt to give a physical interpretation of the effect of observation in terms of the collapse of the wave packet, the general effect of all this was to direct attention away from ontological questions to observation itself with the formalism simply functioning to make predictions.

A major difficulty of a purely formalist approach to quantum theory is that it is impossible to provide criteria for its application. Measurement theory is supposed to overcome this problem, but in this it has not been successful. As David Bohm wrote:

> When one tries to apply von Neumann's theory to an actual experimental situation, one finds that without a proper description of the experimental conditions, it is not possible to understand the relevance and significance of the experimental results. (2)

However an even more significant problem of formalism has been revealed by the work of Clifford Hooker. (3) Hooker analysed the relationships between the ontology underlying a theory, the conceptual structure used for physical description, and the mathematical structure of the theory and showed that there was a profound and intimate connection between all three of them. This means that the formalism of a theory itself implies a certain ontology, and the difficulty of giving a physical interpretation

(1) Ibid., p. 368.
(2) David Bohm (1974) op.cit. p. 386.
(3) C.A. Hooker, op.cit. pp.174-304.

to a theory cannot be avoided by retreating into this formalism. Hooker focussed in particular on the different mathematical structures of atomist or particle ontology on the one hand and the plenum or field ontology on the other. He outlines the difference between the mathematics in this way:

> The contrast in mathematical nature and structure between classical field theory and classical particle mechanics is quite substantial, despite some similarities...Now this difference...pivots on the fact that particles are spacially localized systems whereas fields are global entities... Thus systems in classical particle mechanics may be regarded as spatial aggregates of spacially localized systems and their locations may thus be represented by a set of triples. Essentially the 'configuration space' is the sufficient and proper mathematical object on which to build the entire edifice of classical particle mechanics. Fields cannot be represented in this fashion, their single, whole field solutions over space must be represented at each time. This accounts for the centrality of two quite different fundamental structures in the two mathematical theories. To classical particle mechanics belongs <u>set theoretic</u> structure of <u>phase space</u>, expressing in its representation the individuality of the fundamental entities. To classical field theory belongs the <u>vector space</u> structure of <u>function space</u>, expressing the fundamental globalness and superposability of the fields. No superposition principle applies in classical particle mechanics, neither in its phase space nor in its function space, whereas such a principle is fundamental to classical field theory. Correspondingly, the composition principles of the two theories are quite different. In classical particle mechanics we construct a <u>higher dimensional phase space</u> in which the composite state is still represented by a <u>point location</u>; in classical field theory we construct the <u>tensor product function space</u> of solutions to the coupled field equations in which a state is given by a <u>vector</u>, or superposition of vectors, in the space. (1)

On the basis of this analysis of the relationship between ontologies and the mathematical structures of theories, Hooker examined the mathematics of quantum mechanics. The conclusion he came to was that the formalism of quantum mechanics is a fusion of the characteristic mathematical structures of field theory and particle theory, with the overall abstract

(1) Ibid., p. 237.

structure being that of field theory and the dynamics being that of a particle theory. Since there is a basic cleavage between the two ontologies, and their union in one theory inevitably means each situation demands features of both at once, it is inevitable that the understanding and application of the formalism itself will present problems. As Hooker wrote: "the approach is therefore doomed at the outset to be no more than a makeshift, more or less ad hoc, adjustment pressing various fragments of the particle and field conceptual schemes into service blindly as the interpretational occasion demands." (1) That the formalism has in many cases given correct predictions does not overcome this problem. As Ted Bastin wrote: "no amount of experimental evidence can count in favour of a logical muddle." (2)

Hooker came to the conclusion that:

> quantum mechanics demands either a new conceptual-ontological scheme (a revision of the two conceptual schemes more thorough going even than their logic) or the abandonment of quantum mechanics as a hopelessly bastard offspring of an attempted marriage of the two great classical theoretical structures, doomed forever to a jerrymandered interpretation in terms of one of them. (3)

In the light of this suggestion, von Neumann's completeness theorem bears looking at. What von Neumann and others have shown is that the algebraic structure of self-adjoint Hilbert space operators cannot be embedded into the algebraic structure of real-valued phase space functions.

(1) Ibid., p. 260.
(2) Ted Bastin (1971) op.cit. p. 8.
(3) Hooker op.cit. p. 270.

What this means is that the statistical relations of quantum theory cannot be explained by the simple introduction of hypothetical variables to 'complete' the theory. However no such hidden variable theory has ever been proposed, and the theorem is basically irrelevant to the attempts that have been made to go beyond the existing formulation of the theory. (1)

To overcome the confusion of ontologies in quantum mechanics, various strategies have been attempted. The most important of these are the attempts to interpret the theory in terms of a single ontology, either atomism, formism, field theory or process philosophy. I will examine each of these attempts in turn.

Interpretations designed to interpret quantum theory in terms of materialism take two forms, statistical and stochastic. The statistical interpretation according to which the psi-function is understood to describe an ensemble of systems rather than a single system was first put forward by Einstein and has been defended by Popper and Lande. (2) In contrast to Born's hypothesis that quantum mechanics predicts the probability of the result of a measurement performed on a single system, the Einsteinian approach is to say that quantum mechanics predicts the frequencies of the results of measurements performed on an ensemble of identically prepared systems. It is doubtful whether this distinction has any real meaning. The most telling arguments against this interpretation are those relating to the results of the double slit experiment or any other phenomena involving diffraction where only one system is

(1) Jeffrey Bub in "Reply to Professor Causey" in Suppe (1974) p. 403.
(2) Jammer (1974) op.cit. p. 440ff.

involved. Lande's attempt to explain such diffraction has been severely criticised by Stopes-Roe. (1) This interpretation has not gained a wide following.

The objective of the stochastic interpretation is to show that quantum theory is a classical theory of probabilistic or stochastic processes of the same form as those theories dealing with Brownian motion. (2) Its main proponents were Bopp and Feynes. Support for this approach originally derived from the similarities between the Schrödinger equation and equations in the theory of diffusion processes or Brownian motion. Schrödinger himself noted the similarities first but came to the conclusion that these were superficial. Later stochastic interpretations were based on the connection between Feynmann integrals, Markov processes and the Schrödinger equation. (3) However a thorough study of attempts in this direction made by J.G. Gilson showed that the analogies were spurious. He wrote:

> quantum mechanics has little if anything to do with stochastic theory...However, it would seem possible from this work that Schrödinger quantum theory could be regarded as the continuous limit of a discrete time stochastic theory, but as we have seen, as going to this continuous limit the stochastic picture evaporates entirely. (4)

Though Heisenberg is generally regarded as one of the founders of the Copenhagen interpretation, he has espoused a number of different interpretations, sometimes in the same work. At times he has expressed positivistic sentiments, writing that indivisible elementary particles

(1) Ibid., p. 462.
(2) Ibid., p. 418ff.
(3) Ibid., p. 432.
(4) Cited ibid. p. 436.

are "in a way only a symbol on whose introduction the laws of nature assume an especially simple form." (1) More recently he has been working towards a unified field theory. (2) However he has also attempted to deal with the problems of quantum theory by espousing the ontology of formism. Heisenberg used the conceptual framework of formism to interpret Born's probability waves as not simply indicating the probability of finding electrons at certain points, but as having a real existence, understood as possibility or 'potentia' in the Aristotelian sense. He wrote:

> The concept that events are not determined in a peremptory manner, but that the possibility or 'tendency' for an event to take place has a kind of reality - a certain intermediate layer of reality, halfway between the massive reality of matter and the intellectual reality of the idea or the image - this concept plays a decisive role in Aristotle's philosophy. In modern quantum theory this concept takes on a new form; it is formulated quantitatively as probability and subjected to mathematically expressible laws of nature. (3)

The concepts of form and potentia also provide a way of understanding the wave-particle dualism with waves and particles being the forms which can be actualized by the different experimental arrangements from a world which has the potentia to take on either form. Later Heisenberg used the notions of form and potentia to describe the various types of elementary entities. In this vein he has written:

> If we compare this situation with Aristotelian concepts of matter and form, we can say that the matter of Aristotle, which is mere 'potentia', should be compared to our concepts of energy, which gets into 'actuality' by means of the form, when the elementary particle is created. (4)

(1) Werner Heisenberg PHYSICS AND PHILOSOPHY, George Allen & Unwin, London, 1959, p. 55.
(2) W. Heisenberg INTRODUCTION TO THE UNIFIED FIELD THEORY OF ELEMENTARY PARTICLES Interscience Publishers, John Wiley & Sons, London, 1966.
(3) Cited by Jammer (1966) op.cit. p. 287.
(4) Heisenberg (1959) op.cit. p. 139.

Electrons, protons, neutrons, photons and the various unstable elementary entities were each regarded as different forms of matter with the forms corresponding to the type of entity and matter or potentia corresponding to energy. (1)

The main problem with this approach is that, like the formism of the Middle Ages, it makes explanations too easy. It is capable of accounting for anything. All difficulties associated with indeterminancies,and contradictory attributes are simply bypassed without explanation, and each new elementary entity discovered can simply be described as a new form.

More recent attempts to develop quantum theory have tended towards a purely field interpretation. This is more promising than a materialist or particle interpretation for a number of reasons. If the mathematics of quantum theory are basically in accordance with those of field theory and only secondarily with those of particle physics, it is more likely that the particle features of quantum phenomena will be explained in terms of field theory than that the field-like qualities will be explained in terms of particle theory. Also a field version of quantum theory can more easily be reconciled with the theories of relativity. And finally interparticle conversion processes where it is impossible to regard the original particle as a complex of the particle into which it is converted cannot be understood in terms of particle theory where particles must be regarded as immutable, but can be understood if particles are thought of as singularities in a field.

After the failure of Schrödinger's field interpretation of wave mechanics, the first attempt to develop a field theory to come to terms with the

(1) Werner Heisenberg PHILOSOPHICAL PROBLEMS IN NUCLEAR SCIENCE tr. F.C. Hayes, Faber and Faber, London, 1952, p. 103.

particle like features of sub-atomic phenomena on which Schrödinger's position had foundered was that of Louis de Broglie between 1923 and 1927. (1) This was his "theory of double solution" according to which the wave equation admits two different kinds of solution: a single psi-function which is continuous and a singularity solution which constitutes the particle features. However the theory was received so poorly that de Broglie himself rejected it until David Bohm developed similar ideas in the 1950's.

More influential were the ideas of Dirac. These were originally developed in relation to two approaches to electromagnetic radiation. Debye (1910) had derived Planck's law for the distribution of energy among different wavelengths using field notions, while Bose (1924) had derived the same laws by regarding radiation as a gas of photons. (2) Dirac in 1927 showed how the radiation field could be treated in two distinct ways and arrive at the same result; a quantised field. One way was to begin with the field and subject it to a quantisation procedure that is, the method of field quantisation, while the alternative was to begin with an assembly of particles and first quantise it, then reformulate the theory according to an operator formalism, this being referred to as a second quantisation. These ideas, which united field and particle descriptions, were immediately applied to material particles by Jordan, Klein and Wigner to deal with the wave-particle duality. (3) Dirac in 1928 applied these ideas in his attempt to develop a relativistic wave theory, and through following the implications of this, postulated the

(1) Jammer (1974) op.cit. p.44ff. and Louis de Broglie "The Reinterpretation of Wave Mechanics" in FOUNDATIONS OF PHYSICS, Vol.1, 1970, pp.5-15.
(2) M.L.G.Redhead "Wave-Particle Duality" in the BRIT. J. PHIL. SCI. 28 (1977) p. 71.
(3) loc.cit.

existence of positrons which were later discovered experimentally by Fermi. (1)

However there are a number of problems with quantum field theory. For instance there are divergences in the theory and these prevent a consistent mathematical formulation. (2) Also since there is no way of introducing extended structures into relativistic field theory, particles are treated as extentionless points. But this leads to infinite energies in calculation. These can be removed by a 'renormalization' procedure, but this is both mathematically and physically ad hoc. Another problem is that it is extremely difficult to find suitable expressions for the basic observables position and momentum within the formalism and no adequate argument has been presented for rejecting these as fundamental observables. Finally there is no understanding of what is the significance of the quantisation procedure. As C. Hooker notes: "We speak glibly of quantisation representing the change from continuity to discreteness without bothering to find out precisely where this change is made mathematically and what the conceptual ramifications are likely to be." (3)

One of the main problems with the early versions of quantum field theory is that the people who developed it were not interested in ontological issues and did not make any attempt to comprehend the depth of the impact of the different formalisms on our conceptual descriptive forms. (4) They tended to work with the concepts with which they were most familiar,

(1) Hesse (1962) op. cit. p. 272f.
(2) Hooker (1974) op. cit. p. 273.
(3) Ibid., p. 274.
(4) Loc.cit.

those of particle physics. For this reason the second quantised field procedure which begins with a particle approach has always been more prominent than the quantised field procedure which begins with the field. This accounts for the blind acceptance of position and momentum which really only have relevance in the atomist ontology, as the basic concepts of observation. Taking the concepts of particle theory as basic in which there is an assumption of discontinuity makes it possible to ignore the problems this raises for field theory. The only way of introducing discontinuity at a fundamental level into quantum field theory which was exploited by the early theorists was by making use of the 'normal modes' of a field produced by boundary conditions. (1)

Contempory field theorists such as Mendel Sachs are explicitly concerned to develop a field ontology in opposition to particle theory. For this reason they have attempted to come to terms with the need to revise the concepts of observation and to show how a field can have discontinuities. Sachs and Darryl Leiter among others have focussed on one of the main sources of continuity in field theory, the principle of superposition. In this, complexes of field distributions are freely superposable and this is characterised mathematically by the use of linear equations. To remove this source of continuity Sachs and Leiter are developing non-linear field theories in terms of which it is possible to describe particle like singularities. (2) These ideas are still in the process of development.

A second source of continuity in field theory is the assumption of

(1) Loc.cit.
(2) Darryl Leiter "Can Atomic Processes be Described by Non-linear Wave Mechanics in Space-time?" INT.J.THEORET.PHYS., Vol.3 1970 pp.205-231 and Mendel Sachs "On the Nature of Light and the Problem of Matter" in Hooker ed. Contempory Research in the Foundations and Philosophy of Quantum Theory, Reidel, Dordrecht 1973, pp.346-368.

continuous space-time. Heisenberg in 1938, and following him, Margenau in 1950 have attempted to abandon this continuity and introduce a 'smallest length' of 10^{-13} cms. into quantum mechanics called a hodon. (1) Correspondingly there is introduced a smallest unit of time: the chronon. Such an approach acknowledges the problem noted by Poincaré in the quote at the beginning of this section that with the introduction of Planck's constant the dynamics of the world can no longer be described by differential equations. To overcome this problem the dynamics can be cast in the form of difference equations, but so far no workable formalism has been developed along these lines. (2) Furthermore in the context of field theory the introduction of such discreteness is just as _ad hoc_ as the normalization procedures which are avoided by the discreteness assumption.

Given this state of the debate between field theory and particle theory in the context of quantum mechanics where there are reasons to support both ontologies, but neither is capable of accommodating all features of the domain, the obvious way out is to develop a quantum theory based on the ontology of process philosophy. Such is suggested by the comment made by Jammer in the concluding remarks to his THE CONCEPTUAL DEVELOPMENT OF QUANTUM MECHANICS:

> Contrary to the Aristotelian physics of qualities and in contrast to the Newtonian physics of primary properties, the language of quantum mechanics is a language of _interactions_ and not of _attributes_: _processes_, and not _properties_, are the elements of its syntax. (3)

(1) Jammer (1969) op.cit. p. 186ff.
(2) Hooker (1974) op.cit. p. 275.
(3) Jammer (1969) op.cit. p. 381.

In process philosophy any particular entity has both an autonomy from its environment and is dependent on its environment. As suggested in the last chapter, a particular process is like an eddy in a stream, which, like the ripple on a pond used in the analogy for field theory, does not have an existence independent of the stream. However unlike the ripple, it is not simply a manifestation of the whole but has a dynamics of its own. This accounts for a world having both field-like characteristics and particle-like characteristics. Such a process, being a self-ordering activity can only be known through its power to affect other processes and cannot be simply regarded as a thing to be known as can an atom. The adoption of this ontology could then form the basis for reconciling the quantum mechanics and relativity theory as it was interpreted in the last section.

One attempt to interpret quantum mechanics in terms of process philosophy has been made by Milič Čapek. He argues that the impossibility of determining both the position and the momentum or the time and the energy of a system together is an indication of the problematic nature of these concepts and for the validity of process philosophy. In a world of processes there can be no place for dimensionless points or durationless instants. In support of this position he quotes the conclusion reached by Zigmund Zawirski in 1934 in relation to time and energy:

> If the instantaneous cut of the temporal flow according to Heisenberg's formula leaves energy completely undetermined, does this not prove that the universe needs a certain time to take on precise forms? (1)

While this approach accounts for discreteness of space and time, Čapek

(1) Čapek (1961) op.cit. p. 239.

rejects the atomic view of these. Such 'atoms' must be thought of as being bounded by points and instants, reintroducing the concepts which the atomistic view is designed to exclude. Furthermore relativity theory precludes the separate atomisation of space and time. Rather, the extensive process of becoming of the universe must be seen pulsational and therefore not infinitely divisible. This indivisibility is of the same order as the indivisibility of a note of music; beyond a certain level it ceases to be a note, though there are no instants at which a continuously played note ends and another begins.

A more radical revision of quantum theory based on the ontology of process philosophy is being developed by David Bohm and a group of physicists and mathematicians associated with him. Bohm argues that quantum theory in its present form is incomplete, being a mere statistical algorithm which provides no conceptual structure in terms of which the movement of individual systems can be understood. (1) To overcome this, Bohm proposes a theory of non-localized hidden variables which will show how individual systems and the statistical ensemble represented by the Schrödinger wave function are related. This will then enable the statistical nature of quantum phenomena and the apparent "collapse" of the wave packet on measurement to be understood. According to Bohm, the theory indicates that: "the probabilities are...the result of 'hidden' variables (and not 'irreducible') and the 'collapse' is due to a deterministic process that satisfies a law that could in principle be studied with regard to its order and structure of movement." (2)

(1) D.Bohm and J.Bub "A Proposed Solution of the Measurement Problem in Quantum Mechanics by a Hidden Variable Theory" in REVIEWS OF MODERN PHYSICS, Vol. 38, 1966, p. 456f.
(2) Ibid., p. 464.

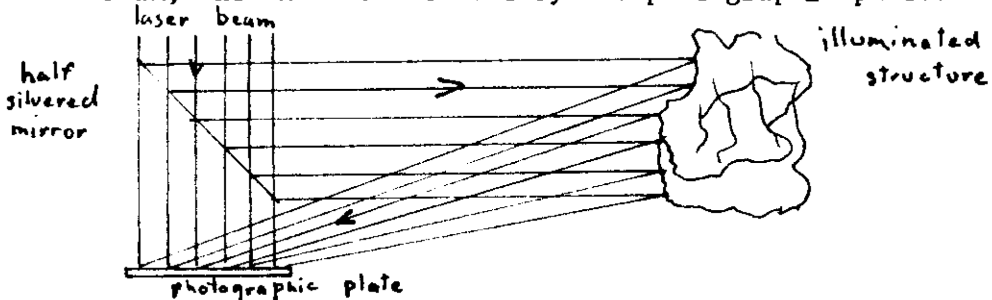
This recourse to hidden variables in no way heralds a return to a mechanistic conception of being. Bohm writes:

> What we are suggesting...is that all matter is to be understood as a relatively autonomous and constant set of forms built on and carried by the universal and indivisible flux...Such material forms have a certain subsistence, in the sense that under appropriate conditions they can continue with a certain limited possibility for stable existence. However they are not to be regarded as substances, which would be completely stable, permanent and not dependent on something deeper for their continued existence. (1)

The equation of motion of the system in this theory is nonlocal and non-linear. (2) This means that the change in the wave function at any point depends on the values of the wave function at every other point. The measuring apparatus is reflected in the equation of motion and the measurement process is seen as a particular case of the coupling of large scale and small scale levels. This means that the experimental arrangement in which observations are made is taken as an undivided whole.
It is Bohm's aim to develop a concept of order which will "give primary relevance to activity and wholeness in the sense of undivided movement." (3) In this, discreteness will be seen to follow as a natural consequence. What had been previously taken as primary concepts, namely particle, trajectory, potential field etc. which are all dependent on the assumption of continuous space and time as represented by Cartesian coordinates will be seen as the secondary consequence of this more primitive order. (4)

(1) David Bohm "The Implicate or Enfolded Order: A New Order for Physics" in MIND IN NATURE: ESSAYS ON THE INTERFACE OF SCIENCE AND PHILOSOPHY eds. John B. Cobb Jr. and David Ray Griffin University Press of America, Washington, 1978, p. 40.
(2) Bohm and Bub (1966) op.cit. p. 467.
(3) David Bohm, Basil J. Hiley and Allan E.G. Stuart "On a New Mode of Description in Physics,"INT.J.THEOR.PHYS. Vol. 3, 1970, p. 172.
(4) Loc.cit.

Bohm has been at pains to develop an intuitive understanding of this order and has coined the term 'implicate' order to describe it. (1) Etymologically, the verb 'to implicate' means 'to fold inward', and so 'implicate order' is an enfolded order in which the total order is contained in some implicit sense in each region of space and time. The hologram illustrates this type of order. In this, coherent light from a laser is passed through a half-silvered mirror so that part of the beam goes directly onto the photographic plate. The other part is reflected to illuminate a whole structure, and the light from this illuminated structure is reflected down to the photographic plate. All this is illustrated in the figure below. The light reflected from the structure produces complex interference patterns with the undeflected laser beam, and this is recorded by the photographic plate. If a laser



beam is now shone through the photographic plate, the eye on the other side will see the whole of the original structure in three dimensions, and from a range of possible points of view as though one were looking through a window. And if a small part of the photographic plate is illuminated, we still see the whole structure, but with less sharply defined detail and with a decreased range of possible points of view, as though one were looking through a smaller window.

What is significant in this is that there is no one to one correspondence

(1) David Bohm "Quantum Theory as an Indication of a New Order in Physics. B. Implicate and Explicate Order in Physical Law", FOUNDATIONS OF PHYSICS Vol. 3, 1973, pp. 139-168.

between parts of the illuminated structure and what is recorded on the photographic plate. Rather, each region in the photographic plate is relevant to the whole structure, and each region of the structure is relevant to the whole of the interference pattern on the plate. However the plate is only a record of the interference pattern. It is the light itselfwhich in its movement contains implicitly in each region the order of the whole illuminated structure. This is what is meant by implicate order.

A further analogy which extends what is meant by implicate order is provided by considering a viscous fluid which is being slowly stirred. If drops of insoluble dye are now placed at regular intervals of time and space in the fluid, these will disappear into the fluid, becoming enfolded within it. If now the stirring is reversed the drops will reappear one after the other and appear as an individual drop moving along a path. Whole pictures could be enfolded this way. However the implicate order which is made explicate by stirring in the opposite direction is really dependent on the whole movement of the fluid as determined by the mechanical stirring device.

On the basis of these analogies, the phenomena of quantum mechanics become more comprehensible. Unlike the situation where one looks through a lens and perceives various parts of an entity so that there is a one to one correspondence between the parts of the observed object and the image of this, it was shown in the account of Heisenberg's thought experiment that such an analysis is impossible, and that the experimental arrangement has to be regarded as a whole. Such indivisibility of the whole experimental arrangement in which the whole order is relevant in each region of what is observed, is typical of the quantum domain. (1) The analogy of the hologram provides a way of understanding the meaning of this. The enfolded drop of dye used as an analogy enables one to understand the role played by experimental arrangements. The example of the enfolded order appearing as a moving drop is very similar to what happens in the quantum domain where what is taken is a track of an elementary particle. The tracks in a recording device such as a photographic emulsion or bubble chamber are a series of points rather than a continuous track and it is necessary to describe movement discontinuously in terms of quantum jumps. The dependence of this track on the experimental arrangement indicates the necessity of viewing this as dependent on the whole experimental arrangement rather than as the autonomous motion of a localized particle. From this it can be seen how quantum theory can be understood in terms of the primacy of the implicate order of the whole movement or activity with such explicate order as particle-like behaviour being of secondary significance. The explicate orders are those aspects of the implicate order which are made relevant or 'relevated' by the different experimental arrangements. It is not difficult to imagine two different types of order enfolded by a fluid which could not be relevated at the same time thus providing an analogy with the wave/particle duality of the quantum domain.

As useful as these analogies are to emphasise the spatial indivisibility of the whole, they also suggest that the explicate orders are nothing but manifestations of the whole. This is not what Bohm is arguing for.

(1) Ibid., p. 145.

He merely wants to stress that: "nothing is 'a law unto itself.' At most, something may behave with a relative and limited degree of autonomy, under certain conditions and in certain degrees of approximation."(1)

In a later paper Bohm suggested that the idea of relative autonomy could be expressed more succinctly in terms of hierarchies of systems in which each system is composed of many subsystems, while in turn it is a constituent of various supersystems. (2) However this is not to imply that subsystems are independent of the systems and supersystems in which they participate, since it must be seen as having only a limited degree of autonomy from the whole of which it is part. The analysis into such systems must be seen as a convenient abstraction which can serve as a basis of description. On this view there can be no ultimate set of subsystems nor an ultimate supersystem which constitutes the universe as a whole, since this would deny the dependence of the subsystems on the systems of which they are constituents, and the dependence of the supersystem on the subsystems from which it is constituted. While each subsystem is intimately dependent on the systems in which it participates, which in turn depends on supersystems etc. ultimately merging with the unknown totality of the universe as a whole, it is possible for this subsystem to be made to stand out in relief against a background (including the observer) which is not important for its function or behaviour. However since this independence is dependent on the conditions, the whole is implicitly present in every description. This conception of the world involves a topological and topochronological view of space and time, consistent with

(1) Bohm (1973) op.cit. p. 154.
(2) D.J. Bohm and B.J. Hiley "On the Intuitive Understanding of Nonlocality as Implied by Quantum Theory" in FOUNDATIONS OF PHYSICS Vol. 5, 1975,p.101ff.

the views expressed in the last section. As Bohm writes: "We have... to start from nonlocality as the basic concept, and to obtain locality as a special and limiting case, applicable when there is relative functional independence of the various 'elements' appearing in our description." (1)

While these system concepts are useful for describing single body systems in which there is a need to emphasize the dependence of the quantum phenomena on the experimental arrangements, its usefulness is more fully illustrated in the case of atoms. Bohm argues that "a quantum many-body system cannot properly be analysed into independently existent parts, with fixed and determinate dynamical relationships between each of the parts. Rather, the "parts" are seen to be in an immediate connection, in which their dynamical relationships depend, in an irreducible way, on the state of the whole system... (and indeed on that of broader systems in which they are contained, extending ultimately and in principle to the entire universe)." (2) Bohm goes on to show how in a many-body system the system gives rise to a 'many-body force' in which the interaction between each pair of particles depends on all the other particles, and so cannot be reduced to a sum of terms, one for each pair. (3)

Čapek's process interpretation of quantum theory emphasised the temporal aspect of quantum phenomena, the pulsational nature of becoming,while Bohm

(1) Ibid., p. 105.
(2) Ibid., p. 95f.
(3) Ibid., p. 98.

has focussed on spatial indivisibility and the limited autonomy of relevated orders. The question arises as to what is the relationship between these. While Čapek in his earlier work rejected Bohm's concern with hidden variables, there is nothing inherently contradictory in Čapek's and Bohm's interpretations, and Čapek's ideas can be seen as supplementing Bohm's analyses. While these two interpretations cannot be simply added together, the auditory analogy developed in the last chapter provides a basis for relating these two sets of ideas. Music suggests both pulsational becoming and the primacy of indivisible space with the order permeating the whole of space and localization developing as a secondary phenomenon. Since music implies the active involvement of the listener with only the ability to focus on different features of a complex movement separately, the analogy also provides a way of comprehending the importance of the experimental apparatus, of implicate order and of Bohm's idea of 'relevation'. More importantly from the point of view of Bohm's ideas, the auditory analogy avoids the tendency to see everything as a manifestation of the whole. The notion of individuality implied by music, that is, of individuality within a continuity, supports the idea of the relative autonomy of the subsystems defended by Bohm. Thus there would seem to be good reasons for taking the auditory analogy as I developed it in the last chapter as basic for an understanding of quantum phenomena.

This does not mean that it should displace the analogies developed by Bohm. But Bohm's analogies should be understood as sub-analogies important for their ability to elucidate different aspects of the total phenomenon. Similarly if the theory is to be developed it is necessary to use mathematical analogies to further clarify and refine these ideas.

To develop their theory, Bohm and his colleagues have been trying to work out a new mathematical formalism in which discreteness, wholeness, the role of the experimental apparatus and so on as described in terms of this theory can be seen to be basic. (1) Both the particle and the field require local dynamical descriptions using differential equations which give a deterministic account of the universe. This implies that all aspects of the system can be observed simultaneously and interaction during observation can be ignored. As we have seen, all this is different in quantum theory where it is not possible to observe all aspects of the system simultaneously, and the experimental apparatus has to be treated as a whole. The incompatibility of different observations is formalised in the Hilbert space formalism by means of the non-commutation of operators. However in this approach, we are required to specify the relationship of operators to the results of observations and it has been assumed that we must start from classical concepts in observation and then translate this into the formalism by a set of rules, implying an unanalysable disjunction. In the new approach we begin with an informal language which breaks away from classical concepts and recognizes wholeness and discreteness, and then attempts to mathematically formalize this language.

To go beyond the concepts of particle and field theories and to take discreteness as basic, involves the rejection of continuous co-ordinates, as Poincaré originally suggested we must. To do this, a mathematical

(1) R.H. Atkin and Ted Bastin "A Homological Foundation for Scale Problems in Physics" INT.J.OF THEOR.PHYS. Vol.3 1970 pp.449-466; David Bohm, Basil J. Hiley and Allan E.G.Stuart, ibid. pp.171-183; B.J. Hiley "A Note on Discreteness, Phase Space and Cohomology Theory" in Ted Bastin (1971) op.cit. p. 181ff.; R.H. Atkin "Cohomology of Observations" ibid., p.191ff.; David Bohm (1973) op.cit. Appendix pp.155-167.

description using cells is used. This form of description is provided by homology and cohomology theory, a branch of algebraic topology. Phase space is then conceived of as having a cellular structure in which the cells, rather than being taken to imply a limitation on the simultaneous specification of position and momentum, are taken as fundamental. This introduces qualitative features into the description. Also, the shape of the cell in phase space is inseparabley amalgamated with the experimental conditions in such a way that analysis is no longer relevant, thus allowing a place for the experimental apparatus in the mathematics of the theory. The cells then describe structures associated with experimental conditions rather than orders of point particles, point events or the like. The implications of this approach are now being explored.

The prevailing formalism of quantum theory runs into difficulties with distances less than 10^{-13}cm. with high energy particles, and is incapable of dealing with atoms more complex than helium. So quite apart from the more basic difficulties of quantum mechanics discussed in this section, it is necessary to go beyond the existing theory. While the theory being developed by Bohm and his colleagues based on the ontology of process philosophy is still in its formative stages and no final conclusions have been reached, in view of the difficulties faced by alternative approaches, it seems likely that it will be along these lines that a successful overcoming of the problems of quantum mechanics will be achieved. This will then pave the way for a reconciliation of quantum theory and relativity theory.

THE UNIVERSE AS PROCESS

So far I have tried to justify process philosophy through an examination of the theories concerned with the most macroscopic and the most microscopic features of the universe. My reason for focussing on these theories was to show that it was not possible to conceive of the universe as being a unified totality in which everything in it is simply a manifestation of the whole, nor is it possible to view it as nothing but the arrangements and interactions between elementary entities. However on the microscopic aspect of the universe I have not considered the implications of elementary particle physics.

Elementary particle physics is concerned with the nature of strongly interacting particles or hadrons. Protons and neutrons are hadrons as are most of the short lived particles which have been discovered over the last thirty years. Recently evidence has supported the hypothesis that these hadrons are composed of elementary entities called quarks. However although this field of inquiry is still in a state of flux, there is no reason to believe that quarks are any more able to serve as the elementary building blocks of the universe in the materialist sense than can their opposites, electrons. They are not immutable, since a proton and an anti-proton can annihilate each other to produce nothing but gamma rays. Also since there are probably at least six quarks and reason to believe there are more, it is not clear that there is anything fundamental or simple about them. (1) And the stability of certain combinations of these quarks would suggest that this can only be accounted for in terms

(1) Nicholas P. Samios "Elementary Particles"in McGRAW HILL YEARBOOK OF SCIENCE AND TECHNOLOGY 1978 p.158ff.

of the whole ensemble which goes to make up a hadron in the same way as a many body atom as understood by Bohm is characterised by a many-body force which cannot be described in terms of the simple interactions between pairs of constituents.

This is the sort of conclusion reached by one of the main theorists in the field, Geoffrey Chew, who argued that explanations in terms of elementary particles were unsatisfactory since there is always the problem of explaining the last particle identified. For this reason one can never get to the end of the road. Chew's alternative, the bootstrap hypothesis, is to understand each entity on its own level by showing that "the particles are as they are because this is the only way they could be." (1) This must be an entirely different form of explanation than is usual, as Chew points out: "By its very nature it cannot be formulated through equations of motion in the time-honoured tradition as all previous physical theories, because in principle there are no entities which could conceivably appear in the equations of motion." (2) This accords very well with process philosophy.

Having ruled out the possibility of explaining everything in terms of either the whole universe or its most elementary constituents supports the position of process philosophy according to which all processes in the universe have an equal ontological status. Molecules, crystals, liquids and gases, rivers, oceans and geological formations, eddies, clouds and climatic systems, clusters of galaxies, galaxies, stars and

(1) Cited in Toulmin (1972) op.cit. p.235 from G. Chew "Crisis in the Elementary-Particle Concept" in PUBLICATIONS OF THE UNIVERSITY OF CALIFORNIA RADIATION LABORATORY, no.17137, Berkeley, Calif. 1967.
(2) Loc.cit.

and planetry systems, all must be understood primarily in their own terms, being irreducible either to their constituents or to environmental parameters. Attention must be turned away from concern with the laws governing the elements of the universe towards the existence of processes, all of which must be accepted as worthy subjects of investigation in their own right.

This means that science must be preeminently concerned with individuals each of which, as an immanent cause of its own being contributes something to the universe as a whole. Such individuals are not substances with attributes, but self-ordering activities with some autonomy from their environment. All the activity of an individual from its creation, throughout its career to its destruction, is an essential part of it. The type of activity involved and the way an individual reacts to other processes is a unique characteristic of the type of process it is, and cannot be understood in terms of anything else. This individuality is exemplified in the case of a crystal. A crystal maintains the activities of its constituent atoms or molecules in such a way that these are arranged in a fairly rigid structure. This structure is maintained with some degree of independence from the environment, and it is by virtue of the structure that the crystal can diffract light rays. This is an emergent characteristic of the crystal and cannot be regarded as simply a property of the individual constituents.

Quite apart from those processes associated with life, there are enormous variations in the types of processes in the universe. For instance a solid maintains its shape and volume, a liquid retains its volume but not its shape while a gas retains neither but has the power to resist compression which could eventually change the gas into a liquid. Some processes are very stable such as light atoms, others such as very heavy atoms endure for very short periods before disintegrating for reasons independent of the environment. Some, like stars, have tremendous powers to influence other processes while having very few liabilities to being influenced. Neutrinos on the other hand have almost no powers to influence anything. Some processes such as crystals are almost passive, only interacting with other processes when processes which are agents, such as photons, rivers or geological processes, either come into contact with it or bring other entities into contact. Also processes can be in a state of equilibrium or evolving or dissolving.

One type of process which is extremely important from the point of view of process philosophy is the dissipative structures which develop in thermodynamic situations which are far from equilibrium. (1) These manifest more clearly than other types of processes the irreducibility of the whole to the parts, and, while being common in the inanimate realm they are absolutely essential to living processes. Molecules, gases, liquids and crystals as I have discussed them can be interpreted in terms of classical thermodynamics as equilibrium orders, the sort which appear in an isolated system after a sufficiently long period of time. Such order is dominated by Boltzmann's ordering principle. However, where a system is far enough from thermodynamic equilibrium processes develop which are based on an entirely different principle: order through fluctuation. If the whole system is large enough, then self-organizing

(1) Ilya Prigogine "Order Through Fluctuation: Self-Organization and Social Systems" in EVOLUTION AND CONSCIOUSNESS: HUMAN SYSTEMS IN TRANSITION Erich Jantsch and Conrad H. Waddington eds., Addison-Wesley, Reading, Mass. 1976 describes these.

processes or dissipative structures will develop through the amplification of fluctuations in such a way as to establish their own boundaries. The ordering involved can be a temporal organization as in the case of limit cycles, stationary inhomogeneous structures, a spatio-temporal organization in a wave form, localized structures or some multiple of these. (1) Typical examples of such order are provided by hydrodynamics where patterns of convection develop if there is an uneven heat distribution, or where a laminar flow of fluid develops into a turbulent flow. Further studies involving dissipative structures have been made by Ilya Prigogine and his colleagues in the field of chemical kinetics. (2) In all these cases, a large number of molecules manifest a coherent order over a large period of time. (3) Studies of these phenomena are important because they integrate the concept of structure or order into the framework of theoretical physics. Also, dissipative structures, unlike equilibrium structures whose states are uniquely determined by environmental parameters, are involved in a cycle of activities and thus undergo state transitions autonomously. This means that they must be regarded as self-animating. This is the type of order involved in biological and sociological phenomena, and their study in the physical realm provides a bridge between the inanimate and the animate realms.

Every process, no matter how fundamental it may seem, is dependent on its

(1) Ibid., p. 98.
(2) Ilya Prigogine "Unity of Physical Laws and Levels of Description" in INTERPRETATIONS OF LIFE AND MIND: ESSAYS AROUND THE PROBLEM OF REDUCTION, Marjorie Grene ed. Routledge & Kegan Paul, London, 1971, pp.1-13.
(3) Ibid., p. 5.

environment for its continued existence. This is even true of elementary particles. When particles of very high energy collide, they are transformed into other elementary particles. It is possible to conceive of states of very high temperature, and such conditions may have existed in the interior of stars, where the mean energy is so high that such changes would take place continuously. (1) In this environment elementary particles would have very little stability or autonomy. Thus a process, being a self-ordering activity must be seen as existing only by virtue of the environment with which it is in reciprocal interaction. The balance of forces of the various background and substructural processes which allows a process an even approximate independence from the infinite diversity of the processes with which any process is in interaction must be seen as only conditional. To further illustrate this, consider the case of a certain liquid. In this, the intermolecular forces tending to hold the molecules together are balanced by the random thermal motions which tend to disrupt the entire system. In nature, the liquid always exists in some environment which cannot fail to change with time. Given long enough, this change will disrupt the balance of forces and change the liquid into something else. This means that no process has complete autonomy in its mode of being, since its basic characteristics must depend on its relation to other processes and activities.

It is only possible to understand the world by applying the concept 'thing', where this refers to an object, a quality, an event, a relationship, a process or whatever. Since all that can be identified as a thing is dependent on a process or processes which maintain themselves, and since

(1) David Bohm CAUSALITY AND CHANCE IN MODERN PHYSICS Routledge & Kegan Paul, London, 1957, p. 59.

all these are dependent upon their environment and substructure, what is taken as a thing must be seen as an abstraction which is conceptually separated from its infinite background. The concept of 'thing' must be understood as only approximately applicable to what we find in certain contexts, under suitable conditions, over a characteristic period of time, and what is conceptualized as a thing is always less and in some sense different from what is in the world. While it is necessary to make such abstractions, this should not lead us to conceive of the world as simply consisting of all the things in the world and their relationships, since these 'things' could not exist apart from the contexts from which they have been abstracted. In particular, the interactions between processes cannot be understood simply in terms of the external relationships between things.

Having made this point it is possible to see the validity of the process view of causality. The emphasis here is on the activity of the processes and implies natural necessity rather than extrinsic causality or the logical necessity of lawful behaviour. On the process view of causality, processes can be seen as modifying or destroying each other in their interactions, they can be seen as supervening causes, constraining their constituents, or they can be seen as creative in the sense of giving rise to the conditions in which entirely new processes arise. All this is predicated on the assumption that each process is also an immanent cause of its own being.

Considering first the case of interaction between processes, the point being emphasised here is that processes must be seen as agents producing whatever effects take place. They are the efficient causes of the modifications or dissolution of other processes with which they interact. The way an individual process behaves will always be partly due to extrinsic conditions, but will also be to some extent an immanent feature of the process. This can be seen even in the case of the interaction between billiard balls which is the paradigmatic example of extrinsic causality. Where an object is seen as an ordered activity, the motion of this object must be seen as part of this order rather than as something extrinsic to it. To be an object involves the maintenance of shape by the process, and interaction between billiard balls must then be seen as the changing of one aspect of the order of each, their motion, as a consequence of their being shape maintaining processes. In the same way wherever a process affects some other process, it must be seen as this process, being an immanent cause of its own being, modifying or destroying the other as part of its self-maintaining activity.

It is because the context within which interactions between processes take place is ignored that supervening causality is so hard to comprehend. When it is seen that the very existence as well as the particular nature of a process can only be understood in relation to its environment, then it can be seen that the ordering of the environment constrains the particular process. This constraint on the particular process, since it is part of the environment of other processes, also constrains them. Along these lines it can be seen how there can be hierarchical ordering with higher levels constraining their constituents by providing the environment within which they exist. For instance, a sugar crystal provides the environment which constrains the activities of each individual molecule to create the order which is the whole crystal. The molecule constrains the atoms and the atoms constrain the protons, neutrons and electrons. In fact it is only in the context of the atom that the neutron is stable. Outside this environment it has a half-life of only eighteen minutes. It is because the whole provides the environment in which its constituents are constrained, and this constraint, by reproducing the environment, maintains the whole, that all processes must be regarded as the immanent cause of their own being.

A form of causality less often considered is that by which a new order is created. In the materialist view it is generally seen as simply a matter of the constituents coming together, acting according to their own laws. However this is again to ignore the context in which such coming together takes place. New orders must be seen as emerging from within fields which are favourable to their production, being more a matter of an ordering within a field than simply an agglomeration of constituents. This is perfectly evident in the case of dissipative structures, but even in the case of equilibrium structures this can be seen to be the case. Thus crystalization occurs within a saturated solution through the emergence of a new order which, once begun, imposes itself on the surrounding environment.

The emergence and destruction of order is the process of evolution. In the nineteenth century the idea of evolution emerged in two conflicting ways. The first was that involved with the development of life which leads to the emergence of more and more complex types of order. The second was associated with the second law of thermodynamics and describes the tendency of every closed system to develop towards a state of maximum randomness. The first view led to the sort of philosophy expounded by Bergson who wrote: "The more we study the nature of time, the more we shall comprehend that duration means invention, the creation of forms, the continual elaboration of the absolutely new." (1) The second view led to the idea that the universe is dissolving into progressive chaos. These two different types of evolution correspond to different thermodynamic situations. Creation of structures can occur "with specific non-linear kinetic laws of far-from-equilibrium conditions." (2) In this case energy exchanged between the system and the outside world is converted into order. In the neighbourhood of thermodynamic equilibrium there is a destruction of order. In both cases, evolution takes place in the environment provided by a broader process which maintains either the thermodynamic equilibrium or dis-equilibrium.

This all provides further insight into the nature of the world understood as a process of becoming, and the place of space and time in this. The concept of evolution implied by thermodynamics suggests that the universe is incomplete and the future full of potentiality. The irreversibility of this process contrasts with the reversibility of time as understood by classical mechanics. It has been suggested that elementary particles are not localizable and that they have a minimum duration. This means that the process of extensive becoming is not infinitely divisible.

(1) Henri Bergson CREATIVE EVOLUTION tr. Arthur Mitchell (1911) Greenwood, Westport 1975, p. 14.
(2) Ilya Prigogine (1971) op.cit. p. 2.

But this is also true of all processes, and the higher level processes discussed in this section require a much longer duration to fully become than do elementary particles. For instance the properties and powers of an atom, such as spectral frequency and chemical reactivity arise over the duration required for the electrons to orbit at least once, which means that the atom cannot even be thought of as such in less than this duration. In this way the process of becoming can be seen to be multilinear. Where processes are such as to provide the environment for other processes which have some autonomy from the environment, the notion of locality and temporal order becomes significant, since the sub-processes have a stable background against which these can be defined. Consequently, along with the Swiss alchemist and physician Paracelsus, we must say that there is a multiplicity of times. (1) There is a cosmic time, a geological time, an evolutionary time, a multiplicity of biological times, an atomic time and so on. To each of these there corresponds a spatial order defined in terms of the potentiality for interaction between the sub-processes constituting the process which defines the particular time. It is because of the multiplicity of interlocking processes and levels of articulation of the process of becoming of the universe as a whole that for practical purposes it is possible to think of one universal space-time. However it is necessary to recognize this as an abstraction from the multiplicity or polyphonic nature of the process of extensive becoming of the universe.

(1) J.T. Fraser, "The Interdisciplinary Study of Time" in INTERDISCIPLINARY PERSPECTIVES OF TIME: ANNALS OF THE NEW YORK ACADEMY OF SCIENCES Vol. 138, Art.2, N.Y. 1967, p. 823f.

REDUCTIONISM AND DETERMINISM

In the world as understood by process philosophy, there is no reason to regard any particular type of process as having a higher ontological status than any other. Each process must be understood on its own level and cannot be explained away as simply the effect of other processes. Also the world is not to be regarded as in any sense determined but must be seen as a creative advance into the future. But reductionism and determinism have been closely identified with science, and for this reason I will examine these issues more closely.

What gives weight to the reductionist position is the prevalence of explanations of wholes in terms of their constituents. However C.D. Broad pointed out that if we want a complete explanation of the behaviour of any whole in terms of its parts:

> we always need two independent kinds of information. (a) We need to know how the parts would behave separately, and (b) we need to know the law or laws according to which the behaviour of the separate parts is compounded when they are acting together in any proportion and arrangement...it is extremely important to notice that these two bits of information are quite independent of each other in every case. (1)

In the analysis of the relationship of wholes to their constituents in terms of the notion of causality deriving from process philosophy it was emphasised that this second bit of information is only provided by focussing on the whole which provides the environment in which each of the parts function. This was brought out by Bohm who argued that a many body atom gives rise to a many body force which cannot be understood

(1) C.D. Broad THE MIND AND ITS PLACE IN NATURE Routledge & Kegan Paul, London, 1925, p. 61.

as the sum of interactions between pairs of sub-atomic particles. It is also evident in the way that atoms are constrained within a crystal by the whole process.

The illusion that an explanation of something in terms of its parts justifies the conclusion that the whole is nothing but the parts, is created by the way in which that which is tacitly understood can be ignored. When an attempt is made to explain a comprehensive entity in terms of its parts, it is necessary to already have some understanding of the whole and how it provides the environment for the parts. Only in this way can the parts be understood in relation to the whole in such a manner that an explanation of the whole can be made. But in focussing on the parts it is necessary to attend from the whole to the parts, and then the whole is only tacitly understood. Because this understanding of the whole is tacit, it can easily be denied and it is this which creates the illusion that what exists are the parts and the laws governing them, and that the whole has been explained away.

The other feature of science which has contributed to the acceptance of ontological reductionism is the way experiments are usually conducted. Normally an experimental situation is set up in which a simple cause-effect relation can be isolated. In this way the causal agent can be manipulated and the results investigated. But this leads to the context within which this cause effect relation is isolated and which contains those aspects of reality which cannot be so analysed, being ignored. It is because of the prevalence of this form of experimental design that such phenomena as the dissipative structures which develop in far from thermodynamically equilibrium situations which are not amenable to such treatment have not been investigated until recently. These now provide the clearest examples of phenomena which must be treated holistically.

Determinism derives from materialism and was originally proposed by Leucipus. When everything in the world is conceived of as being composed of inert matter in motion, then the only function of science can be to formulate the laws of motion and interaction. However, field theory which tries to explain everything in terms of fundamental equations governing the totality of the universe, is also deterministic.

The two most obvious places where this deterministic conception of the universe falls down are in the indeterminacy of quantum theory, and in relativity theory where it was seen to be impossible for any observer to know the universe as a totality. However these only provide minor comfort for the anti-determinist as they stand. The indeterminacies of quantum theory average out over macroscopic levels and the indeterminacy implied by relativity theory can be construed as simply a limitation in the possibility of observation. It is necessary to examine more closely the ideas which give determinism its intuitive plausibility.

Firstly there is the question of what determinism means. Determinism implies that the state of the world, both now, and as it will be, is determined by something. Therefore if determinism is to be valid, there must be a plausible candidate to fill this role. It is often thought that if every event has a cause, then the ultimate determinant of the whole universe is the first cause. However to say that every event has a cause does not necessarily imply that events are determined by their causes. An example which illustrates this point fairly clearly is the case of air moving over the smooth surface of water causing waves to form. The air causes the waves but does not determine their nature. This is because as soon as the surface of the water is disturbed, the disturbances interact. This interaction then plays a major part in determining the nature of the waves. Thus the waves are caused by the movement of air but not determined by it.

A better candidate for the role of ultimate determinant is the laws which are supposed to govern the universe. However from the point of view of process philosophy, laws are not to be thought of as governing anything, they are merely approximate descriptions of behaviour. As such they simply point the way to genuine explanations in terms of the nature of processes. In fact the most important function of laws in science is to indicate the existence of some sort of order. They are heuristic devices, and anyone formulating a law should be prepared to attempt to show the nature of the process which lends itself to being described in this way. This secondary place of laws can be seen by looking at those already accepted in science and what status they have.

In fact there are scarcely three fundamental laws, namely those of gravitation (Newton's Law), light and electricity (Maxwell's Laws) and the simplicity of these is only apparent. What they really do is express how gravitation and electromagnetic radiation are a manifestation of the universe as a whole and for this reason are intimately connected with the geometry of space-time. It has already been argued that contrary to the assumptions of field theory, individual processes act to some extent on their own principles and are therefore not predictable by these laws. The laws only apply statistically to a large number of isolated, independent, small processes in which the effect of individuality cancels out.

It is possible for emergent processes to give rise to behaviour which can also be described in terms of laws. Examples of this are the laws describing the behaviour of gases, and the laws of refraction and diffraction associated with crystals. The possibility of there being such laws arises with the existence of the corresponding processes and they must always be understood as dependent on these processes. Often determined efforts are made to reduce the laws describing higher order processes to the fundamental laws. These have usually been accepted as successful by everyone except those people involved in the attempt. For example the attempt to reduce thermodynamic descriptions to molecular dynamics by rigorous mathematical arguments has been nearly successful but not quite. It is generally accepted that this is good enough and it is thought by the proponents of reductionism that this is a classical case of a successful reduction. But as Howard Pattee remarked: "This result is not trivial since 'not quite proved' in mathematics is like 'not quite pregnant' in biology." (1)

These laws are only applicable in limited contexts, and it is not even possible to describe these contexts in such a way that perfect predictions could be made about the future. Science works with abstractions and the laws associated with a theory are only applicable in ideally isolated systems. Even where the world is most congenial to being understood in

(1) H.H. Pattee "The Problem of Biological Hierarchy" in TOWARDS A THEORETICAL BIOLOGY 3 SKETCHES ed. C.H. Waddington, Uni. of Edinburgh Press, Edin. 1970, p. 129.

terms of such abstractions, where factors other than those specified by the model can be most nearly ignored, there are always some extraneous factors involved. For instance the planetry system which is successfully treated as an exclusively mechanical phenomenon is affected by the pressure exerted by sunlight and the light of the stars. Since such independent contingencies in the environment will always influence the context under consideration to some extent, any theory which can be formulated will not be adequate to make predictions even in the context for which it was formulated. The appearance of determination by law in any context is only a reflection of the constructs used to understand that context, not of the context itself.

All this reveals the general overestimation of the concept of law in science and points to the real nature of the issue. The 'behind the scenes' candidates for the role of determinants of the universe are the entities in terms of which everything else is supposed to be reduced to in explanation, whether these be the elementary particles of materialism or the universe as a whole as in field theory. Determinism really falls with reductionism. In a universe consisting of a multiplicity of processes, each of which is an immanent cause of its own being and contributes something to the universe as a whole which is irreducible to anything else, determinism has no meaning. The processes which make up the universe must be seen as actualizing the potentialities of the future by creatively producing and expressing themselves while in constant interaction with each other.

It can be seen from this that determinism and predictability are two separate issues. If it is possible to predict what will happen in the future only by understanding all the individual processes in the universe and all their interactions, then it cannot be said that this is determined since it must be seen as an expression of particular individuals. There is nothing which can fulfil the role of the ultimate determinant. But even the idea that the universe is predictable must be rejected, and this also for other reasons than those discussed in relation to quantum theory and relativity theory. The universe is constantly creating novel processes, and since each of these is explicable only in its own terms, neither their creation nor their behaviour can be understood in advance.

MATHEMATICS AND PROCESS PHILOSOPHY

The progress of science has been so clearly associated with mathematics that to ignore the achievements deriving from the mathematical treatment of ideas is simply a failure to come to terms with the reality of science. However the way in which mathematics is important to science is open to question. It is generally assumed that quantification is important to enable predictions to be made, but it has already been argued in Chapter II that the role of predictions in science has been overemphasized. Rather, it is being suggested that the real importance of mathematics lies in refining the concepts deriving from an analogy or metaphor so as to allow more precise statements to be made from which a broader range of significant inferences may be drawn in a clear and coherent way. For this reason it can be expected that different ontologies will involve different sorts of mathematics and that there will be an intimate connection between ontologies, conceptual structures and the mathematics. This has already been suggested in the discussion of quantum theory. To illuminate this relation I will show some of the developments in science which reveal such a relationship, and then go on to consider what sort of mathematics is likely to be appropriate for process philosophy.

Mathematics has a special place in the ontology of formism deriving from the Ancient Greeks and dominating in the Middle Ages since it derives ultimately from the Pythagorean belief that the world is number and measure. By this is meant that the world imitates or participates in mathematical forms, and these forms imply an aesthetic and moral perfection. For instance harmonious music is characterized by simple ratios of the length of the string or windpipe. This perfection of form was thought to be least on the surface of the earth and to increase progressively towards the heavens where heavenly bodies expressed the perfection of their nature by moving in the most perfect of geometrical figures: the circle. To retain this conception of perfect order in the face of disconfirming evidence, Ptolemaic epicycles were postulated. It was only with Kepler that the central place given to the circle was questioned.

With the replacement of formism by materialism, attention shifted away from considerations of proportion, harmony and perfect form to the representation of the movement of matter according to fixed laws. This was given precise mathematical form by Descartes with the invention of co-ordinates in which position through time could be plotted and represented algebraically. This allowed the development of calculus through which Newton was able to clarify the nature of acceleration. The calculus, which enables a prediction to be made of a system at any time given a knowledge of the state of the system at any other time, has been the basis of materialism ever since, and it is by means of this that most of the inferences about the nature of the universe have been drawn by materialists.

The basic ideas of field theory, like those of materialism, were worked out without the aid of mathematics. This task was performed by Faraday, whose work was then given mathematical form by Maxwell. This involved the use of partial differential equations analogous to those used for the understanding of fluids. The important difference between this mathematics and that associated with materialism is that attention is focussed on the entire space or some delimited portion of it without a bias to certain small regions, the 'particles' which had been taken by the materialists as the seat of action. (1) On the field view, physical action is present in all points of space. In a 'vector field' a certain vector is associated with every point in space, changing continuously as we move from point to point. This conceptualization is entirely in harmony with the geometrical program of Gauss, since 'field strength' can be replaced by the 'metrical tensor' which exists at every point of space and which may be measured from point to point by a triangulation, beginning with small regions, then gradually extending to larger and larger regions of space. While Maxwell had assumed Cartesian coordinates as the basis of his differential calculus, the formulae of tensor analysis opened the way to a formulation of the equations of field physics in the curvilinear coordinates of Riemann. (2) This then provided the basis of the extension of field theory in Einstein's general theory of relativity.

It is possible to offer some speculations on the basis of this brief history of the relationships between mathematics, scientific theory and ontology about the direction these developments have taken. It seems fairly clear that the developments have been in the direction of the rejection of what had been presupposed by adopting a more general form of mathematics. It had been assumed before Kepler that if the motion

(1) Cornelius Lanczos SPACE THROUGH THE AGES: THE EVOLUTION OF GEOMETRICAL IDEAS FROM PYTHAGORAS TO HILBERT AND EINSTEIN, Academic Press, London, 1970, p. 130.
(2) Ibid., p. 148.

of the planets were to be made intelligible in mathematical terms, they must be seen in terms of circular paths. With the new mathematics based on Cartesian coordinates, Newton showed that an ellipse could be made just as mathematically intelligible as a circle. Similarly, before the development of field theory, it was assumed that change could only be understood in terms of motion of an entity, and this assumption was embodied in the mathematics. Maxwell's mathematics avoided this assumption. Then Gauss defined space in such a way that alternatives to Euclid's geometry could be developed, so overthrowing the assumption that Euclid's geometry simply described the world the way it really is. In each case, a certain type of order was assumed to be basic and it was expected that the world could be understood in terms of this, and later developments showed this to be a particular manifestation of a more basic order.

In the light of this, it is possible to get some idea about the mathematics that might be appropriate for process philosophy. Process philosophy as presented here defines order in terms of similar differences and takes no order for granted, nor does it assume that any particular type of order is more basic than any other. The appropriate mathematics should therefore be such as to assume the least order so that the existence of order can be described in terms of it. For instance the existence of an ordered space-time must be something which is seen to be produced rather than simply assumed, as also must the existence of any stability within this. The branch of mathematics which assumes the least order is topology, and the mathematical formalization of ideas deriving from process philosophy, namely catastrophe theory and homology and cohomology theory, are both developments of topology.

Catastrophe theory has been developed by René Thom to formalize our understanding of the genesis, stability and destruction of forms in the realms of the universe in between the totality and sub-atomic processes. (1) The seriousness with which he takes these forms derives from his Heraclitean starting point in which since flux is taken as basic, the existence of any order at all needs to be explained. He writes: "all the basic intuitive ideas of morphogenesis can be found in Heraclitus: all that I have done is to place these in a geometric and dynamic framework..." (2) His view of the world is outlined in the statement of the programme of his book:

> ...it is indisputable that our universe is not chaos. We perceive beings, objects, things to which we give names. These beings or things are forms or structures endowed with a degree of stability; they take up some part of space and last for some period of time...Next we must concede that the universe we see is a ceaseless creation, evolution, and destruction of forms... (3)

The task Thom sets himself is to develop the mathematical concepts which can account for this succession of form.

Thom describes these forms as 'structurally stable islands' which are represented mathematically as attractors in multidimensional space. The creation or destruction of these islands of stability, that is, morphogenesis can then be represented by showing the disappearance of the attractors representing the original islands of stability as they are captured by the attractors representing the final forms. Such an occurrence is called a catastrophe. It is possible to represent the

(1) René Thom STRUCTURAL STABILITY AND MORPHOGENESIS: AN OUTLINE OF A GENERAL THEORY OF MODELS (1972) tr. D.H. Fowler, W.A.Benjamin, Reading, Mass. 1975.
(2) Ibid., p. 10.
(3) Ibid., p. 1.

path of development or chreod of a form, and also how such chreods can be in hierarchical relationship. (1)

An important feature of this mathematics is that it comes to terms with the fact that there are boundaries in the world. Boundaries imply a discontinuity, and since most mathematics used in science so far has been based on the differential calculus which presupposes continuity, problems in science where boundaries are important are simply ignored. However it is not the existence of discontinuity as such which is most important. It is that the existence of discontinuities implies that continuity is not something to be taken for granted but is something which is maintained, and can disintegrate.

The qualitative models based on this mathematics cannot be experimentally controlled in the sense of yielding experimentally verifiable predictions. All an experiment can do is to confirm the stability of a particular form. At the limits of stability of a form there is an indeterminate zone which is by definition unstable, thus making individual predictions impossible. However this qualitative mathematics is more basic than any quantitative mathematics for two reasons. Firstly, quantitative models are only applicable within a field of structural stability. Thus science is divided into a number of fields within which quantitative mathematical methods may be used. In other words, quantitative models must be isolated before an effective experimental situation can be set up. Qualitative models are required to isolate the fields. Secondly, only qualitative models can show the limits of quantitativve models. In

(1) Ibid., p. 114ff.

this way, Thom's mathematics reveals why the quantitative laws of those few fields which have been understood in terms of quantitative models, cannot be taken to explain everything in the universe. (1)

However catastrophe theory is a development of differential topology and it is essentially involved in describing how discontinuities result from continuous changes. This presupposes that there is something which can be regarded as continuous. It is algebraic topology which should be taken as basic. As pointed out earlier, homology and cohomology theory is being used in quantum mechanics to describe a discrete space-time. In homology one starts with cells called simplexes as primitive and fundamental terms. (2) It is possible to introduce the notion of an abstract simplex which is not related to any manifold. These can then be used as the starting point from which a discrete space-time structure can be described. The space-time continuum can then be seen as something generated by the discrete order.

(1) Ibid., p. 322.
(2) B.J. Hiley (1971) op.cit. p. 187.

CONCLUSION

In this chapter I have tried to show that developments in physical science can best be understood in terms of process philosophy. The universe must be seen as a creative process of becoming involving a multiplicity of processes in various relationships, each maintaining itself with some autonomy from its environment and making an irreducible contribution to the universe as a whole. This universe can be partly understood on an analogy of a stream in which eddies are continually forming, developing and dissolving into their environment. However this analogy must eventually be seen to be inadequate in that it implies some substratum which changes and it fails to make fully intelligible the nature of becoming. This can only be grasped by means of an auditory analogy, which as Čapek has pointed out, also enables us to comprehend the apparently anomolous features of modern physics:

> In the concrete and attentively analysed awareness of the polyphonic structures the following traits, which remain unintelligible and even absurd within the visual scheme of classical physics, become intuitively clear:
> The incompleteness of becoming and its pulsational character;
> The compatibility of the emergence of novelty with the causal influence of the past;
> The individuality of events within the continuity of the flux;
> The fictitious character of instantaneous cuts and, consequently, the impossibility of instantaneous space;
> The replacement of the relation of juxtaposition or co-instantaneity of points by that of co-becoming or contemporaneity of the causal tubes. (1)

The various theories discussed were seen to throw light on different

(1) Čapek (1961) op.cit. p. 377f.

categories of process philosophy. Relativity theory gave some content to the category of activity and revealed how space and time only become features of the world with the introduction of order into this activity. Quantum theory indicated the inadequacy of field theory and dissipative structures in particular revealed the immanent nature of causality and the autonomy of emergent processes. Relativity theory, especially the general theory, quantum theory, thermodynamics and an examination of processes in general also threw light onto the nature of becoming and time, revealing becoming's pulsational multilinearity, and the dependence of the concept of time on the hierarchical nature of this multilinearity of the process of becoming. However this chapter should not be seen as simply interpreting a finished body of knowledge and it is not meant to offer final explanations of anything. Physics is in a state of flux, and it is just as important to establish some order within this by pointing the way to overcoming problems within theories or to reconciling theories as it is to interpret the more established aspects of science. Having justified process philosophy to this extent, and in particular to have shown its superiority to materialism and field theory in attempts to understand the physical world, I will now try to show how on this ontology the emergence of life and mind into the world can be seen to be intelligible.

SCIENCE, PROCESS PHILOSOPHY AND THE IMAGE OF MAN
THE METAPHYSICAL FOUNDATIONS FOR A CRITICAL SOCIAL SCIENCE

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VOLUME II.

CONTENTS

VOLUME II

CHAPTER V

LIFE

> ...just when physics is moving away from mechanism, biology and psychology are moving closer to it. If this trend continues it may well be that scientists will be regarding living and intelligent beings as mechanical, while they suppose that inanimate matter is too complex and subtle to fit into the limited categories of mechanism.
>
> David Bohm (1)

When the vital order is examined, the picture becomes more complex. An organism has to be seen in terms of at least three processes, each with a very different temporal rhythm, simultaneously. Firstly there is the metabolic process in which through a turnover of energy and matter the organism maintains itself. Secondly the organism must be seen as having a life history in which it develops from birth, reproduces itself and dies. Finally it must be seen as part of the dynamic process of the ecosystem in which life forms have evolved and continue to evolve. The relationship between the whole and the parts of a living entity are also more complex because it is necessary to show the relationship between the whole which is functioning teleologically and the ultimate constituents which are not. It has been in the domain of biology that reductionism has been argued for most vigorously and has succeeded most completely.

There are three forms of reductionism: methodological reductionism, epistemological reductionism and ontological

(1) David Bohm "Some Remarks on the Notion of Order" in TOWARDS A THEORETICAL BIOLOGY 2. SKETCHES, ed. C.H.Waddington Edin. U.P. Edin. 1969 p. 34.

reductionism, and in biology these tend to be confused. Methodological reductionism relates to method. Since no anti-reductionists are opposed to analysing organisms into parts as a strategy in the attempt to understand them, there is no real conflict here. The conflict arises from the interpretation of the implications of this method, and over whether it is adequate by itself.

Epistemological reductionism is the view discussed in Chapter 2 that knowledge develops by reducing theories of limited scope to theories of broader scope. This leads to the view that the ultimate aim of science is to reduce all theories to the laws of physics. Nagel specified two conditions for the successful reduction of one theory into another. (1) It must be shown that all laws of the reduced theory are derivable from the theoretical constructs of the reducing theory, and secondly to accomplish this reduction all theoretical concepts of the old theory must be defined in terms of the new theory. This means that the reduced theories must be preserved within the theories of broader scope so that a successful reduction would not affect those theories concerned exclusively with living phenomena. However, it was pointed out that the second condition is never fulfilled. New theories simply replace old theories.

This means that the real issue in the dispute about reductionism is ontological. Ontological reductionism is

(1) Ernst Nagel THE STRUCTURE OF SCIENCE Harcourt, Brace & World, N.Y. 1961, p. 352.

the acceptance of the materialist ontology according to which the universe is composed of elementary entities governed by immutable laws, and that it is only these entities which have real existence. Thus J.J.C. Smart who defines himself as a materialist wrote "By 'materialism' I mean the theory that there is nothing in the world over and above those entities which are postulated by physics." (1) If biological entities are to be considered as such on the basis of this conception of being they must be regarded as nothing more than convenient characterizations of types of groups of elementary entities.

The materialism of biology is supplemented by the use of mechanistic analogies. This involves using such analogies to comprehend how living beings perform their distinctive functions. It is then assumed that since the mechanisms involved consist of nothing but physical and chemical constituents acting according to their own principles, life itself is nothing over and above inanimate matter. As mechanisms have become more sophisticated this has made possible the use of more sophisticated analogies. Nowadays biological phenomena tend to be interpreted by materialists in terms of cybernetics and information theory. Such analogies seem less implausible than older mechanistic views about life.

Support for such analogies is drawn from methodological reductionism. The method involves the identification of

(1) J.J.C. Smart "Materialism" in THE MIND/BRAIN IDENTITY THEORY ed. C.V.Borst MacMillan, London, 1970, p. 159

the constituents of an organism which can be experimentally manipulated, and then observing the consequences of such manipulation. The manipulated constituent is then taken as the cause and the consequences of this as the effect. For instance if the genes of an animal can be altered so as to produce a change in the colour of the animal's eyes, the conclusion is drawn that the genes are the cause of the eye colour in animals, and it is extrapolated from this that genes are the cause of the way the whole animal develops. The genes are then seen as encoded information and the mechanism by which the cause is seen to have the effect is understood on the analogy of information theory. This analogy originally derived from the study of telephone exchanges. It is then assumed that, as in any mechanism, the whole process can be analysed into cause and effect relationships. In this way the whole of the life process is seen as a linear sequence of cause and effect relations.

A number of things can be said about this. One, in the light of the rejection of materialism by the physical sciences and particularly by physics, the acceptance of this mechanistic conception of organisms must put biology in opposition to these sciences. This is disastrous from the point of view of the reductionist biologists since their position implies that physics is the queen of sciences. Another is that if methodological reductionism is used exclusively, the results will always be able to be cast in the form of a linear sequence of cause and effect relations since it is only these which are uncovered by the reductionist form of experiment.

The rejection of any other method on the basis of ontological reductionism then makes it impossible to see anything which could contradict this conception of being. The idea of a linear sequence of cause-effect relations is assumed by reductionists to be equivalent to or ultimately reducible to an explanation in terms of the laws governing constituents. However it was pointed out in Chapter 3 that this is not the case since the notion of a law governed universe excludes the notion of cause. The mechanistic analogy and the corpuscular kinetic analogy lead to incompatible concepts of causality in this respect. In the more detailed analysis of biology which follows it will be shown that this idea of a linear sequence of cause and effect relations is inadequate, always involving an abstraction from the total context in which the experiment takes place. When this is understood, it will be shown that causality must be understood in accordance with the concept of it implied by process philosophy. That is, it will be seen to be necessary to refer to the immanent causality of biological processes by which these maintain and develop themselves, supervening causality in which processes order their constituent processes, efficient causality where organisms effectively interact with the contingencies of their environment, and creative causality which takes place in evolution with the emergence of ever higher levels of ordering, in epigenesis in which new processes emerge as part of the developmental process of organisms, and in cognitive development in which new forms of understanding are attained by animals and particularly by humans.

The mechanistic analogies themselves can be criticised in a number of respects. It is assumed that because mechanistic analogies have been successful in many cases that all that has not been explained will eventually succumb to such an explanation. But it was pointed out in Chapter 2 that analogies often only appear successful because they have no rivals. As soon as a different analogy is used, gross inadequacies and distortions are revealed in the attempts to use the original analogy. The apparent success turns out to be merely a consequence of lack of competition.

I will show that this is the case with mechanistic analogies in biology, showing that living phenomena are ultimately more effectively understood in terms of the analogies of process philosophy.

The use of mechanistic analogies actually involves a subterfuge on the part of the materialists in that their use does not have the implications which are drawn from them, namely, that if living phenomena can be explained in terms of mechanistic analogies, then all that has real existence are the constituents of the mechanisms and the principles which govern them. It has been pointed out by Michael Polanyi that in fact machines always involve hierarchical order, with the higher order necessarily involving some reference to purpose. (1) A machine is always put together according to a plan, and it is by virtue of

(1) Michael Polanyi "Life's Irreducible Structure" in KNOWING AND BEING: ESSAYS BY MICHAEL POLANYI ed. Marjorie Grene, Uni. of Chicago Press, Chicago, 1969, 224f.

the order established between the parts according to this plan that the machine works, performing the functions for which it was designed. And it is only in relationship to this design that the nature of the machine can be understood. No matter how much is known about the constituents: the nature of the metal from which the machine is made and so on, this will never provide us with an understanding of the design of the machine or the purpose for which it was constructed. The design of the machine harnesses the constituents of the machine for the purpose for which it was designed. As Polanyi wrote:

> ...the machine as a whole works under the control of two distinct principles. The higher one is the principle of the machine's design, and this harnesses the lower one, which consists in the physical and chemical processes on which the machine relies (1)

What is implied by this is that while a successful explanation in terms of mechanism gives the appearance of being a reductionist explanation, purpose is presupposed. In this way teleology is smuggled in the back door. This is brought out in the sort of statements made by reductionists. For instance the socio-biologist Richard Dawkins writes:

> [Genes] swarm in huge colonies, safe inside gigantic lumbering robots, sealed off from the outside world, communicating with it by tortuous, indirect routes, manipulating it by remote control. They are in you and me; they created us body and mind; and their preservation is the ultimate rationale for our existence...we are their survival machines. (2)

(1) Michael Polanyi "Life's Irreducible Structure" in KNOWING AND BEING: ESSAYS BY MICHAEL POLANYI ed. Marjorie Grene, Uni. of Chicago Press, Chicago,1969, p.224
(2) Richard Dawkins THE SELFISH GENE, O.U.P. Oxford,1976,p.21.

Here humans are treated as nothing but machines, but in order to do this consistently it has been necessary to reintroduce concepts implying purpose elsewhere. Thus while living organisms are denied intentionality, such characteristics are ascribed to genes.

Ontological reductionism in biology received its greatest boost from the Darwinian theory of evolution. (1) This seemed to explain in purely mechanical terms, the existence of living phenomena with all the appearance of having been designed. This was further supported by the discovery of the work of Mendel in genetics, showing how characteristics are inherited discretely, and by molecular biology which apparently explained genetics in terms of chemistry. Thus Delbruck in his Nobel lecture claimed: "Molecular genetics, our latest wonder, has taught us to spell out the connectivity of the tree of life in such palpable detail that we may say in plain words, 'This riddle of Life has been solved'." (2) And the basic viewpoint of most biologists was expressed when J.Lederberg stated in a Nobel symposium:

> A few eccentrics aside, the whole community of contempory science shares the view that the same laws of nature apply to nonliving and living matter alike. All of us who investigate the chemistry and physics of living organisms pursue our work as if organisms were complex machines, and we find man to exhibit no tissues or functions that would except him from this way of analysing human nature. (3)

(1) See G. Montanelli "From Aristotle to Democritus via Darwin" in STUDIES IN THE PHILOSOPHY OF BIOLOGY: REDUCTION AND RELATED PROBLEMS Franscisco Jose Ayala & Theodosius Dobzhansky eds, MacMillan, London, 1974, pp.3-19.
(2) Cited by H.H.Pattee in "Physical Theories of Biological Coordination" in TOPICS IN THE PHILOSOPHY OF BIOLOGY Marjorie Grene and Everett Mendelsohn eds, Boston Studies in the Philosophy of Science, D. Reidel, Dordrecht, 1976, p.153.
(3) Cited by Brian Easlea in LIBERATION AND THE AIMS OF SCIENCE, Chatto and Windus, London, p.259n.

In what follows I will try to present the case for such reductionist views and then attempt to show why reductionism should be rejected. To do this I will argue that evolutionary theory must be formulated in terms of purposefully acting organisms rather than in terms of genes, and that these cannot be regarded as nothing but chemical processes. I will then try to formulate an antireductionist theory of the nature of life in terms of the categories of process philosophy. In this I will try to show how all life forms manifest in germinal form those characteristics attributed to mind. I will then go on to detail the various stages of life which have led to the evolution of human consciousness and then attempt to show the relationship between consciousness and the central nervous system.

THE REDUCTIONIST POSITION IN BIOLOGY

Reductionism in biology is based on the orthodox neo-Darwinian form of evolutionary theory exemplified in the works of the population geneticists and on molecular biology which attempts to show that all the distinctive features of life can be explained in terms of chemical reactions. I will deal first with evolutionary theory, then molecular biology, and then go on to show how these positions support each other to form the reductionist position.

When Darwin originally formulated his theory of evolution, he was concerned with the nature of the organism as such. He explained the diversity of types of organisms in terms of there being a random variation in the progeny of animals which are more or less well adapted to their environments in the sense that they are 'able to carry out ordinary transactions of life.' (1) However evolution was seen to occur through the greater survival rate of the fittest or best adapted animals. Darwin had no very clear idea about the apparatus of inheritance. Originally he thought of inheritance as the blending of the characteristics of the parents, but realized that this would eliminate the differences between individuals. Consequently he was attracted to the Lamarckian theory of the inheritability of acquired characteristics.

(1) Quoted by C.H. Waddington "The Basic Ideas in Biology" in TOWARDS A THEORETICAL BIOLOGY 1. PROLEGOMENA ed. C.H. Waddington, Edinburgh Uni. Press 1968, p.18.

The solution to the problem of inheritance seemed to have been provided by the work of Mendel. This indicated that hereditary factors are carried by discrete factors which do not blend in the offspring. The association of Mendel's theories about inheritance and Darwin's ideas constituted the basis of the orthodox neo-Darwinian theory.
However this neo-Darwinian theory involved changing the meaning of Darwin's basic concepts. Random variation came to be thought of in terms of the discrete factors or genes rather than in terms of the adult organisms or phenotypes. Since it is assumed that developments of the phenotype cannot affect the genotype, or what characteristics will be passed on, the theory is formulated in terms of genotypes and it is to these that fitness is attributed. Thus survival of the fittest no longer refers to the organisms as such but to the effectiveness of organisms in passing on genes to the next generation, that is, to their reproductive efficiency. Thus the whole emphasis is placed on the genes, and organisms are considered only from the point of view of what combination of genes they embody. Evolution is then seen as the process whereby successful mutant genes are preserved and inefficient genes are bred out of existence.

Sewell Wright, one of the major figures involved in the formulating of the original neo-Darwinian position developed a mathematical theory which considered populations in which large numbers of genes were seen to be varying simultaneously and in which fitness was seen in terms of complex genotypes. He expressed fitness in terms of 'fitness surfaces' in which the fitness of combinations of genes was expressed by a surface in multidimensional space with sufficient dimensions

to represent all the possible combinations of the large number of genes within the system. Wright showed that this surface would have a hilly character in which the tops of the hills would represent the fittest points. Each hilltop would be seperated by valleys of lower fitness and if left to themselves, there would be a tendency for actual populations to come to an equilibrium at the tops of the hills, though a higher hill might be available in the near neighbourhood. This exemplifies the way in which population genetics has excluded any consideration of the phenotype as such.
In more recent formulations of evolutionary theory, the focus has been on the fitness of populations of genotypes rather than individual genotypes, as in the long term the survival of individual genotypes is dependent on the survival of the populations of which they are part. (1) The neo-Darwinians believe that the doctrine that there is no influence of the phenotype on the genotype holds not only for the individual level, but can be taken as true when considering populations.(2)

The latest extension of neo-Darwinianism is into the explanation of social behaviour. The socio-biologists have attempted to show that social behaviour such as altruism which on the surface appears to be inexplicable in terms of Darwinian ideas of the fittest genotypes being those which reproduce themselves, can be explained if fitness is considered from the point of view of the genes. Altruistic behaviour which leads to the death of the organism nevertheless results in a greater survival rate for the same sorts of genes.

(1) Theodosius Dobzhansky "On Cartesian and Darwinian Aspects of Biology" in THE GRADUATE JOURNAL The Uni. of Texas Vol.8 p.103.
(2) C.H. Waddington "Paradigm for an Evolutionary Process" in TOWARDS A THEORETICAL BIOLOGY 2 SKETCHES, C.H.Waddington ed. Edinburgh Uni. Press 1969 p.127.

Thus Richard Dawkins, one of the major sociobiologists has titled his book THE SELFISH GENE. The emphasis on the genes rather than the phenotypes is made very explicit in the writings of the sociobiologists.

Thus Edward O. Wilson writes:

> Natural selection is the process whereby certain genes gain representation in the following generations superior to that of other genes located at the same chromosome positions. When new sex cells are manufactured in each generation, the winning genes are pulled apart and reassembled to manufacture new organisms that, on the average, contain a higher proportion of the same genes. But the individual organism is only their vehicle, part of an elaborate device to preserve and spread them with the least possible biochemical perturbation. Samuel Butler's famous aphorism, that the chicken is only the egg's way of making another egg, has been modernized: the organism is only DNA's way of making more DNA. (1)

The molecular biologists have attempted to reduce this theory of evolution to chemistry. Their most important achievement has been the chemical explanation of the genes which are supposed to determine the way in which the organisms develop. According to molecular biologists, genes are DNA and it was shown how these molecules are able to replicate themselves. The relation between DNA and the development of the organism was explained in terms of information theory. Accordingly the information contained in the genes was seen to be encoded by the sequence of bases in the DNA molecule. Working out the structure on DNA and its method of replication was mainly the achievement of Watson and Crick. It was later shown how the information encoded in DNA was transferred to RNA which in turn translates it into specific amino acid

(1) Edward O. Wilson SOCIOBIOLOGY: THE NEW SYNTHESIS, Belknap, Harvard Uni. Press, Cambridge, Mass. and London, 1975, p.3.

chains of proteins. Specific sequences of DNA are related to specific amino acid sequences. Thus reproductive invariance in which an organism produces offspring with the same structure as itself has been accounted for by molecules which encode the information which directs the synthesis of protein molecules.

Jacob and Monod have analysed the chemical processes which lead protein to be synthesized in bacteria in an orderly manner. (1) They set out to show how a class of proteins: enzymes, control the chemical reactions by which order is built up and how another class: regulatory proteins, act as microscopic cybernetic systems to govern and control the chemical activity throughout the organism so that it functions as a coherent and integrated unit. The basic feature of proteins which make this possible is their microscopic discriminatory faculty, that is, they only react with, or catalyse the reactions of specific molecules.

This faculty of proteins makes it possible for oganisms to feed on negative entropy: building order out of relative disorder. By catalysing the formation of particular compounds exclusively, the chemical potential of a solution is utilized by the enzyme to create a particular order at the expense of other potential orders. That is, the chemical potential is utilized in a particular way.
Jacob and Monod have shown the chemical processes by which genes are activated and repressed along with numerous other

(1) Their ideas are expounded in Jacques Monod CHANCE AND NECESSITY: AN ESSAY ON THE NATURAL PHILOSOPHY OF MODERN BIOLOGY (1970) tr. Austryn Wainhouse, Collins, London 1979.

chemical reactions by purely chemical means. This is made possible through the activation and deactivation of the enzymes by other chemicals such as the products of the catalysed reaction. The sort of properties of enzymes which make this possible is instanced by allosteric enzymes which not only bind a particular substrate and activate its conversion into products, but also form associations with particular other compounds which inhibit or heighten their catalytic activity. Thus we have the basis for regulation through feedback circuits. In this way the chemical reactions of the whole organism are regulated by a multiplicity of microscopic cybernetic systems. Jacob and Monod have identified these systems in bacteria.

Monod also tried to show that morphogenesis is a byproduct of the specific reactivity of proteins, that it is basically a microscopic process which manifests macroscopic appearance. He argued that molecules, because of their specific recognition process, form into structures in much the same way as crystals form in solutions. Monod admitted that morphogenegis has not yet been explained in this way but believes that we can expect advances with this approach in the future. Although this analysis only involves molecular components in cells, he believes that the same principle will be found to explain the constructive interactions between cells. (1)

Monod has characterized life in terms of three properties: reproductive invariance, autonomous morphogenesis and teleonomy. (2)

(1) Monod, op. cit. p.87f.
(2) ibid. p.23.

Reproductive invariance means that the living being is able to produce offspring with the same structure as itself. Autonomous morphogenesis means that the structure of the organism results from the interactions within the living being itself. Teleonomy means that the living being is endowed with purpose, both in the sense that its behaviour is purposeful and in the sense that the processes within the organism are in a functional relationship. Crick defines life in much the same way, stating that the minimum requirements for a living organism are that it has "some device for ensuring its descendents...are identical with itself." and that it is "able to metabolize, using raw materials for its own synthetic ends, so that it can build up the molecules it needs in order to maintain itself and reproduce itself in a hostile world."(1) Crick and Monod both claim that these properties can be explained as nothing more than complex chemical reactions. The Watson Crick model of DNA provides an explanation for reproductive invariance and the work of Jacob and Monod has gone a long way towards explaining the autonomous morphogenesis of animals. The chemical accounts of both reproductive invariance and morphogenesis provides the basis for evolutionary theory in terms of which the designation of behaviour as purposeful and relationships within the organism as functional can be regarded as shorthand for an account of why it is that the particular organisms under investigation have survived. Thus molecular biology and evolutionary theory complement

(1) Francis Crick OF MOLECULES AND MEN Uni. of Washington Press, Seattle, 1966, p.9.

each other to justify a purely materialist reductionist account of life with molecular biology showing the chemical reactions involved in a living being and evolutionary theory showing how the particular arrangement of molecules and chemical reactions came to be that way.

There are still two areas which both Crick and Monod recognize as problematic from the point of view of molecular biology. These are the fields dealing with the origin of life and with the relationship between the central nervous system and consciousness. The difficulty with accounting for the origin of life is that in modern cells fifty macromolecular components are required for the apparatus which can translate the code of DNA molecules.(1) It is highly improbable that such a combination of molecules should occur by accident, and is thought by Monod to have been a once only chance occurrence. The difficulty involved is accounting for consciousness is thought by most molecular biologists to be due to the primitive stage of study in this area. Both Crick and Monod are confident that this field will eventually succumb to molecular analysis.

(1) Monod, op,cit. p.135.

REDUCTIONISM AND EVOLUTION

It was Whitehead who first pointed out that ontological reductionism in the form of materialism is incompatible with any theory of evolution. He wrote:

> The aboriginal stuff, or material, from which a materialistic philosophy starts is incapable of evolution. This material is in itself the ultimate substance. Evolution, on the materialistic theory, is reduced to the role of being another word for the description of the changes of the external relations between portions of matter. There is nothing to evolve, because one set of external relations is as good as any other set of external relations. There can merely be change, purposeless and unprogressive. But the whole point of the modern doctrine is the evolution of the complex organisms from antecedent states of less complex organisms. (1)

This point is made in modern criticisms of the neo-Darwinian theory of evolution where it is pointed out that it merely states a tautology. If there is nothing of significance being explained by the theory of evolution, that is, if all that is being accounted for is that matter is ordered one way rather than another, then all that is being said is that those configurations of chemicals which exist are those which are fittest to survive which is evident from the fact that they have in fact survived.

At a more specific level it has been shown that in fact molecular biology and the neo-Darwinian theory of evolution do not support each other. This has been pointed out in a paper by R.C. Lewontin entitled "On The Irrelevance of Genes". (2) Lewontin argued that it is

(1) Whitehead SCIENCE AND THE MODERN WORLD op.cit. p. 101.
(2) R.C. Lewontin "On The Irrelevance of Genes" in TOWARDS A THEORETICAL BIOLOGY 3 DRAFTS, C.H. Waddington ed. Edinburgh Uni. Press 1970, pp.63ff.

chromosomes rather than genes which assort themselves at meiosis as Mendel's laws required. But these chromosomes could not be considered the discrete unit of Mendelian theory because they are composed of subunits which do not stay together. Furthermore it is only the nucleotide bases which are indivisible, with genes lying in between these and the chromosomes which obey Mendel's Law of Independent Assortment. Lewontin went on to show that in population genetics genes are irrelevant to the theory. This obviously makes nonsense of population geneticists such as the sociobiologists who give a fundamental place to genes.

Apart from these problems the neo-Darwinian theory of evolution fails as an account of biological evolution. By focussing on the genes it fails to characterize the development of life and fails to reveal the dynamics of the evolutionary process. (1) In what follows I will try to show that to deal with these issues effectively it is necessary for evolutionary theory to grant an ontological status to the phenotypes as such, and to the ecosystem as a whole.

The standard view that evolution dependent on random mutation and natural selection is enough to characterize the development of life must be rejected since such genetic transmission applies in cases which are clearly not biological. For instance a dislocation on the face of a crystal would be transmitted to succeeding layers of atomic arrays which

(1) C.H. Waddington "Paradigm for an Evolutionary Process" in TOWARDS A THEORETICAL BIOLOGY 2 SKETCHES op.cit. pp.106-128 and "The Theory of Evolution Today" in BEYOND REDUCTIONISM: THE ALPBACH SYMPOSIUM Arthur Koestler & J.R. Smythies eds. Radius Books, Hutchinson, London, 1969, pp. 357-395.

are formed as the crystal grows. Since some types of dislocation would be more able to transmit their characteristics, this would also involve some sort of natural selection. The reason why these phenomena are not thought of as living is that the information transmitted is purely genotypic. To be thought of as living the 'information' would have to do something to its surroundings, forming out of them a phenotype. This means that more than information must be transmitted. What is required is not just information but transmissible instructions. That this involves a considerable translation from the genotype of organisms to the phenotype will be shown in the next section.

For a theory of evolution which is adequate in the sense that it can account for continuing evolution, two conditions must be fulfilled. There must be an infinite number of environments and there must be sufficient genotypes to provide phenotypes to fill these environments. Without these conditions being met evolution would reach a state of static equilibrium. However it is only possible to account for the infinity of environments by reference to the phenotypes. The infinity of environments is ensured by the changing of the phenotypes which are part of the environment of the other organisms.

It can be accepted that new genotypes are provided by random mutation, but this should not be regarded as the whole story. The theory of evolution must be formulated in terms of populations of individuals rather than simply in terms of individuals as such. This was pointed out in the last section. But this means that evolution does not depend on random search to produce the phenotypes which can take advantage of particular environments. (1) The first factor which reduces the importance of

(1) Waddington has developed these ideas in "Does Evolution Depend on Random Search?" in TOWARDS A THEORETICAL BIOLOGY 1 PROLEGOMENA (1960) op.cit. pp.111-119.

randomness is that nearly all organisms have evolved mechanisms to facilitate recombination of different genotypes, usually by some sort of sexual process. This makes for a high degree of efficiency in alighting on a particular favourable phenotypic characteristic. (1) The second factor is the increasing complexity of the epigenetic process by which the genotype is developed into the phenotype. This reduces the effects of individual mutations. In such complex situations only a limited number of paths of development or 'chreods' as Waddington calls these time paths, are possible within the growing organism. These chreods resist change and many unfavourable mutations are buffered out, while many different mutations may cause the same alteration in the phenotype. The consequence of this is that while the ultimate units may have been produced randomly, these are of only minor importance from the point of view of particular evolutionary changes. In Waddington's words the genes are "the pebbles in the concrete" and as such are "almost irrelevant to the engineering of the bridge." (2)

It is also necessary to go beyond the genotype when considering the selective process in evolution. This is because selection operates on the phenotype and this is not determined by the genotype alone. In the process of epigenesis the organism responds to stress so that the nature of the adult will be partly determined by the environment in which it developed. But the environment involved in determining the phenotype

(1) C.H. Waddington "The Theory of Evolution Today" op.cit. p. 371.
(2) Ibid., p. 371f.

is not necessarily the environment involved in the selection of phenotypes, since organisms are mobile. This means that the environment must enter twice into the theory: both as influencing the formation of the phenotype and as selecting the phenotype. It is impossible to take account of the role of the environment in the first sense without making reference to the epigenetic process and the phenotypes which develop. That is, it is impossible to formulate the theory purely in terms of genotypes and still consider the role of the environment in influencing the epigenetic process. The neo-Darwinian belief that the environment's affect on the phenotypes cannot in any way affect what genes will be transmitted to the next generation must then be rejected since it can be seen that natural selection operates on phenotypes which are partially environment dependent.

This is even more evident when the role of epigenesis is considered more closely. Because of the chreodic nature of epigenesis, the involvement of the environment in the formation of phenotypes often leads Darwinian evolution to imitate Lamarckian evolution. When an organism responds to stress by an appropriate modification in such a way as to improve its chances of survival, what happens is that the stress overcomes the environmental resistance to a particular chreod. The organisms which do react to the stress in the appropriate way do so by virtue of having genes which control the stability of the chreod. When a population is subject to a stress of some sort, over a time there will be a concentration of those genes which change the chreod within the population and as a consequence of this individuals will no longer require the stress to produce the stress-produced features. The concentration of the genes in the individual will lead to the new chreod being developed automatically. Thus the phenotypic alteration which was originally only produced by the stress becomes assimilated by the genotype and the acquired characteristic becomes hereditary. Waddington has demonstrated this process of genetic assimilation experimentally with fruit flies. (1)

The necessity for including the role of the phenotype in evolutionary theory is also evident in that it is necessary to account for how the variant genotypes come into contact with the variety of new environments. In the case of animals there is often deliberate activity on the part of the individuals to choose those environments in which they are most able to survive. Which animals will survive will then depend on this activity and this cannot be understood while the genotype alone is considered.

The activity of the organism is important in another respect. When organisms react to their circumstances in an adaptive manner, even though this is an ability reached through the evolutionary process, it adds a new dimension to this process. This dimension was recognized by Baldwin and Lloyd Morgan at the turn of the century and has recently been rediscovered by Hardy and Waddington. The essentials of this dimension are that form follows function and function is established through the initiative of the organism. The importance of such initiative

(1) Ibid., p. 374.

has been illustrated by Hardy with the example of the blue-tits which learnt to open the tops of milk bottles with their beaks. This skill spread throughout the whole of the tit population of Europe. Hardy pointed out that if the bottles were to be provided with thicker tops those tits with more effective beaks for opening the bottles would be more likely to survive so there would be an evolution within tits of specialised tin opening beaks. Such evolution would not be passive but would be dependent upon the original initiative of enterprising individuals of the species. From the consideration of this hypothetical example Hardy argued that it is not random mutation and selective pressure which are the main causative factors in evolution, but

> the restless, exploring and perceiving animal that discovers new ways of living, new sources of food, just as the tits have discovered the value of the milk bottles...It is adaptations which are due to the animal's behaviour, to its restless exploration of its surroundings, to its initiative, that distinguishes the main diverging lines of evolution; it is these dynamic qualities which led to the different roles of life that open up to a newly emerging group of animals in that phase of their expansion technically known as adaptive radiation - giving the lines of runners, climbers, burrowers, swimmers, and conquerors of the air. (1)

An evolutionary theory which takes into account the phenotype in the ways described above implies different conceptions of adaptation and fitness than the orthodox theory. Adaptation must now be thought of in a way that takes account of the organism's organic and conscious reactions to stress situations as well as contingencies such as what has been inherited by the organism and what environment the organism happens to be in. Fitness cannot be defined in terms of genotypes, and

(1) Quoted from A.C. Hardy THE LIVING STREAM p. 192f by Arthur Koestler THE GHOST IN THE MACHINE (1967) Picador, Pan Books, 1975, p. 155.

there are even more difficulties involved in the attempt to speak of the fitness of single genes. Fitness can only be defined properly from the point of view of the population of active, striving individuals.

Such a theory of evolution accounts for two important phenomena: the growth in the number of species and the development of more complex phenotypes. Since any new species produces a more heterogeneous environment as a consequence of the interactions with the diverse phenotypes already in existence it will generate the conditions for more species to evolve to fill the new ecological niches. And since the newer environments will be a function of an increasing number of phenotypes, there will be a tendency for more complex phenotypes to evolve which are capable of operating effectively in the more complex environments.

This in turn focusses attention on the ecosystem as such. There are two important points to be made about this. Firstly, it has been pointed out by C.S. Holling that ecosystems are generally not in a state of equilibrium but involve dynamic processes involving oscillations, and continuous and discontinuous trajectories. (1) These dynamics are themselves the result of large numbers of interacting species and cannot be understood except holistically. And it is only in terms of these holistically understood dynamics that the process of evolution can be fully understood. Secondly, the dynamics of the interactions between species is responsible for providing the conditions under which

(1) C.S. Holling "Resilience and Stability of Ecosystems" in EVOLUTION AND CONSCIOUSNESS: HUMAN SYSTEMS IN TRANSITION eds Erich Jansch and Conrad H. Waddington, Addison Wesley, 1976, pp.73-92.

life can continue to exist on Earth. For instance it has been pointed out by James Lovelock that the Earth now receives between 1.3 and 3.3 times more energy than it did at its formation 4000 million years ago. (1) Yet life has found a way of keeping the Earth's surface temperature within the critical range of 15-30°C for hundreds of millions of years in spite of drastic changes of atmospheric composition and this large increase in the mean solar flux. Life also maintains the disequilibrium situation of an atmosphere composed of nitrogen and oxygen in contact with oceans of water. If an equilibrium situation were allowed to develop there would be oceans of nitric acid. The complex self-regulating processes by which life maintains its environment are only just beginning to be understood by Lovelock and his colleagues. These processes must be regarded as essential features of the process of evolution of life to which reductionists have been completely blind.

Having given an ontological place to holistic phenomena within evolutionary theory makes it possible to consider evolutionary theory to be more than just a tautology. The theory becomes an explanation of why there are in existence the types of phenotypes there are. It becomes an explanation of why living things are not just 'bags of eggs' but have evolved to become increasingly able to adapt to complex situations. In this way evolutionary theory becomes an explanation of why humans have emerged on the scene. Having a content the theory says more than 'what has survived is that which has been the fittest to survive.' It shows why the organisms which have survived are more diverse and why there are more complex organisms than those which existed previously.

(1) James Lovelock and Sidney Epton "The Quest for Gaia" NEW SCIENTIST 6 Feb. 1975, p. 304-307.

EPIGENESIS

In the analysis of evolutionary theory it has been shown that the genotype cannot stand for the phenotype. I will now give a more detailed analysis of the nature of the relationship between the genotype and the phenotype showing how the phenotype cannot be regarded as simply a manifestation of the genotype and how the ideas of the molecular biologists which have led to this reduction are inadequate. It has been shown how reductionism follows mainly from the analysis of Watson and Crick of the role of DNA in encoding information which, by determining how protein is synthesised, enables organisms to produce offspring with the same structure as themselves; and from the analysis of Jacob and Monod of how the synthesis of proteins is conducted in an orderly manner. In criticising this reductionism I will show how it is necessary to understand epigenesis in terms deriving from process philosophy. From this perspective it will be seen how the organism as a functioning whole must enter into the theory of how DNA is involved in the development of the organism. This will complement the anti-reductionist arguments of the last section and pave the way for a general treatment of life in terms of process philosophy.

Watson and Crick thought that they had discovered the secret of life when they worked out the structure of DNA and showed how it could reproduce itself. But DNA cannot reproduce itself outside the environment provided by the cell except in artificial conditions which include the addition of the appropriate enzymes, and it can only fulfil its role in the cell because it is part of a total process. As B.C. Goodwin wrote:

> The DNA is designed to operate in a particular cellular environment, on which it is dependent. We would not expect to be able to mix in a test tube the DNA of a protozon, for example, together with all its other molecular constituents, and observe the DNA directing the construction of the protozon. The sufficient conditions for a biological process are not to be found in any part of the system, but in its total organization. The origin of life is, of course, a different problem. The process was started as a discontinuity; now it survives as a continuity. (1)

Furthermore, Paul Weiss has pointed out that the self-regulation of biochemical dynamics by feedback mechanisms as analysed by Jacob and Monod can only be regarded as a realistic explanation of the emergence of space patterns from random molecular populations through the control exerted by DNA if the preexisting spatial pattern provided by the egg is already assumed. (2) From the beginning of an organism's development the DNA mechanism is in interplay with the spatially and chemically patterned egg, and it is impossible to think of the sum of information encoded in the form of DNA molecules, that is, the 'genome', as some kind of autonomous ruler of living processes. The role of the egg is illustrated by Weiss by showing how the adult organism owes some of its features to the nature of the egg. For instance whether a snail is left or right coiled is not determined by the genome but by the constitution of the egg itself. (3)

As has already been suggested, the holistic nature of the phenotype is not done justice to if its relation to DNA is understood in terms of information theory. In terms of information theory the DNA is

(1) B.C. Goodwin "Biological Stability" in TOWARDS A THEORETICAL BIOLOGY 3 DRAFTS C.H. Waddington ed. (1970) op.cit. 1970 p. 5.
(2) Paul A. Weiss "Life, Order, and Understanding" in THE GRADUATE JOURNAL (Supplement) 1970, p. 101.
(3) Ibid., p. 113.

thought of as encoding information which can be translated by means of RNA and proteins to construct the organism. If this were the case there would not be enough information contained in the DNA to account for the amount of variety contained in the adult organism. The phenotype consists of more than a collection of proteins corresponding to all the genes in the genotype, it is a heterogeneous collection of parts such as eyes, livers, a brain and so on in each of which there are only some of the proteins corresponding to the genes, and in each of which there are a great many other substances and structures. The phenotype is not a mosaic of individual gene controlled characteristics. The only way to understand the relationship between the genotype and the phenotype is to recognize that the phenotype is a developing phenomenon. The genotype can then be understood as participating in this development by giving instructions for this process mainly by forming enzymes which catalyse reactions in the developing organism. In this process the genome does not determine the development but performs its role in the context provided by the developing organism.

The study of the process of development of organisms is epigenetics and this is divided into two aspects: changes in cellular composition which is mainly concerned with cellular differentiation and change in geometrical form or morphogenesis. The Jacob-Monod account of how single genes are turned on by enzymes in single celled bacteria does not go very far towards explaining cellular differentiation. Each cell in an adult organism carries the full complement of DNA molecules, yet these cells vary immensely. Furthermore the cells of higher organisms are different from those in bacteria in that the DNA of the chromosomes is normally combined with protein, which seems to make it impossible for single genes to be switched on except in the final phases of development by which time a large number of other correlated genes have already been switched on. (1) The differentiation process involves batteries of genes which act together rather than single genes. This results in whole complex cells becoming either skin, eye, or nerve cells. The interrelation of all the genes involved in this results in the establishment of an order which cannot be analysed in terms of linear relationships between the individual parts. (2) This order is what was referred to earlier as chreod. The nature of chreods will be examined in greater detail below.

Morphogenesis is unlikely to be explicable by any single principle and the whole field of morphogenesis is still open to speculation. However some accounts of particular morphogenetic processes are either established or show great promise. The most obvious of these are the unit generated forms involving single molecules, fibre systems and sheet systems. These are the sort of morphogenetic processes focussed on by Monod. However they are hardly adequate to account for the structure of large multicelled animals.

The most important morphogenetic processes are those arising out of an initial spatial distribution of interacting processes. In metazoa, growth begins with the division of the original fertilized egg, and the result of this division is to produce two identical cells which under certain circumstances may develop into identical twins or quadruples etc. However with continued divisions the situation eventually arises when some of the cells have an environment of nothing but other cells. This shows how the simple accumulation of particular entities eventually

(1) C.H. Waddington "The Basic Ideas of Biology" (1968) op.cit. p.11f.
(2) C.H. Waddington "Practical Consequences of Metaphysical Beliefs" (1969) op.cit. p.80.

give rise to a phenomenon which is the property not of each of those entities or the relations between them, but of the group as a whole, and which then constrains the behaviour of each member of the group. In this case the different environments of the cells results in the cells developing differently. This is the beginning of cell differentiation where cells develop according to their position in the organism.

At the beginning of the process of differentiation of cells all tissue has the potential to develop through division into any of the forms which are eventually actualised in the adult organism, but during the process of development the tissue becomes progressively more specialised according to its position in the organism. Areas are characterized by the dual features of docility and determination. (1) Docility is the potentiality of any tissue to be determined in its development by neighbouring tissue. Docile tissue can be transplanted to other parts of the organism and will develop the appropriate features for its position. Determinative tissue will affect the surrounding tissue. Thus if an eye-cup is transplanted under the skin of the belly of a frog, the skin will appropriately develop into a lens. Determinative tissue has the power of self regulation, and if half of the tissue is cut away the tissue will still develop into a completed organ. A divided eye cup will develop into a number of smaller but complete eyes.

L. Wolpert has developed the idea of positional information to account for such pattern formation. (2) Wolpert suggests that the way the

(1) These concepts are used by A. Koestler (1967) op.cit. p.119.
(2) L. Wolpert "The Concept of Positional Information and Pattern Formation" in TOWARDS A THEORETICAL BIOLOGY 4 ESSAYS C.H. Waddington ed., Edinburgh U.P. 1972, pp.83-93.

development of a cell is dependent on its position in some mass of tissue can be understood if it is assumed that the cell has some way of ascertaining its position in this mass, a code to enable it to adjust its development to accord with this position, and a clock which tells it when to do so. If it is assumed that the positional information is a feature of the conglomerate of cells, then it can be seen that each cell contributes something to the positional information present at any particular point. If different cells contribute in different degrees to the positional information, then the difference between docile and determinative tissue could be accounted for.

Two suggestions have been made to account for this positional information. The first is that the position is specified by gradients. This is likely to be some simple chemical and in itself does not tell us much about the nature of differentiation. More recently it has been suggested that the positional information is given by phase-shift. It is likely that both these solutions are correct in different instances, but the phase shift model seems to be more promising in scope.

The major proponents of this idea are Goodwin, Cohen and Waddington. (1) It is pointed out that systems involving negative feedback tend to go into oscillation. Since many of the components of cells are coupled by feedback relations it can be assumed that such systems are inherently oscillatory. (2) It is hypothesised that the oscillatory nature of biological systems can account for much that is anomalous including the

(1) B.C. Goodwin "Biological Stability" op.cit. pp.1-17, C.H. Waddington "Cellular Oscillations and Development" in TOWARDS A THEORETICAL BIOLOGY 2 SKETCHES (1969) op.cit. pp.179-183 and B.C. Goodwin "A Statistical Mechanics of Temporal Organization in Cells" in ibid. pp. 140-165.
(2) C.H. Waddington "Basic Ideas of Biology" (1968) op.cit. p.16.

nature of the interactions which take place between cells. To take an example, small groups of cells are determined as hind-limbs rather than fore-limbs before they are determined as upper arm versus finger, or thigh versus toe. Thus when a piece of tissue is transplanted from what would have been the thigh of a bird to the wingtip, the transplant develops into toes and claws. (1) This is incomprehensible in terms of gene activation as there could be no genes 'for' the hind limb. However this feature becomes intelligible if differentiation is thought of in terms of the setting up of patterns of oscillations. In this line Waddington wrote:

> We could not have 'a neural plate substance, a fore-limb substance, a hind-limb substance', etc. but neural plate, fore-limb or hind limb oscillatory patterns, which could be regarded as analogous to musical themes or chord sequences. The later phases of differentiation into the various cartilages, bones, muscles, etc., must certainly involve the 'activation' of different structural genes controlling the proteins in these different sorts of cells; but we could interpret these changes as similar to the development of the initial theme according to the conventions of some school of classical musical composition - I suppose the analogue of what jazz musicians do to a chord sequence in a jam session would be some sort of cancer! (2)

When differentiation is thought of in this way then it is possible to account for the field effects which enable cells to determine their position in the organism. The neighbouring cells act as a temporal template which entrains the oscillations of the cell to their own frequencies and phases. It can also account for the determinative nature of some tissue in that once an oscillatory pattern has been set

(1) C.H. Waddington "Cellular Oscillations..." (1969) op.cit. p. 180.
(2) Ibid., p. 180f.

up it can then influence the oscillatory patterns of the surrounding cells despite the fact that the determinative tissue has been transplanted or that part of it has been cut away.

These oscillatory patterns must be understood in connection with the notion of buffered developmental pathways or chreods. As suggested earlier genes do not act in isolation but in concert as a set of instructions or algorithms, and the interaction or the operations of these instructions define the chreod. This chreod has some kind of stability in that disturbing influences are compensated for so that slight changes in the genotype may produce no changes in the developing phenotype. Corresponding to the term 'chreod' Waddington also coined the term 'homeorhesis' meaning 'the maintenance of a flow along a given path'. This corresponds to the notion of homeostasis which refers to the maintenance of a steady state. When a point is reached where a switch is made from one chreod to another or where a choice is made between chreods, the process has been referred to by René Thom as a catastrophe. These notions have been described in earlier chapters and are concepts deriving from process philosophy (1) with homeorhesus being the immanent causality of a particular type of process of becoming and catastrophe being a creative cause.

The emergence of order from the interactions of a large number of individuals has been demonstrated experimentally by Stuart Kaufman. (2) He showed that if a few hundred binary on-off switches are coupled

(1) C.H. Waddington "The Practical Consequences of Metaphysical Beliefs" (1969) op.cit. p.81.
(2) C.H. Waddington "The Theory of Evolution Today" (1969) op.cit. p.368.

together at random so that each switch has inputs coming from two other switches chosen at random with each of these inputs assigned at random one of the Boolean functions so that the switches will compare their own state with that of the input and respond either: yes, no, and, or, and so on, then when this system is started off in an arbitrary state and the whole thing followed on a computer, in quite a number of cases the system gets into a steady cyclic condition and goes round and round the same sequence of stages without deviation. A stable limit cycle has been reached.

This can be taken as the sort of thing that happens when a chreod is buffered, that is, where there is a form of homeorhesus. The genes do not act as individuals but in concert to form a harmoniously operating control system. Following from this it can be seen that the switches which occur when the organism develops one way rather than another cannot be thought of as being due to the action of particular genes but must be regarded as the result of the system as a whole. The effect of the genotype at any particular time must be regarded as indirect and incapable of being unravelled from the total process of the developing organism. This accounts for how it is possible for the environment to affect the way the phenotype develops. The environment enters into the whole process of development of the phenotype which means that the phenotype can develop on one chreod rather than another if the development takes place in a different environment. Such influence cannot be understood in terms of the linear cause effect relationships implied by the analogy of mechanism but only in terms of the forms of causality implied by process philosophy.

This reveals that there is a complex relationship between the genotype, the environment and the phenotype which makes it impossible to substitute the genotype for the phenotype in evolutionary theory. What the molecular biologists such as Crick and Monod have done is to analyse some of the chemical processes involved in life. However these processes are only possible in the environment provided by the total organism, and over and above these processes which can be understood in reductionist terms, epigenesis involves processes which develop from the complexity of all the particular processes. Thus oscillations are features of cells and are the basis of the integrated development of the whole organism and they cannot be thought of as the properties of chemicals. The same is the case with homeorhesus and catastrophes.

This means that both the analyses of evolutionary theory and the analysis of theories of heredity, which together were supposed to form the basis of ontological reductionism, have revealed that the living organism must be treated as a whole. Evolutionary theory and heredity theory are each incompatible with ontological reductionism and require an alternative ontology if they are to be understood.

LIFE AND PROCESS PHILOSOPHY

Evolutionary theory and the biochemistry of genetics were together the pillars of reductionist materialism in biology. There can be no doubting the achievements of the biochemists in particular in attaining some understanding of life. But the biochemists have ignored the ingenuity which went into the setting up of the experimental designs which allowed them to interpret life processes in reductionist terms. This led them to ignore the processes which make possible the types of chemical interactions they analysed, and this in turn allowed them to espouse an impoverished conception of life. In the previous two sections it was shown how this impoverished view of life was inadequate for a theory of evolution or for understanding the relationship between genes and phenotypes. It was argued that for an adequate theory of evolution organisms must be understood as striving to adapt to their environments while the relationship between genes and phenotypes could only be understood in terms of patterns of oscillations and self-stabilizing paths of development. I will now elaborate on these ideas to show how they can form the basis of a coherent conception of life which does justice to the richness of the observed phenomena.

The development of such ideas is still at an early stage and it could be argued that biologists influenced by ideas of process philosophy have yet to prove themselves. The slowness in the development of these ideas is exacerbated by the difficulty in developing experimental studies on such a basis. However this can be no argument against a position if the alternative has been shown to be logically incoherent. It is necessary to develop such new ideas even if for a long time there are no solid achievements. As Waddington wrote:

> All of us who want to understand living systems in their complex and richer forms are fated to look like suckers to our colleagues who are content to make a quick (scientific) buck wherever they can build up a dead-sure pay-off. (1)

But the problems confronted by these thinkers are deeper and more embracing and must prove to be more significant in the long run.

The essence of the anomaly of life is the ability of living processes of all levels of complexity to be self-organizing. I will try to show how the type of self-organization involved in life can best be understood in terms of its patterns of oscillations. These in turn provide an understanding of the nature of hierarchical ordering within organisms. Such hierarchical ordering based on oscillations will be seen to involve a multilinear conception of becoming which enables one to view the organism as a teleologically functioning being. On this basis it becomes possible to come to terms with such concepts as mechanism, health and death.

The self-organizing characteristics of living processes has been described by B.C. Goodwin:

> Biological systems are engaged in a perpetual process of self-maintenance and self-realization directed by internally-defined criteria of stability and organization. Phenomenologically it is this attribute of living beings which allows us to identify them as discrete, autonomous systems: autonomous not in the sense that they are independent of their environment, but in the sense that their 'goals' are different from those of the physical environment, and these goals are internally defined. That is to say, their states of stability, towards which they are constantly moving and away from which they are constantly being perturbed, are defined according to different criteria from the stable states of the natural physical world. These criteria are the laws of biological organization, the constraints which govern the process whereby the organism realises itself as a biological system. (2)

(1) C.H.Waddington "The Practical Consequences of Metaphysical Beliefs"(1969) op.cit. p.81
(2) B.C. Goodwin "Biological Stability" (1970) op.cit. p.1.

Such self-organization is manifest morphologically when structures lost by accident are replaced, dynamically in the process by which mean levels and temporal orderings of physiological processes are re-established after disturbances, and in epigenesis whereby embryos develop into complete, spatially ordered and functionally integrated structures.

Self-organization involves two opposing tendencies. While the process is maintained as a distinct, single unit, incompatible requirements which cannot be satisfied simultaneously impose internal differentiations of the system into partially autonomous sub-processes. In a single cell for instance, chromosome replication must involve temporal differentiation, and since ribosomes cannot occupy the same place as DNA, a nuclear zone is required and thus we must have spatial differentiation. The more complex the demands the living process must be able to satisfy, the more incompatible requirements there are, the greater must be the spatial and temporal differentiation of the organism. Thus as environments become more complex and demand more varied behaviour, the more complex must be the differentiation of the organism.

This means that the form of stability in self-organization cannot be the classical type in which a system is stable in relation to a point but must be a dynamic stability in which there is a spatio-temporal differentiation. Living systems are stable in relation to a causally closed cycle of events such as the sequence: DNA RNA protein DNA elucidated by molecular biology. When that which reproduces itself involves self-organization and is thus distinct from its environment and must maintain its integrity throughout the cycle, then there must be temporal differentiation in order to provide phase information for the relative timing of such things as DNA replication and cell division. To achieve such differentiation the system must involve a dynamic oscillation in which the causal cycle becomes a limit cycle so that after a perturbation the oscillation will return to its original frequency and amplitude. This means that oscillations must be regarded as a central feature of life. As Goodwin wrote:

> There will evidently be continuous, on-going activities in a system which maintains itself as a distinct entity throughout the reproduction process, and the basic dynamic characteristic of this activity is that it is rhythmic or oscillatory. We are led thus to the conclusion that oscillatory behaviour is the fundamental dynamic mode of living, self-reproducing systems, as we know them at and above the cellular level. The oscillation is not imposed on the environment; nor is it incidental to the living process. It is central to its organization. (1)

The maintenance of limit cycles in open systems is a feature of the thermodynamically non-equilibrium dissipative structures analysed by Prigogine, and Prigogine himself has pointed out the relevance of his analysis of dissipative structures for understanding the phenomena of life. (2) The role of dissipative structures in the form of fluctuations or oscillations in the development of a spatial order is manifest with particular clarity in the development of the slime mould. This animal is unusual in that it exists both as a single celled organism and as a differentiated aggregate of cells, and it is for this reason that the role of oscillations is revealed so clearly. To begin with the isolated cells which have developed from spores use up all the food supply. At this stage there are no cell divisions. The

(1) Ibid., p. 8.
(2) Ilya Prigogine "Order through Fluctuation" in Jansch and Waddington eds (1976) op.cit. pp.93-133, p. 107ff.

cells then begin to aggregate and eventually form a structure in which some cells become rich in cellulose and develop into a foot or base which supports a found mass of cells above which in turn becomes rich in polysaccharides. This whole structure is called a pseudoplasmodium. This development takes place over a period of 20 to 50 hours and involves between 10 and 10^5 cells. As a multicellular organism, the round mass on top develops as a fruit and eventually produces a large number of spores. If these land on a favourable environment the whole process can begin again. Prigogine has shown how the initial homogeneous distribution of cells is disturbed when the cells become more sensitive to the chemical acrasin which is exuded by each of them. The acrasin eventually exerts an attraction on the cells which results in their aggregation. What is involved in this process is the development of oscillations in the acrasin. An increased rate of production of the acrasin destabilizes the stationary homogeneous solution so that the situation moves from a themodynamically equilibrium situation to a non-equilibrium situation in which dissipative structures develop. These are in the form of oscillations, and a certain critical wavelength exists which determines the spatial distribution of the aggregate. Predictions made on the basis of this model have been verified by Keller and Segal. (1)

The oscillations in the living system order the whole organism by different principles than those normally considered by the molecular biologists. Most notably it is possible for oscillations to be entrained. The role of entrainment in the process of epigenesis was

(1) Ibid. p.110.

pointed out in the last section, and A.S. Iberall has shown how the ubiquity of oscillations on the macrolevel of more complex organisms facilitate their ordering in the same way. (1) The oscillations examined by Iberall included those of the bio-electric nervous cycle, the endocrine systems, the heat balance system, water cycles and so on. The time scales of these were shown to vary greatly but to be such as to be able to be entrained in chains so that each oscillation comes to form a coherent part of the whole system. On the basis of these studies, Iberall was led to conclude: "It has become increasingly apparent that the many oscillations in the biological system are not incidental characteristics of the system, but represent the working components of the system." (2)

The most important feature of the self-regulation of living organisms which must be understood is the nature of their hierarchical ordering. As H.H. Pattee wrote:

> If there is to be any theory of general biology, it must explain the origin and operation (including the reliability and persistence) of hierarchical constraints which harness matter to perform coherent functions...The problem is universal and characteristic of all living matter. It occurs at every level of biological organization, from the molecule to the brain. It is the central problem of the origin of life, when aggregations of matter obeying only elementary physical laws first began to constrain individual molecules to functional collective behaviour. It is the central problem of development where collections of cells control the growth of genetic expression of individual cells. It is the central problem of biological evolution in which groups of cells form larger and larger organizations by generating hierarchical constraints on subgroups. It is the central problem of the brain where there appears to be an unlimited possibility for new hierarchical organization. Theoretical biology must face this problem as fundamental, since hierarchical control is the essential and distinguishing characteristic of life. (3)

(1) A.S. Iberall "New Thoughts on Bio-Control" in TOWARDS A THEORETICAL BIOLOGY 2 SKETCHES (1969) op.cit. pp.166-177.
(2) Ibid., p.170.
(3) H.H. Pattee "The Problem of Biological Hierarchy" in TOWARDS A THEORETICAL BIOLOGY 3 DRAFTS op.cit. pp. 119f.

It has already been pointed out that process philosophy leads to a hierarchical conception of the world. Such hierarchical ordering becomes intelligible when it is seen that the higher levels do not involve higher substances existing to interrupt the laws controlling the entities in the lower levels, but simply involve the sum of the parts forming an environment which thus constrains and so orders the behaviour of each of the parts which are themselves ordered activities. This is also the way biologists such as Pattee have understood hierarchical ordering. Thus Pattee wrote of such ordering: "the constraint is simply some additional regularity or order which is not explicitly found in the initial conditions." (1) In the dissection of the whole to the parts, what has been lost is the orderly interaction between the parts.

However the sort of hierarchical behaviour involved in life is different from that involved in the inanimate world. For instance in a crystal the elements are characterized by a permanent loss of degrees of freedom. This is a structural hierarchy and it is intuitively obvious that this involves too many rigid constraints to be important in biological coordination. On the other hand liquids and gases involve too few constraints. What is missing in both these cases is a recognizable 'function'. As Pattee pointed out,"Function is a process in time, and for living systems the appearance of time-dependent functions is the essential characteristic of hierarchical organization." (2) This means that the constraints must be variable and imposed on only select

(1) H.H. Pattee "Physical Theories of Biological Co-ordination" in TOPICS IN THE PHILOSOPHY OF BIOLOGY eds Marjorie Grene and Everett Mendelsohn, Reidel, Dordrecht, 1976, p. 161.
(2) H.H. Pattee "The Problem of Biological Hierarchy" op.cit. p. 127.

degrees of freedom of the constituent processes or entities. Such functional constraints are manifest in machines where the physico-chemical properties of inanimate matter are harnessed to perform functions according to a design, the principles of which transcend the physico-chemical realm. (1) These constraints are called 'non-holonomic' constraints because they can only be described by equations which relate coordinates to the trajectories, but which cannot be derived from the ordinary equations of motion and the initial conditions of the system. (2)

Since functions are time dependent, the nature of time becomes extremely important when it comes to understanding the hierarchical ordering of living processes. And the most important feature of the time of such processes is that it must be seen as multilinear. Ted Bastin has tried to construct an abstract model of hierarchical order to get a simple picture of the relations involved in such a system. The most central idea which emerged from this was that "levels of control must be distinguished by different time constants." (3) By time constant he means relaxation time which Goodwin has described as roughly speaking the time required for the variables to reach a steady state after a 'small' disturbance." (4) To illustrate this Bastin pointed out that if there is a hierarchical order of command, then it will be impossible for an individual to operate if commands come to him with

(1) The implications of this have been worked out by Michael Polanyi in "Life's Irreducible Structure" in KNOWING AND BEING op.cit. pp. 225ff.
(2) H.H. Pattee "Physical Theories of Biological Coordination" op.cit.p.275.
(3) Ted Bastin "A General Property of Hierarchies" in TOWARDS A THEORETICAL BIOLOGY 2 SKETCHES (1969) op.cit. pp.252-265, p. 253.
(4) B.C. Goodwin TEMPORAL ORGANIZATION IN CELLS: A DYNAMICAL THEORY OF CELLULAR CONTROL PROCESSES Academic Press, London, 1963, p. 10.

a frequency comparable to the rate at which he must implement them in detail. Bastin concluded from this that there is "a non-formalized (but probably formalizable) theorem underlying hierarchical control which asserts that two levels are specifiable if and only if the ratio of the time constants characterizing the two levels is large (numerically)." (1)

Such temporally multilinear processes involving non-holonomic constraints can be made intelligible when the control processes are understood in terms of oscillations deriving from thermodynamically non-equilibrium situations. Goodwin has pointed out that if two systems have very different relaxation times, for instance if one is a hundred times as fast as the other, the variables of the faster one can be regarded as being always in a steady state relative to the time required for significant changes to occur in the slower system. (2) This means that only the steady state quantities of the faster system will be significant for the slower system, while the variables of the slow system will enter into the equations of motion of the fast system as parameters of the environment rather than as variables. Thus if relaxation times are used as a criterion for identifying types of order within a living being, it is possible to consider the metabolic system, the epigenetic system and the genetic system as distinct with the genetic system containing the epigenetic system and the epigenetic system containing the metabolic system. What is involved in the

(1) Ted Bastin "A General Property of Hierarchies" op.cit. p. 256.
(2) B.C. Goodwin TEMPORAL ORGANIZATION IN CELLS op.cit. p. 20f.

relationship between such systems is that the slower systems are constituted almost entirely of faster systems, but then form part of the environment of the faster systems and this way constrain their behaviour.

This simple hierarchy was used by Goodwin to analyse single celled organisms. However similar analyses could be made of multicelled organisms. In particular the epigenesis of multicelled organisms involving morphogenesis and cell differentiation as analysed in the last section suggest that the chreods involved in this can be understood as temporally transcending the rhythm of development of particular cells in this way, thus constraining their development. In the adult organism the functioning of the differentiated parts can also be seen in relation to the life of the total organism in these terms. And finally, the life of the individual can be understood as being contained within the genetic system of the total population of the species, which in turn can be seen as contained in the dynamics of the ecosystem.

Such hierarchical ordering together with ordering through entrainment, both of which are based on oscillations, imply that it is oscillations which make possible the distinctive characteristics of living beings as Iberall suggested in his attempt to redefine life on the basis of his studies:

> Thus life is tentatively defined as any compact system containing a complex of sustaining non-linear limit cycle oscillators, and a similar system of algorithmic guiding mechanisms, that is capable of regulating its interior conditions for a considerable range of ambient environmental conditions so as to permit its own satisfactory preservative operation; that is capable of seeking out in the environment and transferring and receiving those fluxes of mass and energy that can be internally adapted to its own satisfactory preservative operation; that is capable of performing those preservative functions for a long period of time commensurate with the "life" of its mechanical-physical-chemical elements... (1)

(1) A.S. Iberall "New Thoughts on Bio-Control" op.cit. p.168.

Thus a living being must be understood as a polyphony of processes of becoming rather than a unilinear sequence of interactions between basic constituents.

This enables life to be understood as functioning teleologically in a way which was impossible when life was seen as a linear sequence of events. Self-realization implies the implementation of a program, and a program can be seen as being effective without being analysable into linear cause and effect relations by being conceived of as an ordering with a relaxation time much greater than the time required to perform each item in the program. (1) The program is a supervening cause which transcends the temporality of the processes which are ordered by it. Thus an organism can be regarded as a polyphony of processes which maintains and realizes itself, or as Jacob von Uexkull put it: "Every organism is a melody which sings itself." (2)

While living beings must be understood in teleological terms, the use of mechanistic analogies can be legitimate. What is involved in considering something as a mechanism is that processes are ordered for the implementation of ends which are higher than the ordered processes themselves. Thus the skeleton of an animal involves the use of calcium carbonate to form a structure which is an essential part of the mechanism of locomotion. As in all mechanisms, the calcium carbonate involved is

(1) This interpretation has been suggested by C.H. Waddington who drew an analogy between Pattee's notion of non-holonomic constraints and the notion of programs by which Christopher Longuet-Higgins attempted to characterize all life in TOWARDS A THEORETICAL BIOLOGY 2 SKETCHES op.cit. p. 266.
(2) Cited by Maurice Merleau-Ponty in THE STRUCTURE OF BEHAVIOUR (1942) tr. Alden L. Fisher, Beacon, Boston, 1963, p. 159.

subject to two ordering principles: that which maintains the molecules of calcium carbonate, and that which orders these molecules for the purpose of the organism. The higher on the evolutionary scale an animal is, the more it makes use of sub-processes for its own ends, and the more it is capable of being understood in mechanistic terms. However since the analogy of mechanism implies something ordered for a purpose, it must always be subordinate to the concepts of process philosophy in terms of which the organism can be seen as a teleological order.

Having understood life teleologically it then becomes possible to do justice to a number of other concepts usually associated with life. In particular the notion of health takes on a specific meaning and it is possible to make a distinction between life and death. Where living beings are seen as trying to realize ends, the state of an organism can be evaluated in terms of the ends which it is trying to realize. Evaluation is more plausible where the underlying metaphor is that of music. With atoms moving in a void there is no place for values, while with music, it is possible to talk of harmony, discord and so on which are implicitly evaluative. Similarly since it is impossible to have any conception of an arrangement of matter which could be regarded as living, it is meaningless to make a distinction between life and death in terms of materialism. But where it is possible to conceive of some processes as acting teleologically it is possible to conceive of these processes as disintegrating and so conceive of death.

In this section I have tried to show how life can be characterized in terms of the concepts of process philosophy in a way which remains faithful to the richness, complexity and uniqueness of living phenomena, yet which does not involve a departure from the concepts used to understand the realm of inanimate nature. However there are two features of life with which I have not yet dealt: that it has evolved from inanimate nature and that living beings have consciousness. I will now try to show how these can be understood within the framework of the conception of life developed so far.

THE ORIGIN OF LIFE AND THE EMERGENCE OF NEW ORDERS

It was pointed out that the origin of life is regarded by reductionists such as Crick and Monod as one of the major problems to be explained. The basis of the difficulty is that fifty macromolecules are required for the process which can translate the code of the DNA molecule. The molecular biologists try to explain the origin of life in terms of the association of more and more complex units until there is an ultimate culmination to form the minimum complexity that can be characterized as life. This is far from satisfactory since the probability of all 50 macromolecules coming together in the right order by pure chance is negligible, even considering the time and the number of places which could have been favourable to such a development.

But there is a more basic problem in the reductionist's attempts to account for the origin of life. The notion of hierarchical ordering is inconsistent with ontological reductionism. This means that it is impossible to explain how integrated sets of constraints could have emerged where none had existed before since the reality of that which is to be explained is denied. Reductionism only appears to be successful when the totality with its self-maintaining constraints is assumed and 'dwelt within' before the analysis into parts and their relationships is undertaken. Whatever form of emergence is under question, whether this be the origin of life, the development of multicelled organisms from single celled organisms, or the development of consciousness, the reductionists have no way to approach the problem.

Process philosophy on the other hand which takes flux as paradigmatic and makes the development of order something to be explained is the ontology which enables such a question as What is the origin of life? to be focussed upon. The answer to this question suggested by process philosophy is not to start with the constituents but to start with an aggregate and to consider how a simple ordering could emerge from this. This has been the approach adopted by Pattee who considered spontaneous organization in terms of the formation of persistent regularities from chaotic aggregations of extreme complexity. (1) While this is more subtle, less easily pictured and much more difficult to model or study experimentally, it accounts more easily for the emergence of the integrated sets of constraints involved in new hierarchical levels of control. The emergence of simplicity from complexity is illustrated by Kauffman's randomly connected, randomly switching nets and the emergence of dissipative structures in thermodynamically non-equilibrium situations both of which have been discussed earlier, in Levins' spontaneously simplifying complex systems, (2) and in the mathematics of topological dynamics developed by René Thom where the emergence of a new ordering is conceptualized as a catastrophe. Using such ideas it is possible to think of the emergence of life not as simply the coming together of constituents but as the development of a simple and regular self-sustaining ordering based on dissipative structures involving only 50 macromolecules from irregular patterns of interactions between much larger numbers of molecules.

(1) H.H. Pattee "Laws and Constraints, Symbols and Languages" in TOWARDS A THEORETICAL BIOLOGY 4 ESSAYS ed. C.H. Waddington, Edin. U.P., Edin. 1972, p. 255ff.
(2) R. Levins "Complex Systems" in TOWARDS A THEORETICAL BIOLOGY 3 DRAFTS 1970, p. 73.

THE ORGANISM AND ITS ENVIRONMENT: THE NATURE OF SUBJECTIVITY

Having seen how life must be conceived of as a polyphony of processes, I will now try to show how this makes it possible to ascribe subjectivity, at least in germinal form, to all forms of life. Beginning with the ontology of process philosophy circumvents the major ideas deriving from materialism which have rendered the very idea of subjectivity unintelligible, most notably those deriving from the materialist concepts of time, space and causality. But over and above this, the subjectivity of living processes derives from two features already described: they are basically dissipative structures of thermodynamically non-equilibrium states which are hierarchically ordered.

Having shown the intelligibility of subjectivity in terms of the concept of life developed so far I will then be able to go on to describe the various developments of subjectivity and awareness which have culminated in the emergence of consciousness. This is a fundamentally different approach to the usual way of attempting to understand the relationship between the body and consciousness where the focus is upon the relationship between the central nervous system and the subjective experience of humans. Taking this as the starting point, where the central nervous system is understood in mechanistic terms, consciousness remains utterly mysterious. I will be considering the organism in its environment as a whole in such a way that subjectivity will be seen as an essential aspect of this. The central nervous system must then be seen as a constituent process in this whole, being both essential to its functioning and dependent on the functioning of the whole for its existence.

In his attempt to arrive at a definition of life, A.S. Iberall asserted that living beings "must be capable of seeking out in the environment and transferring and receiving those fluxes of mass and energy that can be internally adapted to its own preservative operation..." (1) This in effect sums up the features of a process which must involve a constant interchange with its environment, but in such a way that the interaction is ordered by the process itself. For this to be possible the process must be a hierarchy of orderings of a special sort. There is not simply an order which is ordered into a higher order which in turn is ordered into a higher order still. Rather the higher order involves an ordering of the powers of the lower order in its interaction with the environment. This is the cognitive function which as an extension of organic regulations, constitutes a differentiated organ which regulates exchanges with the environment. (2) Such a process defines the environment as a field of potentialities: as food which can satisfy it, as irritants which it must move away from, and so on. This means that the process defines the environment in terms of itself. According to George Herbert Mead, it is this which characterizes a teleological object. (3) The environment then becomes a world for the organism. Correlatively there is established a realm of inwardness as the organism stands over against its world, assuming its own significance. This is manifest in the tension within the organism which can only be fulfilled through appropriating the material of the organism's world. This tension

(1) A.S. Iberall "New Thoughts on Bio Control" op.cit. p.168.
(2) This is the basic idea behind Piaget's book BIOLOGY AND KNOWLEDGE: AN ESSAY ON THE RELATIONS BETWEEN ORGANIC REGULATIONS AND COGNITIVE PROCESSES tr. Beatrix Walsh, Uni. of Chicago Press, Chicago, 1971, esp. pages 26 and 369.

(3) George Herbert Mead THE PHILOSOPHY OF THE ACT ed. Charles W. Morris, Uni. of Chicago Press, Chicago, 1938, p. 301.

can lead to either satisfaction in which the needs of the organism are fulfilled, or frustration in the case of failure. Thus all organisms must be conceived of as being at least in some degree subjects-in-the-world.

These characteristics are only intelligible on the basis of different concepts of time, space and cause than those associated with materialism. Where time is understood in spatial terms as a point moving along a line this rules out the possibility of conceiving of an entity as a subject. Subjectivity can only be understood when as implied by process philosophy the living organism is seen as in the process of becoming. It is only by acknowledging the incompleteness of the present and the potentiality of the future that the idea of subjectivity can be made sense of. In the incompleteness of the present, an organism must then be seen as a being-in-the-world as the environment is defined as a field of potentialities over which the organism stands as an embodied subject projecting itself towards the future in response to these potentialities.

To be able to constitute the environment as a field of potentialities and thus as a world implies that the organism transcends the immediacy of its being towards the future. A temporal horizon is opened up as the simple flowing passage of change is transformed by the pull towards the future, defining the present as that in which past tensions or desires have been satisfied or frustrated, and in which there are existing tensions or desires which may be satisfied in the future. In this way the organism becomes a being-in-the-world in which the existing state is a present full of potentialities for the future. It is this temporality of the organism's being-in-the-world which gives it an inwardness which is the essence of subjectivity. This seems to be implicit in Kant's characterization of time as "...nothing but the form of inner sense..." (1) But the idea of transcending the present towards the future is unintelligible where time is conceived of as unilinear and independent of its content. In these circumstances the world must be conceived of as a linear sequence of events. Only where becoming is understood as multilinear does such transcendence become intelligible.

As was seen in the last section, living beings are polyphonies of processes in hierarchical order, with the higher orderings having longer relaxation times than the lower order processes. It is only because of the different relaxation times or rhythms that there can be hierarchical order. But it was pointed out in the analysis of time in Chapter 3 that it is only because of the asymmetry of rhythms that the notion of time can be introduced into the world. The asymmetry makes it possible to define the regulating order as permanent relative to that which is changing, and the regulated order as changing relative to that which is permanent. This makes it possible to take that which is defined as permanent as a standpoint from which that which is defined as changing can be seen as changing through time. But since the time in which the change takes place is defined in terms of the order which regulates it, this regulating order must be defined as outside this time. Since the interactions which take place between an organism and its environment are regulated by a higher order than the particular interactions, these interactions can be regarded as changes occurring through the time defined by the organism as a whole. This means that the whole organism

(1) Immanuel Kant's CRITIQUE OF PURE REASON tr. Norman Kemp Smith, Macmillan, London, 1933, p. 77.

can be conceived of as transcending the flow of time in which the metabolic processes take place. Since the whole organism directs the interactions with the environment for its own ends, and these ends must be understood in relation to the organism as a whole, the ends themselves must be seen as transcending the flow of time within which these are realized. In this sense the organism can be thought to be moved by final causes, and must be seen as a project to the future which transcends the present.

Where space is seen as an infinitely divisible container of objects which are then conceived of as being in and moving in space it is impossible to think of any combination of these or patterns of interaction between these giving rise to subjectivity. It is necessary to reinterpret the concept of space before it is possible to introduce the notion of subjectivity. To be a subject the organism must be separated from its environment, yet be able to interact with it. This requires that the organism have a boundary which is part of itself which sets it over against its environment. Thus modern evolutionists hold "...that the origin of life can be located as the first establishment of an entity enclosed in a semi-permeable membrane." (1) The nature of the boundary of the organism means that it does not simply exist at some place, but takes up a position in the environment which becomes a world by being constituted as a spatialised field of potentialities. Helmuth Plessner has tried to develop a conception of life based on this 'positionality' of the organism. What Plessner means by this concept has been summed up by Marjorie Grene:

(1) Marjorie Grene THE UNDERSTANDING OF NATURE: ESSAYS IN THE PHILOSOPHY OF BIOLOGY, Reidel Dordrecht, 1974, p.324.

> ...a living thing _takes_ its place...It not only has its position in a coordinate system of space and time: it has _its_ place...It is a question of the whole way in which an organism 'takes its place' in an environment - arises in it, is dependent on it, yet opposes itself to it. (1)

The spatialization of the world is then intrinsically associated with the organism taking up a position within the environment which means that spatiality is here understood in terms of the possibility of the organism's interacting with the environment over various durations. In other words, space is defined in relation to becoming as the potentiality for causal interaction in accordance with the concept of space of process philosophy.

In order to conceive of beings which are subjects in the world it is also necessary to reject the materialist notion that things have a simple location in space and time. So long as this notion of simple location is assumed it becomes necessary to show at what place the subject exists and this inevitably leads to the conclusion that since the subject cannot be located anywhere in the body or in the brain, it does not exist at all but is an epiphenomenon, an illusion. This is then further supported by showing how the body can be analysed into constituents which do have such a simple location which then interact in space and time and are affected by inputs from the environment such as photons of light, food etc. which also have such a simple location. Where processes are seen as processes of extensive becoming and the space-time order which is essentially an order of potentialities for interaction is seen as derivative from extensive becoming such problems

(1) Marjorie Grene APPROACHES TO A PHILOSOPHICAL BIOLOGY, Basic Books, N.Y. 1969, p. 74f.

do not arise. The subject is not at a place within the organism but can only be understood in relation to the total process of extensive becoming of the organism in interaction with its environment.

Lastly, where causality is understood as extrinsic to what is and is thought to be indefinitely analysable into smaller and smaller sequences of events it is impossible to make sense of the subjectivity of organisms. To be seen as a subject an organism must be seen as an immanent cause of its own being so that it can be regarded as the agent of its actions. To be able to do this within the materialist framework of concepts requires the postulation of something like a life force or a mind to affect the constituents of the organism. But where being is defined as essentially active and all processes are defined as self-ordering activities, this is not necessary, and conceiving of the biological organism as an agent presents no problems. Also to think of the organism as constituting the world to which it responds requires the notion of a supervening cause. Where causality is reduced to a sequence of events the organism is seen as being acted on by the environment and responding accordingly. Photons hit the eye and produce nerve impulses and so on, eventually producing a response on the part of the organism. To avoid such a mechanistic account of the organism/environment relation it is necessary to recognize that causality is epochal and is evident in the ordering of the totality rather than in a sequence of events. If the way in which organisms cognize their situation in the world is to be understood cognition must be seen as an ordering of the organism in relation to its environment, and as such, irreducible to events produced within the organism by the environment. Cognition is a supervening cause which constrains the interaction between the organism and the environment as a whole, and any analysis of cognition must presuppose the holistic nature of the cognitive process.

But even with the transformation of concepts effected by process philosophy it might be held that it is impossible to 'know' that an organism is a subject. This reflects the influence of the empiricist epistemology where all that is considered is what is immediately given to the senses. However I have already argued against this in favour of an epistemology in which understanding is the central concept. Understanding involves an 'indwelling' in that which is to be understood so that the significance of each particular thing focussed on is seen in a context of which one is tacitly aware. In the case of a living animal, each action observed must be understood from the point of view of the total organism as a purposefully acting being responding to a world which it experiences as meaningful to it. And such indwelling in the totality, where this totality is conceived of in terms of the framework of concepts outlined above, must involve an awareness of the meaning of these actions in relation to the inwardness or subjectivity of the organism.

Thus to understand an organism in terms of the categories of process philosophy it is necessary to see it as a subject interacting purposefully with its environment. This means that a major place in biology must be given to the work of the ethologists. This does not preclude the possibility of a physiological explanation of all aspects of organisms which makes such purposeful behaviour possible; showing for instance how the central nervous system works. But such explanations must be understood as effective only if they presuppose an understanding of the living order as a being-in-the-world, and are aimed at understanding how such an order is possible. Physiological explanations cannot be thought of as explaining away the subjectivity of living organisms but must be regarded as showing how such characteristics are possible.

THE EVOLUTION OF CONSCIOUSNESS

Although the above analysis of life implies that subjectivity is present in germinal form in all forms of life, it can only be thought to exist very dimly in the case of plants. Though the plant maintains its form through the change of matter which takes place in the metabolic process, and in this respect manifests a basic concern with its own continuation, there is virtually no activity over and above the immediacy of the metabolic process. The plant and the environment form one context as the environment is nothing but the immediate surroundings with which the chemical interchanges of metabolism take place. The organism/environment relation functions automatically. The outward has no true dimension, but diffusely coincides with the sensitive surface of the organism itself. The beginnings of subjectivity really become apparent only when the organism is mobile, that is, with animal life.(1)

The essential feature which distinguishes animals from plants is the mobility of animals. They must actively attain their food and escape from danger. If animals are not to act simply at random, it is necessary that they be sensitive to their environment, and there is no knowledge of any animal existing which is totally insensitive. (2) This sensitivity then in some way allows the animal to direct its locomotion. The functioning of the organism vis-a-vis its environment is its behaviour, and that aspect of behaviour which expresses the behaviour's dependence on the inner order of the organism is the organism's adaptation to the environment. This adaptation can be considered in

(1) Hans Jonas THE PHENOMENON OF LIFE, Dell, N.Y., 1966, p.100ff.
(2) Konrad Lorenz BEHIND THE MIRROR: A SEARCH FOR A NATURAL HISTORY OF HUMAN KNOWLEDGE tr. Ronald Taylor, Methuen, London, 1977, p. 46.

two directions. To be sensitive to the environment requires the organism to assimilate inputs from the environment to its own order or structure, while to adapt, modify or apply this order in a particular environmental situation can be referred to as an accommodation on the part of the organism. (1) Learning involves a modification of the inner order of the organism. A stimulus is only defined as such by the organism which reacts to it, and it is intrinsically related to the inner order of the organism as something which can be assimilated to it. As such it is an 'indication' by which the animal orients itself. In the same way a response is always something constructed in part according to determinants that are intrinsic to the order within the organism. Thus a stimulus cannot be said to 'cause' the response - the animal acts purposefully on the basis of what it experiences as an indication. Such adaptive behaviour implies some understanding by the animal of the environment. Understanding can be viewed as the constitution of the environment as a world according to the internal order of the organism, or as an ordering of the subject in living interaction with the environment. Understanding is thus neither solely in the subject nor is it of a supposedly independent world, but is part of an indissociable organism-environment relation. It is in this way the environment is constituted as a world over against which the animal stands.

The nature of animal worlds has been examined by Jacob von Uexkull. (2) Firstly he distinguished the perception world or the world as sensed which is all that the sentient organism is aware of. It is this world which enables the organism to guide its movements. Secondly, he

(1) The concepts of assimilation and accommodation are taken from Piaget. See Hans G. Furth PIAGET AND KNOWLEDGE: THEORETICAL FOUNDATIONS Prentice Hall, Englewood Cliffs, 1969, passim.
(2) Jacob von Uexkull THEORETICAL BIOLOGY, Kegan Paul, Trench, Trubner & Co., London, 1926, Ch.5.

distinguished the action world which is the world as understood by the animal in the execution of its actions. The combination of the perception world and the action world is the surrounding world. By directing action on the basis of the perception world, the animal creates for itself an inner world. The periodic cycle in which the animal perceives the world, and then on the basis of this, directs its actions, which in turn leads to a new perception of the world, is the function circle of the animal. An animal can have any number of these. There are function circles for the medium in which the animal lives, there are enemy function circles, food function circles and sexual function circles. These can be integrated to various degrees. It is only when a function circle is established by which the animal takes the movements of its own body as indications that a sharp line can be drawn through the perception world between the subject and the outside world. A new dimension is opened up when the animal directs its organs of perception to obtain a better understanding of its situation before acting. Here a new circle is established within the inner world of the animal. Von Uexkull argued that to understand an animal it is necessary to study the function circles from every side. Such a study reveals that each animal lives in its own world, and to understand an animal requires an understanding of the world within which it lives. He concluded that "...we are justified in assuming that there are as many surrounding worlds as there are animals." (1)

By a study of animal worlds the way is then open to trace the evolutionary path of development which has led to human consciousness. This involves

(1) Ibid., p. 176.

rising degrees of world perception, increasing freedom of action and a progressively greater capacity to learn, all of which interpenetrate to produce deeper understanding and a greater potential for the organism to decentre itself as a subject from its immediate involvement in the world. This tendency is further strengthened by the growing capacity of animals to communicate. Showing such developments will then form the basis for the development of a conception of the human order.

The most elementary form of relationship to the environment by an animal involves nothing more than the ability of the organism to accommodate itself to the immediate environment in order to ingest food and the ability to assimilate this food to itself. Higher states of awareness are attained through the development of both cognitive and action schemata. What is involved in the evolution of cognitive and action schemata is the development of the ability of the animal to assimilate environmental inputs not simply as food but as indications which orient the animal in its environment, and the ability to accommodate itself to the environment not simply by ingesting food but by performing complex patterns of activity. The greater the development of these schemata the freer the animal is from the immediate metabolic processes. I will now try to trace out the main developments along these lines, beginning with cognitive schemata and then going on to consider action schemata. In the section following this I will consider the problem of instincts and the relationship between instincts and learning and attempt to show how the highest developments of cognition follow from the capacity of individuals to learn.

The amoeba represents the most elementary type of relationship between an animal and its environment. The amoeba is simply a naked mass of protoplasm which moves by a process of reducing the thickness of its outer layer or ectoplasm at one point so that an outgrowth develops, while at the same time thickening the ectoplasm at the opposite end. The outgrowth forms into a 'false foot' or pseudopod into which the entire content of the cell eventually flows. In this way the whole cell can change its position in any direction. The amoeba moves from a noxious stimulus or towards a source of favourable stimuli and embraces the source of this stimuli by the same process. Its intelligence is manifest in its ability to respond selectively to different stimuli. This means that the stimuli are defined as noxious or favourable by the amoeba and thus become indications for it on the basis of which it is able to make selective responses.

The differentiation of animals which leads them to develop refined sense organs and organs of locomotion begins when the organism is structured with fixed front and rear end. However this involves sacrificing the three dimensional mobility of the amoeba and the lowest forms of such structured animals seem less competent in their response to the world as a consequence. Such animals are characterized by different forms of kinesis in which there is no orientation of the body relative to a source of information. (1) The simplest form of this is orthokinesis where the animal moves faster in an unfavourable environment than in a favourable one, thus increasing the amount of time spent in the favourable environment. The other form is klinokinesis whereby the animal increases its rate and angle of change of direction as it enters a more favourable environment. Klinokinesis is usually associated with orthokinesis.

(1) W.H. Thorpe ANIMAL NATURE AND HUMAN NATURE, Methuen, London, 1974, p.48.

Another extremely simple form of reaction to the environment is the phobic response. (1) For instance such animals as the paramecium react by turning if there is a rapid increase in unfavourable stimuli due to their present movement. This is the only response the paramecium make to its environment. However this is superior to kinesis in that the organism learns something about the direction of that which is to be avoided and this enables it to stay permanently in a favourable environment.

A far higher level of awareness is attained when the organism is able to orient its behaviour in relation to the source of a stimulus. Directed movements based on this are known as taxes or topic responses. (2) Klinotaxis, exemplified in the fly maggot is based on the organism having sense organs able to discriminate intensity. The maggot is then able to orient itself and move towards the source of light by swinging its body from side to side in order to compare light intensities. Tropotaxis requires an organism to have paired sense organs which allow a simultaneous comparison of intensity of stimuli, thus enabling it to move towards the source of light without such swinging movements. However if there are two sources of stimuli the organism will move between them. This is overcome by teleotaxis where the orientation does not depend on a simple balance between the sense organs as the response to the sense organs on one side can be inhibited. This involves an elementary choice. More complex is menotaxis exemplified in ants where the animal does not simply move towards or away from a source of stimuli, but moves at a constant angle to it. Thus an ant can make a straight path to a foraging ground

(1) Konrad Lorenz (1977) op.cit. p. 50f.
(2) Thorpe (1974) op.cit. p.52f.

by keeping the sun at a definite angle to the axis of its body. Finally animals are capable of perceiving a pattern and organizing their behaviour in relation to this.

The ability to perceive a pattern occurs in various degrees. At one end of the spectrum there is the paramecium which is only able to react to acid concentrations, or ticks which bite everything that is 37°C and smells of butyric acid. (1) In between are animals which can perceive some complex of stimuli such as the young cichlid fish which follow their mother, but are unable to distinguish the mother fish from a predator fish of the same size. (2) Similarly a young kestral bathes itself when it first perceives water but behaves in the same way when it comes across a polished marble surface. (3) A robin is more highly developed and during the mating season it is only possible for ethologists to elicit attacking behaviour on the part of most robins by using a complete stuffed model of a robin. (4) The greater ability in such respects, the more perception depends on the internal order, the schemata, of the animal, and so it becomes increasingly necessary to understand perception as being ordered by its own principles. Such principles are those which have been elucidated by the Gestalt psychologists.

Some animals which respond to patterns show remarkable powers of perceptual organization. This is most clearly evident in birds which are able to navigate by the stars and the sun and migrate over immense distances.

(1) Lorenz (1977) p. 55.
(2) Ibid., p. 54.
(3) Ibid., p. 55.
(4) John Paul Scott ANIMAL BEHAVIOUR 2nd ed. Uni. of Chicago Press, Chicago, 1972, p. 153.

This means that the birds are able to correct for the movement of the sun by means of an internal clock mechanism. Where navigation is at night by means of the stars the birds must orient themselves to a total Gestalt. Warblers can maintain a constant direction in relation to the stars when only the central part of the sky is visible. (1) Perhaps more remarkable than the regular migratory behaviour of birds is their ability to return to their nests when taken a great distance away to regions totally unfamiliar to them and released. For example a shear-water was taken from its burrow on the island of Stokholm off Pembrokeshire and taken by air to Boston Harbour in U.S.A. and released, and in thirteen days it was back in its burrow, having covered a distance of 3,050 miles. (2) U.S.A. is beyond the geographical range of the bird. Birds are capable of great exactness in their ability to orientate themselves. The Dove Prion is able to burrow through snow to its old nest site despite the fact that the topography of the area has been obliterated by fresh snowdrifts. (3) Albatros are also capable of exact location of a nest site or a food storage place in such circumstances. In doing this they have been observed zigzaging and pausing to look at the sky until they finally land at the right spot. (4) A tracked Swainson's thrush covered 450 miles in eight hours, having actually flown only 453 miles which is better than what is usually achieved by human navigators. (5) In performing such tasks the birds compensate for such disturbances as wind as well as sun and star movements. It is also possible that birds are aware of magnetic fields. (6)

(1) Thorpe (1974) op.cit. p. 192.
(2) Ibid., p. 193.
(3) Ibid., p. 194.
(4) loc. cit.
(5) Ibid., p. 199f.
(6) Donald R. Griffin THE QUESTION OF ANIMAL AWARENESS: EVOLUTIONARY CONTINUITY OF MENTAL EXPERIENCE, The Rockefeller University Press, N.Y. 1976 p. 13.

A new stage is reached where action is taken solely in order to better perceive the world. This is usually associated with the physiological developments such as the ability to focus the eyes, to move the head in relation to the body and so on. A particularly high development of this interrelation between acting and perceiving occurs with the echolocation of bats and porpoises. Here the animals literally question their surroundings by producing sounds in order to orient themselves. (1) Such a link up between perception and action integrates the perception world and the action world to form a more coherent surrounding world.

This integration of the experience of the world involves a spatialization of this world so that the animal comes to experience itself as within a spatial order. However this spatialization of the world is derivative from the temporal becoming of the organism in relation to its environment. It develops from the growing ability of the organism to orient itself in terms of directions. Spatial perception is a dynamic integration of directional orientations. As Koffka wrote: "Visual space is a dynamic event rather than a geometrical pattern." (2) According to Uexkull, such orientation in space cannot be understood simply in terms of being at a place within a geometrical order since such an orientation is an ordering of significant relationships. Such an orientation can better be understood as being like the situation of a tone within a melody than like a place within space. For instance when a Sphex wasp attacks a Cetonia it finds with its sting the precise point of the larva's ganglia

(1) Griffin (1976) op.cit. p. 13.
(2) Cited by Zuckerkandl op.cit. p. 344 from Kurt Koffka PRINCIPLES OF PSYCHOLOGY.

that will paralyse it but not kill it, this can better be understood as being like singing the right tone in a melody than like conceiving the right 'place' to put the sting. Von Uexkull illustrated the nature of this by considering what is involved in listening to music:

> When music takes such hold of us that we forget the origin of the tones that proceed from this or that instrument and give ourselves to the rhythm, subjective feelings of direction awaken in us, even without sympathetic motions by our bodies and, together with the tones, seem to fill the space that belongs to them. (1)

Thus the spatiality of animals must be seen as a topological space understood in terms of an auditory analogy in accordance with the ideas of process philosophy.

So far I have been considering action only as a reponse to the environment. However arthropods and vertebrates are characterized by motor coordinations known as action schemata, motor melodies or fixed motor patterns. (2) The complexity attainable in these is evident in the elaborate stitchings and fastening used by the different weaver birds. (3) Where such fixed motor patterns exist, the relationship between the stimuli and the response becomes a lot more complicated as stimuli elicit the whole pattern.

These motor patterns cannot be thought of as a sequence of reflexes. They are wholly patterned by the central nervous system, and coordinated motor patterns of a highly differentiated nature function independently of outer or inner receptors. (4) If the receptors do play a part it is to adjust the pattern to particular circumstances. The central

(1) Cited by Zuckerkandl op.cit. p. 320.
(2) Lorenz (1977) op.cit. p. 55f.
(3) Thorpe (1974) op.cit. p. 149.
(4) Ibid., p. 136ff.

coordination of such patterns is manifest in the way alterations of any part of the pattern influence every other part of the pattern so that a new integrated pattern emerges. For instance if one or a number of phlanges of a dung beetle is amputated, the animal continues walking in an orderly manner but by a new mode of locomotion in which the damage has been adjusted for by the total pattern. (1)

The fixed motor pattern begins functioning when it is triggered by a key stimulus. But release is really only the de-inhibiting of the spontaneity of the behaviour pattern. As Konrad Lorenz wrote:

> In many lower animals the most important function of the highest centres of the nervous system is to exercise a permanent inhibiting effect on the various endogenous-automatic behaviour patterns of the organism, and on the basis of instantaneous external information to 'set the pattern off' at the appropriate moment. (2)

Thus when an earthworm is deprived of its 'brain' it is unable to stop crawling while a crab deprived in the same way cannot stop eating in the presence of food. The importance of this is that the ordering of behaviour must be seen as constraining of what is essentially an active being rather than an impetus added to an inert being, thus according with the notion of hierarchical order implied by process philosophy.

If the motor pattern is not used, the threshold of its releasing stimuli will gradually fall. This can lead to the animal responding to substitute stimuli or eventually to nothing at all. This lowering of the threshold is associated with an excitation of the whole organism which functions as a drive to search actively for key stimuli. This indicates a form of appetite or mood in which the organism becomes aware of its own state

(1) Merleau-Ponty (1942) op.cit. p. 39.
(2) Lorenz (1977) op.cit. p. 59.

of being. This leads to appetitive behaviour to find the stimulus situation which will enable the appetite to be satisfied by a consummatory performance. The consummatory performance gives the animal satisfaction, and in this way is a consummatory stimuli.

The three elements involved in such behaviour patterns can facilitate the formation of hierarchical systems. In these, the appetitive behaviour leads to a stimulus situation which releases a different form of appetitive behaviour and so on prior to the final consummatory performance. Thus a falcon in searching for a flock of starlings initiates the manoeuvre which will isolate one of them. Only after this is the final behaviour pattern of killing and eating initiated. In this process which takes the animal from a more general and accessible situation to a more specialized one, there are a definite number of releasing mechanisms with corresponding fixed motor patterns which can be precisely described. (1) Since new information is acquired with each successive releasing mechanism, such systems of behaviour can be much more flexible than where simple behaviour patterns are concerned. This flexibility is further increased if there is an ability to leave out links in the chain.

The idea of stimuli triggering releasing mechanisms which set in motion a fixed motor pattern should not be interpreted as a mechanical response to the environment. It was pointed out in the general introduction to animal behaviour that the stimuli to which the animal responds are not a given of the environment but are defined as indications by the organism in its interaction with the environment. This means that an animal can experience an identical situation as defined from the point of view of the

(1) Ibid., p. 60.

environment and experience different stimuli. An example of this occurs with some spiders. (1) The female spider first sees a male as a potential mating partner and responds with the appropriate behaviour. But after copulating, the male is only seen as prey and is responded to by being eaten. In contrast the male never sees the female as anything but a female of its own species and so only offers weak resistance. More common examples of differing ways of experiencing the world occur where animals change during the year or develop through different stages throughout their lives. The first type is exemplified by some birds which migrate together and experience an attraction devoid of hostility for other birds of their own species. This enables the birds to fly in flocks. However when the mating season approaches, the male birds find one another increasingly obnoxious. Eventually a territory is established, and an individual will attack any other male bird entering its territory. In the first situation the sight of the other birds acted as an indication to which the bird responded with the pattern of action associated with being part of a flock, while in the second situation, the sight of the same birds acted as an indication triggering the fixed pattern of action associated with aggression.

This ability to react differently in the same basic situation allows for a high degree of flexibility in the animal's behaviour. For instance male birds which normally never feed the young will start to do so in the absence of the female. (2) The honey bee also illustrates this flexibility. In the hives of the honey bee there is a rigid division of labour and each

(1) von Uexkull (1926) op.cit. p. 170.
(2) Arthur Koestler THE GHOST IN THE MACHINE (1967) Pan Books, London, 1975., p. 107.

task is filled by worker bees at a different stage of their lives. To begin with the young bees clean the hive, next they feed the older larvae, then the younger larvae who need an additional diet. After this they work at building the cells, and then graduate to guarding the entrance of the hive. Finally they become foragers which they continue to be for the rest of their lives. All these forms of behaviour involve fixed action patterns. But the bees are even more flexible than this development would indicate. If all the bees of one age group are removed from the hive, then the others will take their place. Thus if all the foragers are removed from the nest, six day old bees will fly out and forage even though these normally feed the larvae and do not graduate to foraging until they are at least twenty days old. And if all the building workers are removed, then older bees will revert to their former tasks, regenerating their wax glands in the process. Such animals cannot be regarded as responding mechanically to the environment.

(1) loc.cit.

INSTINCT AND LEARNING

There is a strong tendency among reductionists to think of the nature of the animal's response to the world as being instinctual and as such determined by heredity. The existence of apparently intelligent behaviour can then be ascribed to accidental mutations which have resulted in forms of behaviour which enable the organism to survive. This tendency has been developed to its most extreme form by some of the socio-biologists. There can be no doubting that much of the understanding and the ability to act of animals is instinctive. However in this section I will try to show that it is necessary to give a major place to the efforts of individuals to adapt to their environment if the evolution of instinctive behaviour is to be understood. I will then go on to show that much of animal behaviour is not instinctive at all but is learned by the efforts of individuals to master their situation in the world.

It was pointed out in an earlier section that evolutionary theory cannot be formulated in reductionist terms as simply an accumulation of successful mutant genes. Where sexual reproduction is involved the individual genotype must be seen as part of a gene population in which new genotypes are arrived at not so much by gene mutations but by recombinations of genes. And it is impossible to substitute the genotype for the phenotype in evolutionary theory. It is the phenotype which is modified by the environment and which is actively striving to come to terms with its environment that survives or fails to survive to reproduce itself. Furthermore the environment within which any individual must survive is an environment composed of other phenotypes.

The implications of the complex relationship between the genotype and the phenotype are that instincts, being phenotypic, cannot be thought of as innate. Since the phenotype is the outcome of the interaction between the environment and the workings of heredity, instinctive behaviour must be seen as being partly formed by the environment. Where such modifications are favourable, the gene population of the species will accumulate those genes which facilitate such modifications, and as these become more concentrated in the population there will be a tendency for animals to develop with the new instincts. That is, instincts can evolve by genetic assimilation as can other features of the organism.

These instincts will not develop in an atomistic, cumulative fashion. The chreodic nature of the organism's development makes it possible for new developments to take the form of association and integration of instinctive schemata into higher levels. An example illustrating this has been described by Piaget:

> ...the edible snail Helix Pomatia L. lays its eggs in the ground a few centimetres below the surface. Not having much intelligence, it is doubtless incapable of forseeing the advantages of behaving in this way; so we cannot point to any anticipation in what it does. However, (a) it takes shelter from the sun and cold beneath stones, etc.; (b) it is capable of generalizing this protection schema in times of intense cold to the point where it will even bury itself in winter; (c) it has a tendency, no doubt hereditary, to hibernation, and shuts itself up into its shell, blocking the entrance with some epiphregmatic secretion (accumulated mucous); (d) moreover, it lays eggs, and one can well imagine that it will never confuse them with any excretion, so that, however rudimentary its perceptions may be (proprioceptive as well as exteroceptive), it takes these eggs into its sphere of conservation as soon as it lays them. Thus the tendency to lay eggs below the ground could be seen as the result of coordination or assimilation of the laying schema into the schema for self-protection or sheltering in the ground. (1)

Such development of instinctive schemata by means of genetic assimilation

(1) Jean Piaget BIOLOGY AND KNOWLEDGE: AN ESSAY ON THE RELATIONS BETWEEN ORGANIC REGULATIONS AND COGNITIVE PROCESSES (1967) Uni. of Chicago Press, Chicago 1971, p. 240.

represents a pre-individual or trans-individual form of species learning. However even in the lowest forms of organisms such pre-individual learning tends to be associated with at least some capacity for individual learning, and it is this capacity which can account for the elaborate developments of trans-individual learning. Individual learning involves a form of accommodation of the organism to the environment by an adaptive modification of its inner order. This involves a constraint on the type of changes produced in the organism affecting its action or cognition so that only those changes which improve the ability to realize its ends are produced. Such constraints can involve the limitation of such changes to a certain number of fixed modifications or it can involve a more general constraint so that entirely new modifications are likely to be adaptive. Animals having this capability are also likely to be constrained to put themselves into positions where such adaptive modifications are likely to take place. That is, they are likely to strive to learn. At a higher level still, the organism must be seen as able to evaluate types of modifications, rejecting those which prove unsuitable and accepting those which are adaptive. Individual learning occurs very low down on the evolutionary scale. For instance if paramacia are put in water half in light and half in darkness so that the light end is warmer than the dark end, they will tend to congregate at the dark end even after the temperature has been evened out though they originally manifested no such preference. (1) And stylonichia, another protozoa can be taught to crawl only on a smooth surface by fitting rough surfaces with an electric current. (2) The form of learning in which

(1) Ibid., p. 252.
(2) Ibid., p. 252f.

modifications are likely to be beneficial can be expected where animals with fixed motor patterns are characterized by an appetite. As this appetite fails to be satisfied by the normal stimuli, the animal becomes increasingly likely to respond to other than the usual stimuli. This is in effect searching behaviour on the part of the animal and the stimuli most likely to be effective are those with some similarity to the normal. And where consummatory stimuli are involved the animal is able to judge any new response. Where organisms have some capacity to learn the striving of the organism to adapt over and above its instinctual ability will result in improved chances of survival where appropriate learning is achieved. It can be conjectured that the accumulation of genes within the population which facilitates such learning will result in the new learning becoming instinctual by genetic assimilation. Thus the evolution of instinctual behaviour cannot be regarded as the mechanical survival of the best adapted programmes of behaviour but must be seen as the product of complex adaptive processes involving the striving to learn by the animals involved. With greater capacity for individual learning there can be expected to be a greater potential for the elaboration of instincts.

Trans-individual learning facilitated by the capacities of individual organisms to learn can then account for the elaborate developments which have taken place in the evolution of instincts. When such adaptations are seen to be taking place to an environment composed of other animals themselves developing increasingly elaborate instinctual systems it becomes comprhensible how ecosystems have developed involving complex interdependence of instincts between the animals of both the same and of different species.

However, apart from the development of instinctual learning, with the increasing complexity of the environment the capacity to learn how to perceive and how to act becomes increasingly important in its own right. The most elementary forms of learning are quite simple, involving nothing more than the refinement of instinctive abilities, but with the gradual evolution of the capacity for individual learning at the expense of instinct, animals have come to live in open worlds in which the manner of perceiving the world and acting within it are almost entirely the result of learning.

Chickens illustrate learning which is nothing more than the refining of instinctive behaviour patterns. These animals know instinctively how to peck, but after practice reduce the scatter of their movements. On the side of cognitive ability animals with an instinctive ability to perceive some phenomena become sensitised to this after the first successful act of perception. The animal is then able to respond more quickly to this stimulus.

More complex is the process of habituation by which a stimulus loses its effectiveness on second appearance. This is more than simple desensitisation since the effect is due to the central nervous system. Slight changes are thus able to elicit the full response even in cases where the change involved is a reduction in the intensity of the stimulus. This means that the organism has learnt to discriminate a very specific stimulus situation to which alone it no longer responds. An example illustrating this is the hydra's habituation to flowing water within which it leaves its arms extended, though its normal response to movement is a contracting of its arms. Such habituation involves the linking of the instinctive releasing

(1) Lorenz (1977) op.cit. p. 71.

mechanism to a highly complex form of perception. Unlike the cases where motor patterns and perception are improved upon, this involves a form of association in which new relations are established between nerve processes which normally function independently.

Association in this sense is also involved in the process of building up a Gestalt. A greylag gosling responds to anything that moves when it has just hatched but soon only responds to that to which it originally perceived as moving. This means that it has become habituated to all the other elements of the moving thing to which it first responded, and requires all of these to elicit the original response. In this way it can discriminate its parents from other geese. This form of permanent fixation is called 'imprinting'. (1)

Another learning phenomena is that of trauma. Here a powerful stimulus which elicits an escape response of maximum intensity, produces sensitisation to the total stimulus situation. In such circumstances an animal will remain permanently fearful of anything associated with the traumatic situation. Since this is associated with sensitisation, it occurs low on the evolutionary scale, and flatworms which always move away from the light once they have escaped from a situation in bright light, manifest trauma. (2)

A new level is reached when the organism becomes able to learn from its mistakes, thus acquiring an understanding of the world through feedback. This form of learning has evolved from the fixed motor patterns involving

(1) Ibid., p. 78.
(2) Ibid., p. 77.

appetitive behaviour discussed earlier, and is present in insects, crustaceans, arachnids, cephalopods and vertebrates. For such learning to take place the behaviour pattern which initiates action must be open to modification. An adaptive modification is essentially the memory of the organism. But to be able to modify the behaviour pattern through feedback from experience, the organism must have some reliable means of knowing if it has made a good or a bad response. It is here that the consummatory stimulus becomes important and is built on. Where the appetite is satisfied by a particular response, this type of response is encouraged, while failure leads to discouragement. Appetite is further supplemented by such sensations as pain and nausea. These allow the animal to evaluate the success of its responses.

The close association of learning by trial and error and instinctive behaviour patterns is exemplified in the jackdaw's building of a nest. (1) Each of the behaviour patterns associated with nest building, and the sequence with which they must be performed is known instinctively by the jackdaw. But what material to use is not. When the urge to build is first aroused, jackdaws collect the most inappropriate objects, such as bits of ice and the broken ends of light bulbs, as building material. But in building the nest the instinctive behaviour pattern of pushing the material downwards and sideways against the base of the nest or against that part which has already been built does not lead to the satisfying experience of the material becoming firmly lodged as would a twig. This leads to discouragement from using anything but the right material. On

(1) Ibid., p. 91f.

the other hand the satisfaction attained from using the right material encourages its continued use.

Such learning cannot be understood in terms of the stimulus response model of the behaviourists. To understand such a learning process it is necessary to understand the whole context within which it takes place and is associated with an instinctual perceptual ability which enables the animal to judge what is a satisfactory response. What will count as encouraging or discouraging experience which enables the animal to make such judgements cannot be formulated in advance of the study of the animal in terms of such universal statements as 'reinforcement is the satisfaction of tissue needs or the reduction of tension.' The discouragement can be pain from touching something hot, or nausea from eating the wrong food, while the encouragement can be the satisfaction of a consummatory stimulus or in some instances, aesthetic appreciation as is evident in the process by which song birds learn their songs and bower birds build their display platforms. (1) Animals live in much more colourful worlds than reductionist psychologists would allow, and it is necessary to understand these worlds to understand the animals.

Beyond trial and error learning there is learning which develops from the ability of animals to perceive the world as spatially ordered. This form of perception is present in most vertebrates and may also be present in lower animals. Apart from animals whose spatial conception of the world is built up through echolocation, orientational information which enables the animal to spatialise its perceptual field derives either from parallactic displacement of the retinal image of individual objects brought about by

(1) Thorpe (1974), p. 204ff.

the individual's own movements, or by binocular vision. Nearly all binocular vertebrates are capable of focussing both eyes, though in many animals it is only of importance in the final stages of stalking prey. (1) Binocular vision is characteristically associated with intelligence, since locomotion and location do not coincide as they do with parallactic displacement. This means that the animal remains stationary while it builds up an understanding of its surroundings, then on the basis of this, acts in a purposeful way. It acts after deliberation, that is, deliberately. The ability to see the world spatially then leads to the ability to learn by means of perceptual synthesis. This is evident in latent learning and in the process by which the animal displays insight.

In latent learning the animal develops a general understanding of its environment through exploratory behaviour without any rewards being given. Thus when rats are allowed to run around in a maze in which there is nothing which counts as a reward, they are able to go straight to a place where food has been shown to them from any point in the maze. (2) This indicates that the rat has been able to develop a general conception of spatial relations in the maze. Such latent learning is also evident in hunting wasps and bees. (3) When a bee hive is shifted to a new location, foragers circle around the new environment to get an understanding of the place and of the hive within it. A particularly impressive example of latent learning is displayed by the Gobiid fish which inhabit

(1) Lorenz (1977) op.cit. p. 12.
(2) Thorpe (1974) op.cit. p. 172.
(3) Ibid., p. 175ff.

tidal pools. These fish swim over the area in which they live at high tide, then at low tide are able to jump from one tidal pool to another without danger of landing on dry land. (1)

This form of learning has been described as the development of a 'cognitive map' of the environment. However this implies that the animal has some sort of representation of the world which is hardly likely. A better way to describe what takes place would be to say that the animal builds up a 'world design'. The notion of world design does not imply a representation but that the animal is able to perceive its position within a context transcending its immediate situation. The world is then experienced in terms of the animal's possibilities for embodied action. Its spatialised mode of being-in-the-world then accords with the description of space in relation to the body given by Merleau-Ponty:

> Each perceived position has a meaning only as integrated into a framework of space which includes not only a sensible sector, actually perceived, but also a 'virtual space' of which the sensible sector is only a momentary aspect. (2)

Insight develops out of the tendency to size up a situation before action. However more is involved than simply working out the spatial relations involved in the field of perception as with binocular vision. The animal is able to reorganize its experience to reveal new possibilities of action. Such insight has been observed in the behaviour of chimpanzees by Kohler. (3)

(1) Ibid., p. 180.
(2) Merleau-Ponty (1942) p. 90.
(3) Thorpe (1974) op.cit. p. 180.

The chimpanzees were in a room with a banana hanging from the ceiling out of reach with a number of wooden boxes lying around. Eventually an animal was seen to take one box and place it under the banana. Since this was not adequate, the chimpanzee sized up the situation looking from the first box to the others, and then stacked a box on top of the first and so on until it could reach the banana. In such situations the effort which goes into working out the solution and the elation produced when the animal hits on the right solution are clearly evident. (1)

Such insightful behaviour has also been observed among wasps. (2) The clay nest of a wasp was damaged so that it could only be repaired from the inside. The wasp always worked from the outside and was observed trying to mend the nest in this way for two hours until night came and it was too dark. Next morning the wasp flew straight to the nest, inspected it, and then set about repairing it from the inside.

To be able to think in this way the animal must be able to retain in memory each of the elements of the situation examined which are later used in the perceptual reorganization constituting the insight. Having achieved an insight, this becomes consolidated into a learned pattern of behaviour and is generalized to new situations even to the extent of interfering with animal's ability to solve new problems.

So far I have not dealt to any great extent with the learning of motor behaviour. This is because adaptive modifications of behaviour occur

(1) Lorenz (1977) op.cit. p. 128.
(2) Koestler (1967) op.cit. p. 106.

on the receptor side at a far lower level of development than on the motor side. (1) The reason for this is that action is dominated by fixed motor patterns and apart from facilitation which occurs with practice, these are difficult to adapt. What is required in order to learn behaviour patterns is the ability to act in accordance with the impulses generated by what understanding the animal has of its situation. Without the ability to act in accordance with improved orientation and insight into the environment, such understanding would be useless. Action directed in accordance with the animal's understanding of the situation is voluntary behaviour.

The ability to act voluntarily is based on two components: the ability to inhibit or deinhibit fixed motor patterns and the ability to steer a coordinated motor pattern by a superimposed movement dependent on external stimuli. The simplest form of voluntary behaviour involving the inhibition of fixed motor patterns occurs when an animal is able to leave out a step in a hierarchical instinct system. Most fixed motor behaviour patterns are associated with some superimposed reaction system dependent on immediate stimuli which enables the pattern to be adapted to particular circumstances. The less significance this superimposed system has, the more mechanical is the application of the fixed pattern. The two components of voluntary behaviour are usually both present and are combined in various ways. This can be illustrated by the behaviour of a horse. A horse has little more freedom of action than the ability to inhibit or deinhibit its gaits: walking, trotting, cantering or galloping. It has little ability to adjust its stride

(1) Lorenz (1977) p. 101.

according to the immediate situation. On the other hand a donkey can choose precisely where to step and is thus much better at moving in mountainous country.

In order to be able to make a flexible response, what is most important is the ability to break down the fixed coordination patterns into units which can be separately inhibited or released. The absence of this ability where it is required most clearly reveals the difference between voluntary and involuntary behaviour. For example a greylag goose which had learnt to climb down a flight of stairs was incapable of interposing an extra step when it was required. (1) As it moved down the stairs each step brought it nearer to the back of the step below until it could not reach the bottom of the next step. It then brought its leg back, but instead of taking a short step it tried again and again to put its foot on the next step. Finally it used its wings to move forward, then repeated the process. The problem was that each step was a fixed motor pattern which could not be broken down and thus modified, despite the fact that the goose understood its situation.

A further example of inflexibility revealing the limits of will in the goose is the situation where it wants to fly. Small birds take off and land innumerable times a day. Whenever they feel that such action is necessary they can instantly start flying. However except when a goose is migrating it usually only flies twice a day, in the morning and in the evening. If a situation arises in which it wants to fly at

(1) Ibid., p. 138.

some other time it has to go through an elaborate procedure to get itself into the mood, and in this it does not always succeed. (1) To be voluntary, a behaviour pattern should be able to be activated at any time.

Learning new motor behaviour involves putting together voluntarily a sequence of unit motor components in such a way that they become linked to form a new motor pattern. Such a new motor pattern is a skill. The smaller and simpler the fixed motor patterns under voluntary control, the greater the possibility for developing new skills. However even in humans the smallest units are of a considerable size.

When an animal begins to learn a new skill it is very awkward because each motor unit is under voluntary control. For instance a mouse in an elevated maze begins by advancing very slowly. (2) As it gradually manages to coordinate the different movements, it accelerates its actions. This occurs over larger and larger distances until eventually all the sections in which the behaviour of the mouse has been coordinated, join up. Even at this stage there is some hesitancy at the junctions which disappears only very slowly. When this is complete the mouse can give a fully skilled response, but with such a perfected performance, each unit of the skill is no longer under voluntary control. Only the implementation of the whole skilled response and the steering of it according to particular contingencies is under such control.

When a skill has been learnt it has the same characteristics as an instinctive motor pattern. There is the same central coordination whereby

(1) Ibid., p. 141.
(2) Ibid., p. 101f.

the rhythms of the various basic actions which make up the whole motor pattern influence each other to produce a harmony between them by bringing them into a phased relationship. (1) And like an instinctual motor pattern, once a skill has been learnt it is almost impossible to modify it. Another more surprising feature of skills is that once they have been acquired there is a persistent urge to use and improve them corresponding to the appetite associated with instinctive motor patterns. Also, as in fixed motor patterns, skilled movements are not subject to response delays, being automatically motivated with their own appetites. This accounts for the fluidity attained by skills.

With the capacity for learning and the ability to act voluntarily, the way is clear for the emergence of a different order of development. An animal whose orientation to the world and whose behaviour patterns are entirely instinctual lives in a closed world in which everything has a fixed meaning for the animal. Where learning is possible, this is no longer the case, and the way the world is experienced and responded to changes. A new level of ordering is reached where animals develop specific appetites in the form of curiosity and the impulse to play which leads to systematic exploration of the world and of the animals' own motor potentialities. Animals characterized by such behaviour live in an open world in which the building up of an organism-environment relationship or world design is an intrinsic part of the developmental process. This enables the species to adapt to diverse environments throughout the world.

The difference between world closedness and world openness is exemplified by the difference between the great crested grebe and the raven. The

(1) Ibid., p. 105.

way the great crested grebe perceives the world is almost entirely instinctive as are its motor patterns. (1) It is born with almost all the understanding of its environment that it will ever have. This means that the bird has a species specific world. For this reason the great crested grebe is found in only one environment and all of them behave in the same way.

The raven on the other hand when it first hatches understands very little about its environment or about itself. (2) However when it is young it displays an intense curiosity about anything novel, and will investigate it, using all the instinctive behaviour patterns at its disposal. In this way the animal finds out whether the object is dangerous or is a potential source of food and about its own potentialities in relation to the object. In this way the object is made familiar and its characteristics are understood. Although there appears to be no learning involved in this, later behaviour of the raven belies this impression. An understanding of the object has been built into the raven's world design and this is reflected in its behaviour when the need arises. This is an example of latent learning as discussed earlier. The consequence of this ability to build up a world-design is that ravens have adapted to diverse environments, adopting different behaviour patterns in each. In North America it lives like a vulture, in the North Sea like a skua, and in central Europe like a crow. Animals with open worlds are specialists in non-specialisation and so are characteristically cosmopolitan.

With animals characterized by world openness there begins to arise the

(1) Konrad Lorenz STUDIES IN ANIMAL AND HUMAN BEHAVIOUR Vol.2, tr. Robert Martin, Harvard Uni. Press, Cambridge Mass. 1971, p. 225.
(2) Ibid., p. 226f.

ability to perceive the world as consisting of objects. This means that the animal is capable of constituting the flux of the world into enduring centres of constancy apart from immediate projects of action. This develops from the method of investigation of the environment where a situation is examined from all directions and in all behavioural situations. This then paves the way for animals to perceive themselves as an object to be explored. Jane van Lawick-Goodall suggests that chimpanzees are capable of such self-objectification. (1)

Finally we come to the last types of learning, those associated with the ability to learn from others. These are the ability to learn by imitation and the closely related ability to learn the tradition of the community. Imitation has its prerequisite in voluntary behaviour. However little is known about what is involved in the actual process of imitating something. (2) Imitation in the strict sense only occurs in birds who learn their songs from other members of the species and in humans. Simians have little ability in this direction.

Tradition involves the ability to hand on from generation to generation what has been learnt. The simplest form of this occurs through the instinctive escape response of a member of a species to the warning cry of another member of the species, and the trauma produced by this leading to the association of the whole situation with the escape response. This is exemplified in the jackdaw where young jackdaws always associate closely with their elders who emit a rasping, rattling sound when a

(1) Jane van Lawick-Goodall "The Chimpanzee" in THE QUEST FOR MAN ed. Vanne Goodall, Phaidon, London, 1975, p. 162.
(2) Lorenz (1977) op.cit. p. 152.

predator is seen. (1) This implants a fear of the predator in the young jackdaw which lasts for the rest of its life. It then also emits the rasping sound on sighting the predator and in this way passes on the fear of the predator to its offspring.

At a more advanced level, tradition is handed on through some form of imitation. This is most evident in the tradition of song birds, with the songs of the same species varying from region to region. Less strict forms of imitation involve animals which simply reenact the behaviour of other members of the group to which the individual belongs. An example of knowledge acquired by a community and becoming part of a tradition on the basis of such reenactment was observed by some Japanese scholars studying a group of monkeys on the island of Koshima. (2) An eighteen month old female found out that sweet potatoes tasted better when they were first washed. Before long a group of young monkeys were following her example. In this way the washing of sweet potatoes became part of the inheritance of the monkey community. Such cultural acquisitions imply the possibility of cultural variation occurring between animals of the same species, a phenomenon noted by Jane van Lawick-Goodall.(3) Thus the final achievement of the ability to learn is the situation in which the animals not only have an open world and build up a world design, but also have the ability to accumulate what is learnt from generation to generation within a community to form a proto-culture.

(1) Ibid., p. 157f.
(2) Serge Moscovici SOCIETY AGAINST NATURE: THE EMERGENCE OF HUMAN SOCIETIES tr. Sacha Rabinovitch, Harvester Press, Hassocks 1976, p. 40.
(3) Jane van Lawick-Goodall (1975) op.cit. p. 150.

ANIMAL COMMUNITIES AND COMMUNICATION

Many animals do not simply exist as individuals within the ecosystem but form into communities. This adds an extra dimension to the process of evolution in that those animals which can form effective social relations survive. The ability to form such relationships generally involves intelligence. This is particularly manifest in the case of communication abilities, and an investigation of these indicates the degree of flexibility, awareness and intentionality involved in animal behaviour.

The simplest form of communication is that between the protozoa of the slime moulds discussed in a previous section. Individual protozoa communicate by means of the chemical acrasin which eventually leads the amoeba to stream towards the central producer to form themselves into the characteristic pseudoplasmodium. Between this example and human communication there is an enormous variety of forms involving different sense systems and different degrees of complexity. Signals made by animals communicate the species, sex and age of the animal and whether the animal is in a state of readiness for fighting, mating or fleeing. The mode of signaling is very diverse. Apart from the obvious sounds, visual signals and odours, aquatic insects use surface vibrations to communicate, some groups of fish use electrical signals and other animals use ground or leaf vibrations. Such signaling behaviour often involves complex sequences in which each step is dependent on an appropriate signal from the partner. The two forms of communication which most clearly reveal the complexity and versatility involved are those of bees and chimpanzees, and I will examine the nature of these in some detail.

As is well known through the work of Karl von Frisch, honeybees communicate by dancing.(1) These dances take several forms, but the most important is the waggle dance which is a figure of eight pattern about six times the length of the bee long, usually carried out in total darkness inside the hive on the vertical side of the comb. In one straight section of the pattern the bee waggles its abdomen from side to side about 14 times a second. Information is communicated by the length and direction of the straight waggling portion of the dance. The length and duration of the straight section indicates the distance away that the bee has found food while the angle of the section relative to the vertical indicates the direction relative to the sun. If the source of food located by the bee is directly towards the sun, the waggling part of the dance will be formed by moving directly up towards the top of the comb, if it is directly away from the sun, the waggling run will be straight down, and so on. The duration of the dance indicates the desirability of what has been discovered. Occasionally the dance is carried out on a horizontal surface and then the direction of the dance points directly towards the source of the food. The information conveyed by dancing is then supplemented by odours, either by contact with other bees or through the regurgitation of the contents of the stomach.

There is a fairly complex process of transmission involved in communication by such dancing. The bee doing the communicating must translate the orientation in relation to the sun to an orientation in relation to gravity. But the bees receiving the communication must do more than just translate this back again. Since the dance is performed in total darkness what, the dancing bee is doing must be perceived through the tactile sense organs so that the complex joslings have to be first

(1) Griffin (1976) op.cit. p.19ff.

understood in relation to the force of gravity before such translation can begin.

The dance cannot be regarded as a mechanical response on the part of the bee to having found food since it is performed only when the community of bees needs to be directed towards what the bee has discovered. Thus when food is plentiful, or when odours conveyed from one bee to another are sufficient to direct the new recruits to new food sources, the dance is often not performed. On other occasions the dance can be used to indicate the location of water, resinous material from plants and when a colony is engaged in swarming, the position of a cavity which can be used for a new hive. Nor is there simply a mechanical response to the dance since the bees often do not respond, and more significantly often do so only some time later. This behaviour suggests that when the bee dances it does so with the intention of communicating something, and that this communication is received by being appropriated as knowledge by the other bees on the basis of which they can decide whether or not to act.

Such intentionality in the communication of bees is even more clearly evident when they are searching for a new site for the hive. Scouts bring back information about where there is a good site which they communicate by the normal dance procedure. But then the scouts inspect the sites discovered by the others and if they are better than the site discovered by themselves, they change their dance to indicate the location of the better site. Thus the scout is both a transmitter and a receiver of information and looking for a new site involves a conversation among the bees until a hive site has been decided on as the best of those found. After a complete consensus has been reached a different dance is performed:

a 'buzzing run' on the surface of the swarm. This seems to be an imperative 'Let's go' and is followed by the mass flight of the bees to the new site.

Originally attempts to teach chimpanzees to speak were a failure, and it was concluded from this that language was the qualitative dividing line separating humans from the rest of the animal kingdom. However on the basis of the evidence provided by studies of wild chimpanzees communicating among themselves and of those chimpanzees taught to communicate with sign language rather than with spoken words, this conclusion must be rejected.

Communication among wild chimpanzees was observed by Goodall. (1) She was able to affirm the effectiveness of the gestures and facial expressions by her observations, but found it difficult to analyse these in detail. The conclusions she reached by watching chimpanzees in the wild have been further supported by Menzel who showed how captive chimpanzees were able to communicate complex information by such means, though he too was unable to decipher the meaning of the expressive movements used. (2) To do this, Menzel confined a number of chimpanzees who were familiar with each other in small cages at the edge of a large enclosure. One chimpanzee was then shown some food within the enclosure and put back in his cage while the other chimpanzees were released. The caged chimpanzee was able to convey to the other chimpanzees the location of the food rapidly and without difficulty. Furthermore he occasionally withheld information from the others, or attempted to mislead them, indicating the prevarication is not an exclusively human ability as has often been thought. (3)

(1) Griffin (1976) op.cit. p. 19.
(2) loc.cit.
(3) Ibid., p. 45.

A breakthrough has been made in the study of the chimpanzee's ability to communicate by the Gardeners who taught a young female, Washoe, to communicate by the sign language of deaf and dumb people. (1) In four years she learnt 130 signs and invented some of her own, and was able to communicate with her human teachers by this means, combining them in a meaningful way and using them in new situations. For instance she used the sign for 'open' which she had originally learnt to use in relation to doors to request the opening of books, boxes and draws. She was able to communicate such sentiments as: 'Please take me into the garden to see the flowers' and on being told in sign language that there was a big dog outside who ate little chimps, she opened her eyes wide. When asked 'Does Washoe want to go outside?' she shook her head emphatically to indicate she did not. (2) Another chimpanzee, Sarah, was able to learn abstract concepts by means of plastic symbols. Taught that 'yellow is a colour' and that 'blue is a colour' she was able to reason that 'green is a colour'. (3) Following the Gardener's lead, Fouts, Chown and Goodwin taught a male chimpanzee sign language. At three it had acquired 70 reliable signs and several spoken words and phrases and at this stage they were able to teach him new signs corresponding to familiar objects using sequences of signs corresponding to ten spoken words without the objects being present. Other experiments by Fouts and others have demonstrated that chimpanzees are able to communicate with each other by means of the signs taught to them.

These abilities of chimpanzees indicates that they do more than merely associate signs with objects but are able to think conceptually, at least

(1) Ibid., p. 16f.
(2) Jane van Lawick-Goodall (1975) op.cit. p. 161,
(3) loc.cit.

to some extent. Further evidence for this is provided by experiments conducted by Rohles and Devine. (1) In these, it was shown that a chimpanzee could be trained to select the middle object from different length rows. Where the spacing was regular they were able to perform this feat when 17 objects were present, and with 11 objects when they were irregularly and asymmetrically arranged. This clearly shows that chimpanzees have the ability to use the concept 'middleness' in a way which is equivalent to the ability of a four to six year old child.

In the use of language the most significant difference between a chimpanzee and a child is that the chimpanzee pays less attention to word order. They do not develop the grammar or the depth structures described by such linguists as Chomsky. Apart from this the difference is only a matter of degree.

The conclusion that must be reached from the above examples of the animal use of language is that language is not an exclusive characteristic of humans but is present throughout the animal kingdom in various degrees. Furthermore it is present in such a high degree in some animals, that it must be concluded thatanthropomorphic characteristics such as understanding, awareness, intention, deceitfulness and so on are not out of place in describing their behaviour.

(1) Griffin (1976) op.cit. p. 43.

CONSCIOUSNESS AND THE CENTRAL NERVOUS SYSTEM

It was pointed out earlier that living beings have to be understood primarily as functioning wholes, with any physiological analysis having to be seen in relation to this whole. This gives primacy of place in biology to ethology. Drawing on the studies of the ethologists I have described the behaviour characteristic of animals on various levels of the evolutionary scale. From this it must be concluded that the lowest form of animals are subjects which are aware in some degree of their surroundings. Their environment is a world for them. At higher levels of the evolutionary scale, the activity of animals is characterized by such a high degree of awareness of their environment, of themselves and their potentialities and of other beings with which they communicate, that these animals must be designated as conscious. The word 'conscious' derives from the Latin 'cum sciens' where cum means 'with' or 'in connection with' and sciens means 'knowing' or 'intentionally'. This linking of 'knowing' and 'intentionally' suggests that intention presupposes knowledge. Thus to say that an animal is conscious is to say that it behaves with intention, this being based on the animal's knowledge of the world.

The unity of single celled organisms which enables them to act as integrated wholes and by virtue of which they can be ascribed some degree of subjectivity derives from the unified structure of the whole. In the case of multicellular animals, particularly where a high level of awareness is present, the integration is provided by a specialized organ of regulation, the central nervous system. The question now arises: What is the relationship between consciousness and the central nervous system?

The import of the ontological position which I have been defending is that the correct solution to the problem is some form of emergent theory.

In the previous two sections I have tried to show that awareness and subjectivity can be understood as emergent phenomena when the organism is seen as a hierarchy of orders in interaction with its environment. In this scheme of things, consciousness must be seen as simply a development of awareness, and so can only be understood in relation to the total organism. The central nervous system must then be seen as only a sub-process required for the development of such a high level of awareness. However this view of emergence differs from that of its most important modern proponent, the neuro-physiologist R.W. Sperry. For this reason I will examine Sperry's position and then attempt to justify my own interpretation of the emergence of consciousness.

Sperry describes his position in this way:

> ...conscious awareness, in the present view, is interpreted to be a dynamic emergent property of cerebral excitation. As such, conscious experience becomes inseparably tied to the material brain process with all its structural and physiological constraints. At the same time the conscious properties of brain excitation are conceived to be something distinct and special in their own right. They are "different from and more than" the collected sum of the neurophysico-chemical events out of which they are built. (1).

He goes on to point out that causality of conscious properties derives from the universal power of any system as a whole over its parts. Thus:

> When it is inferred that conscious forces shape the flow and pattern of cerebral excitation, it is not meant to imply that the properties of consciousness intervene, interfere, or in any way disrupt the physiology of the brain cell activation. The accepted biophysical laws for the generation and transmission of nerve impulses, for example, are in no way violated...[But] Although the mental properties in brain activity, as here conceived, do not directly intervene in neuronal physiology, they do <u>supervene</u>. This comes about as a result

(1) R.W. Sperry "A Modified Concept of Consciousness" in PSYCHOLOGICAL REVIEW 1969, Vol. 76, p. 533.

> of higher level cerebral interactions that involve integration between large processes and whole patterns of activity. In the dynamics of these higher level interactions, the more molar conscious properties are seen to supersede the more elemental physio-chemical forces, just as the properties of the molecular supersede nuclear forces in chemical interactions. (1)

It can be seen from these quotes that while Sperry is working with basically the same view as to the nature of emergence and causality as my own, he sees consciousness as an emergent feature of the brain itself rather than of the total organism. This leads him to the view that experiences are produced by the brain to represent the external world. In a later paper he wrote:

> The neural mechanisms for conscious experience are not just more complex, they are specifically structured on an operational, functional basis to create particular sensations, percepts, and feelings, and to provide a rapid representation of external reality. (2)

These conscious experiences are thought to play a causal role in the functioning of the brain which leads to the conclusion that:

> A full causal account of brain function is thus not possible in purely neurophysiological or biophysical terms that do not include these higher, yet-to-be-described mental processes with their subjective pattern properties different from the neural event per se. (3)

But these ideas are inconsistent with the conception of a supervening form of causality on which Sperry is attempting to justify his position. It is clear that if conscious experiences which represent the external world are conceived of as being produced by the brain, while at the same time

(1) Ibid., p. 533f.
(2) R.W. Sperry "An Objective Approach to Subjective Experience" in PSYCHOLOGICAL REVIEW Vol. 77, No. 6, 1970, p. 589.
(3) R.W. Sperry, "Changing Concepts of Consciousness and Free Will" in PERSPECTIVES IN BIOLOGY AND MEDICINE Autumn, 1976, p. 13.

having a causal effect in the functioning of the brain, then these experiences must be seen as intervening in neural physiology. Conscious experience and neural events must be seen on the same level. Furthermore, such an interpretation makes it impossible to provide any reason why experience should be so radically different from other brain processes. It is for this reason that emergentism loses its plausibility. Thus the editors of CONSCIOUSNESS AND THE BRAIN introduced a paper by Sperry with the following reservations:

> Sperry's emergentism is radical indeed. Although one might be prepared to accept the emergence of water from the combination of hydrogen and oxygen atoms, it is a much stronger claim that mind emerges from brain, since the ontologic status of water and atoms of hydrogen and oxygen on the other are comparable, whereas the ontological status of mind is far different from that of brain. To pursue this point, if anything emerges from the neural parts, it would be an "emergent neural organization," just as an internal-combustion engine emerges from the interrelating of its component parts on the assembly line. But the emergent engine and the emergent neural organisation appear to have "physical" properties which are different from "mental" properties. It might be argued that the question of the relationship between emergent neural organization and emergent mental phenomena is simply to reiterate the mind-brain problem all over again in a sophisticated version. (1)

The way I have conceived of consciousness as an emergent phenomenon obviates both these problems. In my version of process philosophy the whole must be regarded as more than the sum of the parts because the parts are constrained by the environment provided by the whole resulting in emergent powers of the whole. The primary focus of interest then rests on the powers of the whole manifest in its interaction with other phenomena, the principles involved in such interactions supervening over the principles involved in the interaction between the parts of the whole. The problem with Sperry's position is that he has not considered the holistic

(1) Gordon G. Globus, Grover Maxwell and Irwin Savodnik CONSCIOUSNESS AND THE BRAIN, Plenum Press, N.Y. 1976, p. 162.

features of the brain as interacting with anything else, and so cannot think of its causal efficacy as being anything other than intervention in neural physiological processes. With my approach, the brain is understood as functioning within the context of the whole organism in constant interaction with its environment so that consciousness can be seen to be the higher level of ordering principles controlling this interaction.

Following from this, conscious phenomena must necessarily be thought of as radically different from simple neurological processes since what we are dealing with is the process by which the environment of the organism comes to be constituted as a world for it. The unique feature of living beings which requires that they be seen as subjects-in-the-world is that they are neither simply a hierarchy or levels of ordering with each level being contained by the higher level as in a crystal of molecules, nor simply an open system like a thunderstorm where the ordering of the whole is nothing over and above that which is involved in the exchange with the environment, but a hierarchically ordered open system in which the process of ordering the exchange of matter and energy with the environment and the movements within it is sustained by processes which transcend the organism's immediate exchange with its environment. And it is only in terms of such a transcendent ordering of exchanges with the environment that the organism comes to constitute itself as a subject standing over against a world, and in relation to which consciousness can be understood. The uniqueness of this requires that consciousness be seen as different from other types of ordering.

That consciousness should be understood in terms of such interaction of the organism with the environment is supported by evidence deriving from experiments with sensory deprivation. (1) The experiences of the people involved in these experiments became progressively disorganised, with hallucinations and perceptual distortion. On emergence from the stimulus deprived situation they were found to be greatly disoriented seeing changing colours and being unable to see the shapes of objects clearly or the shapes of objects as fixed. This reveals how the cessation of the interaction of the organism with its environment results in a disintegration of consciousness thus indicating that consciousness is not independent of such interaction.

Sperry based his position on his observations of people who had had operations to divide the hemispheres of the brain from each other. (2) In such patients, careful testing showed that they had a split consciousness in which those abilities and inclinations controlled by one hemisphere were unaffected by those controlled by the other to such an extent that such a person could be trying to do two opposing things at once. Such people could identify something with the left hand and communicate what this was with the left hand yet be unable to say or write with the right hand what the left hand knew. Sperry thus concluded that each hemisphere must be conscious within itself, requiring the attribution of consciousness to the brain rather than to the total person. However each part of the brain is still intrinsically related to the body and works in the process of interaction of the whole person with the environment. In the light of this it would be more correct to say that split brain patients have an unintegrated consciousness rather than that the hemispheres are conscious

(1) Symposium on Sensory Deprivation THE JOURNAL OF NERVOUS AND MENTAL DISEASES, No. 1, Jan, 1961.
(2) R.W. Sperry "Lateral Specialization in the Surgically Separated Hemispheres" in THE NEUROSCIENCES: THIRD STUDY PROGRAM ed. Francis O. Schmitt and Frederic G. Worder M.I.T. Press, Cambridge Mass. 1974, p. 7ff.

in themselves. And what the observations reveal is the extent to which consciousness is unified in the normal person and how the brain normally functions as an integrated whole.

Seeing consciousness in relation to the body as a whole in its interaction with the environment involves a different characterization of the nature of experience than that implied by Sperry. Subjective experience is not seen as a representation of the world but as being the experience by the organism of the world constituted by it in the process of interaction with its environment. To understand how an animal will act it is necessary to understand it as being in a meaningful situation experienced as dangerous, attractive or whatever to which it responds with intention. Experience is understood here primarily in relation to orientation for action, and things in the world are "objects of action, i.e. things with which something has to be done." (1) As such percepts are indissociable from feelings and sensations are artificial abstractions from the total experience. Organisms do not experience sensations but a meaningful world which calls forth action on their part. If organisms can produce images and manipulate them in the process of thinking as can humans, then these must be thought of as secondary to perception leading to action. This derivative status of representational thought has been shown by Piaget who revealed how representation is based on the 'interiorization' of co-ordinating action schemata through which the child and animals interact with their environment. (2) Representations are symbols which do not simply stand for objects in the world but for the schemata

(1) Lorenz (1977) op.cit. p. 147.
(2) Hans Furth "Piaget's Theory of Knowledge: The Nature of Representation and Interiorization" in PSYCHOLOGICAL REVIEW 75, (1968) pp. 143-154.

by which the objects are constituted as such. This means that these representations are not representations of external reality but are means for thinking about the organism's relation to its environment. The schemata are originally built up in the process of interaction with the environment to enable the child to interact intelligently with the world, and as implied by the sensory deprivation experiments, require continual interaction with the environment for their maintenance. Without this maintenance of the foundations on which the ability to represent rests, coherent representational thought would be impossible.

If it is accepted that the brain is simply the means by which the organism is able to act consciously with its environment, the next question must be: How is it able to perform this function? C.H. Waddington has suggested in opposition to a paper by R.K. Gregory, that the brain's functioning can be understood in terms of chreods and catastrophes as these concepts have been developed mathematically. Gregory attempted to work out how it is that so little sensory information is able to control so much behaviour and proposed that this could be accounted for if it were assumed that the information triggers off models of objects which have been pre-formed in the brain. (1) Objecting to the mechanistic implications of the concept of 'model', Waddington suggested "that the space of brain states is divided into a number of domains, each characterized by a vector field which at any time, is dominated by a particular attractor." (2) In these terms, perception of a visual entity would involve a visual experience falling into a domain, leading it to be attracted to the centre by the attractor controlling the vector field.(3)This would then stabilize the object of perception, enabling

(1) R.L. Gregory "On How So Little Information Controls So Much Behaviour" in C.H. Waddington ed. TOWARDS A THEORETICAL BIOLOGY 2 SKETCHES (1969) op.cit. p. 236-247.
(2) C.H. Waddington "Comments on Gregory", ibid. p. 247.
(3) C.H. Waddington BIOLOGY, PURPOSE AND ETHICS,Clark Uni. Press, Worcester, Mass. 1969 p. 22ff.

the organism to perceive the object under conditions and at an angle never before experienced. In cases of uncertainty leading to a change of mind as to what it is that is being perceived, this would involve the attractor moving to the edge of the field, allowing the field to be captured by a new attractor.

Such a characterization of the functioning of the brain can be justified if the brain is seen as a system of circuits. The activation of such circuits would be self-stabilizing and capable of resonance effects, entrainment and hierarchical ordering so as to be able to affect the functioning of the brain as a whole. This is in fact the picture of brain functioning offered by Sperry. He writes:

> ...the flow and timing of impulse traffic through any brain cell, or even a nucleus of cells in the brain, are governed largely by the over-all encompassing properties of the whole cerebral circuit system, within which the given cells and fibres are incorporated, and also by the relationship of this circuit system to other circuit systems. Furthermore, the dynamic properties of the cerebral system as a whole, and the way in which these properties direct and govern the flow of impulse traffic throughout the system - that is, the general circuit properties of the whole brain - may undergo radical and widespread changes from one moment to the next with just the flick of a cerebral facilitatory "set". This set is a shifting pattern of central excitation that will open or prime one group of circuit pathways with its own special pattern properties, while at the same time closing, repressing, or inhibiting endless other circuit potentialities that might otherwise be open and available for impulse traffic. These changes of "set" are responsible, for example, for such things as a shift in attention, a turn of thought, a change of feeling, or a new insight. (1)

This characterization of the brain can account for a number of other phenomena. The development of the schemata of cognition and action can be thought of as involving the development of new and the integration of old circuits. Since it was discovered that RNA is produced in the

(1) R.W. Sperry "Mind, Brain, and Humanist Values" in NEW VIEWS OF THE NATURE OF MAN ed. John R. Platt, Uni. of Chicago Press, Chicago, 1965, p.79f.

process of learning, it has been suggested by reductionists that this might function as an engram, storing information like a tape recorder. But such a view has been rejected as 'biological nonsense' by Holger Hyden who pointed out that such an account could not explain the quickness of response of organisms. (1) Rather the RNA which forms should be understood as part of the process by which brain cells are differentiated through the production of modulated protein patterns. (2) The uniqueness of this pattern would then determine whether the neuron would respond to an electrical impulse. In this way the specificity of the response would allow each neuron to function as a member of a great number of circuit systems, thus enabling the brain to fix an almost unlimited number of new circuits.

It is also possible to account for the transcendence of the present by the organism allowing for purposeful behaviour. As C.H. Waddington wrote:

> ...if you think of the brain as a system of sets of circuits through which currents are passing, this concept involves both the past and the future, since the loops can control the incoming signals which go into the brain and thus influence the effect they will have on future action. We therefore seem to have, even in the simplest act of perception, both the past and the future incorporated into an active participation with the outside world. (3)

Thus the temporality of being-in-the-world can be explained in physiological terms and since as it has already been pointed out, the spatialisation

(1) Holger Hyden, "Biochemical Approaches to Learning and Memory" in Koestler and Smythies (1969) op.cit. p.89.
(2) Ibid., p. 97.
(3) C.H. Waddington, BIOLOGY, PURPOSE AND ETHICS, op.cit. p. 25.

of the world whereby the world is experienced as a field of potentialities derives from such temporality, the spatiality of being-in-the-world can also be accounted for. The greater the integration of the multiplicity of circuits through entrainment and the emergence of higher and higher levels of hierarchical ordering, the greater would be the temporal transcendence by the organism of its immediate situation and the more cohesive would be its experience of the world.

It can be conjectured how a number of other phenomena might be explained, particularly concerning the relationship between cognition and action. Perception seen as the assimilation of inputs to the brain circuits could deinhibit the circuits which drive the organism to a particular pattern of action. The ability to deliberate requiring some separation of cognitive and action schemata must involve more complex circuits with a hierarchical ordering involving higher level circuits capable of functioning independently of those circuits relating to action. Deliberate action as opposed to the exercise of skills could be seen as the ordered relating of circuits associated with fixed action patterns, while the learning of the skill would involve the fixing of the circuits relating these action patterns through the production of proteins in the cells. Finally thinking of the functioning of the brain in terms of integrated circuits would account for the global nature of the functioning of the brain revealed by the studies of neurophysiologists such as Kurt Goldstein on the effects of brain damage on the thought processes of a person.

While these ideas have not been fully worked out it is evident that consciousness can be accounted for in a way which was impossible when neurophysiologists concentrated on the analysis of the brain into constituents. There is no unbridgeable gap between the brain and consciousness while the brain is understood as being primarily the means by which an organism constitutes its environment as a world to which it reacts accordingly and the brain is seen to function globally as a system of self-stabilizing circuits.

CONCLUSION.

In this chapter I have attempted to show the inadequacies of the attempt to understand life in terms of the ontology of materialism and to show how ideas developed in accordance with process philosophy, while still in the early stages of development, promise to be far more fruitful in the long run. In particular it was shown how it is possible to conceive of organisms as being subjects, aware of their situation and acting purposefully without departing from the basic framework of concepts used to understand the physical world. The various stages leading up to the emergence of the human order were explicated and it was shown how organisms had to be seen as increasingly autonomous both of their environment and of their genetic endowment. At the highest levels it was seen how organisms must be regarded as highly conscious of the world and their actions within it. The role of the central nervous system was then examined and it was shown how this can be understood to make consciousness possible. I have now provided the foundation on which the conception of the human order can be built. This will be the subject of the next three chapters.

CHAPTER VI

THE HUMAN ORDER

> The distinction between man and animal is in one sense only a difference in degree. But the extent of the degree makes all the difference. The Rubicon has been crossed.
>
> Alfred North Whitehead
> MODES OF THOUGHT

In the last chapter it was shown how animals understood in terms of process philosophy could be seen as purposeful, conscious and deliberative subjects. It was seen that many animals are creatures of curiosity which strive to understand their environment, and then act on the basis of this understanding rather than instinctively. They are capable of complex forms of communication, and their communities sustain protocultures. Some animals show signs of aesthetic appreciation and some are able to fashion tools. The ethologists have shown that many of what have been taken to be the defining characteristics of humans are also characteristics of large numbers of animal types. This shows the continuity of humans with their non-human ancestors.

Given an understanding of nature in terms of process philosophy, it therefore becomes possible to see humans as part of nature. They are creative participants in the process of becoming of the world.

As Serge Moscovici wrote:

> Man's single-handed conflict with nature should be seen as a confrontation <u>within</u> nature; society is a crucial component of our vital constitution.

> Man participates with vegetation against animals, with electricity against mechanical power, in a continuous modification of the environment; the principles which unite him to his allies and oppose him to his enemies are precisely those which unite or oppose physical, biological and chemical beings. The bond between man and nature is also a bond between nature and nature...The notion that nature is inhuman and man unnatural is totally invalid. No part of man is or ever was closer than any other to an ever-changing nature.(1)

However humans are not just part of nature. They are more than the sum of their constituents and the effects of their environment. Having shown how reductionist accounts of animal life are inadequate, how animals must be understood as subjects-in-the-world and having described the relationship between the brain and consciousness it is not necessary to deal with these issues again. If animals cannot be understood as stimulus-response mechanisms or in terms of their genes or physiology, then neither can humans. But humans are not only characterized by the achievements of the higher animals referred to earlier. They transcend these levels of order to open up new dimensions of becoming in the world. The human order represents an emergence of new types of processes which must be understood in their own terms.

To fully understand these emergent processes it is necessary to understand the processes from which they emerge. It is necessary to see the emergent features against

(1) Serge Moscovici SOCIETY AGAINST NATURE: THE EMERGENCE OF HUMAN SOCIETIES tr. Sacha Rabinovitch, Harvester Press, Hassocks, 1976 Introduction.

the background of an understanding that the human order is part of the process of evolution, that the human organism is a process interacting with and exchanging matter with its environment and that its organization is based on oscillations. As Eliot Chapple wrote:

> From the individual cell and its metabolic processes, its synthesis of DNA and RNA, to man as the total organism, the biological rhythms are the controlling factor. They are integral to the nervous system and endocrine mechanisms; which regulate the internal state and ready the individual for attack or flight and maintain metabolic and sexual balance. These major patterns of response to external stimuli are the primary emotional states on which much more complex variants are elaborated.(1)

Chapple then went on to show how cultural processes are founded on the underlying biological rhythms.

But while such background understanding is important, the most important problem is to understand what is unique about the human order which distinguishes it from all other processes and all other animal species. Having dealt with the various processes from which the human order emerged in previous chapters, I will now concentrate on those features of humanity which make it unique.

The thinkers who have reflected most profoundly on the distinguishing features of the human order have been those belonging to the Romantic tradition described in the Introduction. Most of those concerned to define such distinguishing features have been influenced directly or indirectly by the thought of Hegel. Hegel characterized

(1) Eliot D. Chapple CULTURE AND BIOLOGICAL MAN
Holt, Rinehart and Winston, N.Y., 1970, p.10.

human being as both individual and universal, writing: "Mind is the nature of human beings en masse and their nature is therefore twofold: (i) at one extreme, explicit individuality of consciousness and will, and (ii) at the other extreme, universality which knows and wills what is substantive."(1) To become human it is necessary to transcend the particularity of one's being by participating in the universal. As Hegel wrote in the PHENOMENONOLOGY OF MIND:

> To put the matter otherwise, self-consciousness is only something definite, it only has real existence, so far as it alienates itself. By doing so, it puts itself in the position of something universal, and this its universality is its validity, establishes it, and is its actuality...The means, then, whereby an individual gets objective validity and concrete actuality here is the formative process of Culture.(2)

This formative process of culture Hegel described in the Jena lectures of 1803-1804 and 1805-1806 as operating through three dialectical patterns: interaction on the basis of reciprocity which operates through moral relations; symbolic representation which operates through the medium of language; and the labour process which operates through the tool.(3) Hegel's subsequent works elaborated on these patterns and showed how they have interpenetrated to form the dynamics of history.

(1) HEGEL'S PHILOSOPHY OF RIGHT op. cit. s264, p.163
(2) G.W.F.Hegel THE PHENOMENOLOGY OF MIND tr. J.B.Baillie (1931) Harper & Row, N.Y. 1967 p.514f.
(3) Jürgen Habermas "Labour and Interaction: Remarks on Hegel's Jena PHILOSOPHY OF MIND" in THEORY AND PRACTICE (1971) tr. John Viertel, Heinemann, London, 1974, pp.142-169.

Various thinkers have developed different aspects of Hegel's characterization of human being. Some such as Helmuth Plessner have developed the idea that humans are both particular subjects and capable of transcending this particularity by taking an objective standpoint to themselves and the world. Others have explicated the various dialectical patterns by which humans form themselves. George Herbert Mead and the symbolic interactionists in U.S.A. have shown how the struggle for recognition gives rise to the development of moral relations. In France the structuralists have attempted to understand societies in terms of their symbolic systems. And Marx in his early writings and the humanist Marxists influenced by these have tried to understand the history of social relationships in terms of the mastering of nature through the labour process. Together these movements of thought constitute a major part of the corpus of works directed towards understanding the human order.

However Hegel has been criticised for the pan-rationalism which follows from his idealist metaphysics. This criticism has come from two directions: one concerned with the dynamics of society as a whole and one concerned with the lives of concrete individuals. The mature Marx is representative of those focussing on the dynamics of society as a whole. He argued that the dynamics of society and its interaction with the world cannot be understood in terms of the telos of history. Since the dynamics of society are largely the product of the unintended consequences of people's actions it cannot be assumed that humanity is progressing in a rational way.

Society confronts its members as a second nature with its own, non-human laws of development and it is necessary to understand these in their own terms to reveal in what way society is advancing.

While it might be possible to show that history so far has led to the actualization of the potentialities of humanity, there is no reason to assume that this will be so in the future, or that these dynamics won't lead to the total destruction of humanity.

Those thinkers who have stressed the irreducibility of the individual subject are generally designated as existentialists. The existentialists have accused Hegel of not doing justice to the contingency of human existence and have rejected the possibility of assimilating existence to thought or of escaping the contingency of life through philosophy. Troubled by the way in which "the existing subjectivity tends more and more to evaporate."(1) in Hegel's system, Kierkegaard stressed the importance of existence, writing "The systematic Idea [in Hegel's philosophy] is the identity of subject and object, the unity of thought and being. Existence, on the other hand, is their separation."(2) Consequently Kierkegaard focussed on the individual as a contingent subject perpetually engaged in existing with all the uncertainty and anxiety entailed by this. And

(1) KIERKEGAARD'S CONCLUDING UNSCIENTIFIC POSTSCRIPT tr. David F. Swenson and Walter Lowrie, Princeton Uni. Press, Princeton. 1968, p.112

(2) loc.cit.

he argued that the task of existing as a finite and contingent subject is something which cannot be transcended through attaining the perspective of the Absolute. So in contrast to Hegel who wrote: "Philosophy escapes from the weary strife of passions that agitate the surface of society into the calm region of contemplation..."(1) Kierkegaard argued:

> The principle that the existing subjective thinker is constantly occupied in striving, does not mean that he has, in the finite sense, a goal toward which he strives, and that he would be finished when he had reached this goal. No, he strives infinitely, is constantly in the process of becoming.(2)

Of those who believed that they could transcend their contingent existence through philosophy, Kierkegaard wrote: "If a dancer could leap very high, we would admire him. But if he tried to give the impression that he could fly, let laughter single him out for suitable punishment."(3)

These criticisms can find support in process philosophy according to which being, or becoming, precedes thought and always transcends our understanding of it. Thus in terms of process philosophy an adequate conception of the human order must do justice to the achievements of those who have focussed on the autonomous dynamics of processes presupposing but transcending people's intentions and to the insights of the existentialists as well as to the achievements of Hegel and those who have elaborated his ideas.

(1) G.W.F. Hegel THE PHILOSOPHY OF HISTORY tr. J.Sibree (1899) Dover, N.Y. 1956, p.457
(2) KIERKEGAARD'S CONCLUDING UNSCIENTIFIC POSTSCRIPT op.cit. p.84
(3) ibid.p.112

Humans envolved as members of communities, and this evolution has involved a general increase in the intellectual capacities of individuals and an increase in the ability of the community as a whole to understand and control its environment. In the process of this development there evolved the complex relations between individuals and culture focussed on by Hegel and the processes deriving from the unintended consequences of people's actions. All these features of the human order evolved together and presuppose each other. The human organism is nothing outside the social environment necessary to develop its potentialities. While the complex order of society is only possible because of the intellectual capacities of its members. Yet while emergent features of the human order are mutually dependent, they are not reducible to each other, nor can they be seen as simply the manifestations of an all encompassing process.

This is a state of affairs which people have traditionally found difficult to comprehend and this has resulted in continued efforts either to understand society in terms of one unifying principle or in terms of discrete constituents. The tendency to see society in terms of one unifying principle is manifest in those thinkers influenced by Hegel who have attempted to make one of the dialectical patterns of the formation of culture the sole principle of historical development. As Habermas wrote:

> Ernst Cassirer takes the dialectic of representation and makes it the guiding principle of a Hegelianized Kant interpretation, which at the same time is the foundation of a philosophy of symbolic forms. Georg Lukács interprets the movement

> of the intellectual development from Kant to Hegel along the guideline presented by the dialectic of labour, which at the same time guarantees the materialistic unity of subject and object in the world-historical formative process of the human species; finally, the neo-Hegelianism of a thinker such as Theodor Litt leads to a conception of the stepwise self-development of spirit which follows the pattern of the struggle for recognition.(1)

The methodological individualists who try to understand society purely in terms of the actions of individuals obviously exemplify the tendency to explain society in terms of discrete entities, but this is also the case with many of those who argue for a holistic approach to society such as the functionalists. As Robert Murphy wrote:

> The most important reason for the static view of structure is the premise that we look upon social life as a series of discrete, isolatable entities - Durkheim's "things." Social life then is not a process of becoming but something that is. The basic units into which we divide social life for purposes of analysis are of a fixed nature, and it follows that the relationships of these units with other similarly conceived units will share the same rigidity. This situation is aggravated by the fact that our units are almost always far between bounded and more permanent in our analyses than in empirical reality. Functional analysis can thus come perilously close to replicating the mechanical systems so often used as analogies.(2)

To overcome such difficulties it is necessary to think in terms of process philosophy with its underlying auditory analogy. In these terms it is possible to conceive of society as a complex of interdependent and interpenetrating partially autonomous processes each contributing to the polyphonic process of becoming of the whole within the context of the process of becoming of the rest of nature.

(1) Jügen Habermas (1974) op.cit. p.157f.
(2) Robert F. Murphy THE DIALECTICS OF SOCIAL LIFE George Allen & Unwin, London, 1972, p.58f.

Also, since continuity and individuality are not mutually exclusive from the point of view of process philosophy, it becomes possible to form a more adequate conception of the relationship between individuals and their social context. Thus it becomes possible to reconcile those approaches to the understanding of society which emphasize subjectivity and intentional activity such as hermeneutics, existential phenomenology and symbolic interactionism, and those which emphasize the dynamics of society transcending the intentions of individuals. Finally by understanding the relationship between processes in terms of different temporalities or rhythms, process philosophy points the way to the understanding of new dimensions of the human order.

The interdependence of the various processes which make up the human order makes it difficult to describe. It cannot be grasped as a unified totality because it consists of a plurality of sub-processes with some autonomy from the totality, while to understand any particular process in society it is necessary to have some understanding of the multiplicity of other processes which make its existence possible. This is particularly difficult where the other processes are neither simply constituent sub-processes, nor supervening processes which provide the environment of the process, but are interpenetrating mutually constitutive processes which neither transcend it nor are transcended by it.

It has been shown how the higher animals must be understood as highly conscious deliberative subjects embodied in a dynamic world, capable of learning, mastering skills, of aesthetic appreciation and insight, and living in complex communities with a proto-culture which can develop from generation to generation and which includes way of communicating specific types of information. Since it can be presupposed that at least this is true of humans and that any distinctively human processes must have emerged on this foundation, the analysis of any distinctively human process can presuppose such a context. But even presupposing this context, to deal with any one distinctively human process in isolation from all others can only be regarded as an artificial and distorting abstraction. To overcome this problem I will begin my account of the human order with an explicitly abstract analysis of one of its dinstinguishing features. I will then show how this feature is the necessary condition of other uniquely human processes, and then how these processes make possible other processes. In this way I will gradually concretize the concepts in terms of which the human order is to be understood. Only in the conclusion in which I will return to the issues raised in Chapter I in which people will be seen as struggling to make sense of their lives in concrete situations will these ideas about the human order begin to become fully concrete.

I will begin my account of the distinctive features of the human order by showing how the cognitive capacities of individuals develop beyond that which is achieved by any other type of animal. This presupposes that individuals are embodied subjects striving within a meaningful world, but abstracts from the problems that people are engaged in and the social and cultural contexts required for the development of such cognitive capacities. I will then show how the development of this cognitive capacity enables individuals to decentre themselves from their immediate experience and how this makes possible the self-formative processes of culture described by Hegel. I will first show how the decentration from immediate experience leads to the development of a reciprocity of perspectives which leads to the emergence of the self, the struggle for recognition and the development of the moral order and then how this decentration and reciprocity of perspectives leads to the struggle for a common orientation to the world with an associated development of symbolic universes. Thirdly I will show how a decentred attitude leads to the development of technology in order to control the environement. Finally I will show how these processes are mutually constitutive of each other and always function interdependently.

However this analysis will be seen to abstract from those dynamics of society in its relation to the rest of nature which are the unintended consequences of people's action. This will be the subject of the next chapter where, through a study and critique of Marx and the Marxists, the nature of such processes will be explicated. But it will also be shown in this chapter that the social order is an unfinished process of becoming and that the concepts developed to understand the formative processes of culture and the dynamics of processes which develop as the unintended consequences of people's actions do not fully come to grips with the lives of the people who must struggle to come to terms with the contingencies of their concrete situations within the world. This will pave the way for the conclusion.

In the concluding chapter the starting point of the thesis will be returned to. The asumptions about the nature of humanity which were assumed in the introductory analysis will have been justified and explicated. That is, humans will be seen as embodied subjects actively engaged in the world with the potentiality for rational thought and action who must strive to understand their place in the world and to give meaning to their lives. This is a different concluding point from that in Hegel's system which ends with the Absolute Mind and supports a contemplative attitude towards the world. The concluding point here will be human subjects perpetually in the process of becoming. But the individual subjects will not be understood as subjects abstracted from their natural, historical and social environment as in Kierkegaard's thought, but as situated individuals in the process of forming nature and society as they form themselves. This is more in accordance with the existentialism of Maurice Merleau-Ponty who wrote:

> As its name suggests, existential philosophy consists of taking as one's theme not only knowledge or consciousness understood as an activity which autonomously posits immanent and transparent objects but also existence, i.e., an activity given to itself in a natural and historical situation and as incapable of abstracting itself from that situation as it is of reducing itself to it. Knowledge finds itself put back into the totality of human praxis, as it were, given ballast by it. The "subject" is no longer just the epistemological subject but is the human subject who, by means of a continual dialectic, thinks in terms of his situation, forms his categories in contact with his experience, and modifies this situation and this experience by the meaning he discovers in them. In particular this subject is no longer alone, is no longer consciousness in general or pure being for itself. He is in the midst of other consciousnesses which likewise have a situation; he is for others, and because of this he undergoes an objectivation and becomes generic subject...Man no longer appears as a product of his environment or an absolute legislator but emerges as a product-producer, the locus where necessity can turn

into concrete liberty.(1)

I will then be in a position to attempt a resolution of those problems deriving from the separation of the subjective realm from the objective realm. The individual will have been provided with an understanding of the place of the human order in the cosmos and with solid grounds for believing in his or her own significance. A belief in the dignity of human-kind and their potentiality for rationality will have been shown to be supported by science rather than being undermined by it. It will be shown how there can be rational progress in understanding and how the ideas about what humans are, developed in this thesis, provide a general orientation for action and how social science embodying the conception of the human order developed from process philosophy is able to provide a basis for developing and evaluating goals and ideals of both society as a whole and the individuals and groups within it. In this way science will be seen to provide the individual with rational grounds for choosing how to live and how to act in his or her situation, thus negating nihilism rather than supporting it. It is only at the stage where process philosophy and the science based on it have facilitated a greater 'indwelling' by people in the world and revealed what is meaningful and worthwhile in life so that people can orient themselves in their everyday activities that the ideas about the nature of the human order developed on the basis of process philosophy will have become fully concrete.

(1) Maurice Merleau-Ponty "Marxism and Philosophy" in PHENOMENOLOGY, LANGUAGE AND SOCIOLOGY: SELECTED ESSAYS OF MAURICE MERLEAU-PONTY ed. John O'Neill, Heinemann, London, 1974 pp.174-185, p.182f.

THE PROCESS OF COGNITIVE DEVELOPMENT

The process of cognitive development is intricately related to a large number of other processes. The first relations to the world of a child are those with other people. Before the development of cognition the child experiences itself as a unity with the mother and participates in her emotions through an immediate contagion of feeling. In this relationship the mother arouses in basic form most of the emotions known to us. Thus the first relationship of the child to the world is essentially an emotional relationship and this is the ground out of which cognition develops. But cognition does not develop independently of this emotional relationship. Emotions and cognition develop together, and to abstract cognition from emotional development is difficult to do without conveying a distorted picture of both emotions and cognition.

Cognitive development is also closely related to the social relationships and culture in which the child grows up. Merleau-Ponty has shown how the ability of the child to deal with ambiguities in the world is related to his or her social situation(1) and Piaget has acknowledge that the higher forms of intellectual behaviour are developed differently in different societies and in different contexts within the same society.(2) But even with this acknowledgement

(1) Maurice Merleau-Ponty "The Child's Relation with Others" in THE PRIMACY OF PERCEPTION ed. James M. Edie, N.W. Uni. Press, Evanston, 1964, p.100f.
(2) Jean Piaget "Intellectual Evolution from Adolescence to Adulthood" in HUMAN DEVELOPMENT 15, 1972, pp.1-12

Piaget's whole approach to the study of the development of cognition reveals the pitfalls of abstracting cognition from the cultural context. Piaget's emphatic concern has been with how people attain the potential for scientific thought, and this, coupled with his formalistic views of scientific reasoning and his adherence to a specific world-view based on the concepts of space, time and substance of Newton's physics has led to ethnocentricism and conceptual conservatism. Both the child and people in different cultures are interpreted as developing towards this authoritative set of concepts, categories and forms. This means that people are not understood in their own terms but are always measured against Piaget's own standards of how cognition ought to be.(1) Thus unless one is to accept that Piaget's conception of the world is the absolute truth, his analysis of cognitive development must be seen as relative to one particular world-view or culture.

Yet despite these difficulties and despite the fact that cognition is only likely to develop in the context provided by society, and despite the limitations of the studies of cognitive development as a consequence of these problems, it is possible to discern in the results of Piaget's studies a process of development whereby new ordering principles emerge on the basis of ordering principles

(1) This criticism is made by Merleau-Ponty. See Robert J. Sardello in "A Phenomenological Approach to Development: The Contributions of Maurice Merleau-Ponty" in HUMAN DEVELOPMENT Vol.17, 1974, pp.401-423, esp.405

already in existence. The ordering principles underlying the human organism's early interactions with the world are very similar to those of the higher animals, while the higher types of ordering which develop transcend anything found in other animals, and can be seen to be essential if the other unique features of the human order are to be accounted for. Consequently it can be assumed that this developmental process is generic to the human species, and by explicating it through the concepts of process philosophy, it should become possible to understand the continuity of the human order with the rest of nature and the basis of its uniqueness.

As it was pointed out in the last chapter, the cognitive function can be understood as a differentiated organ for regulating exchanges with the environment. Cognition is thus always associated with action, and all thought must be understood in relation to this. (1) Whatever is perceived or known by the organism is done so through a process of intergration or assimilation of the environment to an organisation or structures which pre-exist the particular knowing process so that the environment is constituted as a meaningful world to which the organism can act in an adaptive way. Knowledge of the world involves transforming the experience of it so as to include it functionally in the transformation systems associated with action. This can be seen even in higher forms of intellectual activity. A physicist does not simply measure and describe the world, but by means of conceptualization, logic and mathematics, interprets the world so that it can be experienced as meaningful, predictable and controllable. Mathematics goes far beyond immediate reality, consisting not only of all actual transformations, but of all possible transformations. Logic, for its part, consists of a system of operations such as classifying, making series and making connections which have their source in the general coordinations of behaviour.

Understanding cognition in terms of the organism's active interaction with its environment leads to a fundamentally different conception of the relationship between knowledge and the world than that assumed by psychologists working with the tradition of scientific psychology which has developed from British empiricism. This difference centres on the meaning and role given to the concept 'representation.' Representation has three basic meanings: an active sense of making something present, and two passive senses: the sign which makes something present without there being any figurative relation between the object represented, and a sign which is related to the thing represented by being some type of copy.(1) All three meanings were present in the thought of Descartes when he tried to develop a theory of knowledge to replace the theory of intentionality deriving from Aristotle and the scholastics. By the time Hume had developed his views, representation meant nothing more than an image or faint copy of impressions of the real world. Concepts also were thought of as being images, and except for mathematics, thought was considered to be nothing but a mechanical association of these images or ideas. By doing away with the active sense of representation the role of the subject had disappeared, and consequently

(1) Hans Furth "The Nature of Representation and Interiorization" in Hans G. Furth PIAGET AND KNOWLEDGE: THEORETICAL FOUNDATIONS, Prentice Hall, Englewood Cliffs, N.J.1969, p.74

Hume argued that there was no such thing. Psychologists in the English speaking world, including those thinkers who have emphasized the role of internal structures such a Miller, Galanter and Pibram(1) and Jerome Bruner(2) and those who have used cybernetic models have been dominated by this idea of representation and have understood knowledge as representation of the external world. In opposition to this, psychologists such as Piaget and phenomenologists such as Merleau-Ponty who have taken the organism as actively engaged in the world as a starting point, have understood knowledge not as a representation of the world but as manifest in the way the environment is constituted as a world.(3) The individual is not first a spectator of the world who acts on the basis of his image of the world but is an embodied being-in-the-world who reacts to and acts upon a meaningful world. A concept is not an image or a reified object which we know but that through which we interact intelligently with the world enabling us to constitute the world as an objective reality vis-a-vis our own person. In this, representations do not have any essential role. Representations must be seen as having a derivative status as signifiers whose meaning derives from their association with the forms of activity or schemata by which the world is constituted.

(1) G.A. Miller, E.Galanter and K.H.Pibram PLANS AND THE STRUCTURE OF BEHAVIOUR, Holt, Rinehart & Winston, N.Y.,1960.
(2) J.S. Bruner, R.R.Olver and P.M.Greenfield STUDIES IN COGNITIVE GROWTH, Wiley, N.Y. 1966
(3) This similarity between Piaget and Merleau-Ponty has been pointed out by Richard M. Zaner in "Piaget and Merleau-Ponty: A Study in Convergence" in REVIEW OF EXISTENTIAL PSYCHOLOGY AND PSYCHIATRY Vol.6 1966 pp.7-23

The organizing principles of an organism's cognition and action which can be transposed, generalized and differentiated from one situation to another are the organism's 'schemata'. The assimilation of the environment to the conceptual schemata of an organism is always associated with an accomodation by the organism to the environment by an adaption or modification of the organism's schemata to the particular environmental reality. The organism actively adjusts to the environment and adjusts the environment to itself rather than simply recording reality, and in this process the inner organization, the perceptual and action schemata, are developed to allow more effective interaction with the environment. In this way the higher forms of schemata are generated.

The nature of this development has been described by Piaget in concepts very close to those of process philosophy. Piaget refers to schemata as structures and defines these as self-regulating systems of transformations in which the elements cannot be singled out or defined independently of their connections within the structures. These structures are understood to be active or functioning and also developing. He uses the term 'equilibration' to refer to the immanent causality by which these structures maintain themselves by compensating for internal and external imbalances and develop beyond themselves to more advanced structures. To describe the self-stabilizing path of development by which new structures emerge from preceding structures Piaget adopts the terminology of Waddington, writing: "...intellectual growth contains its own rhythm and its "chreods" just as physical growth does."(1) Piaget then described his position as a synthesis of structuralism and geneticism:

> Thus, the synthesis of structuralism and geneticism towards which we are now moving is brought about by an internal evolution in ideas about biological causality - a coordination between the two demands of conservation and transformation: conservation of structures as a whole, such as may be transformed without losing their identity because these transformations are reequilibrations and because transforming structures are capable (in theory and sometimes in reality) of being integrated into transformed structures derived from them and adding to them.(2)

What this means is that the structures by which the world is constituted by the organism in its interaction with the environment are self-ordering activities or processes with their own immanent causality, and these processes are themselves sub-processes of the process of cognitive development. This process of cognitive development is a creative process in which a succession of higher levels of ordering or emergent processes come into being, with each new level being an ordering of the activity of the preceding levels.

The possibility of such a development of an organism can be explained in terms of the functioning of the brain as it was described in the last chapter. Here it was argued that the brain's functioning is based on systems of circuits 'fixed' by RNA manufacture which differentiates cells so they will respond differently to electrical impulses, and that these circuits could be developed into hierarchies

(1) Jean Piaget (1971) op.cit. p.21
(2) ibid. p.136

of an indefinite number of levels. Understood in this way, cognitive development must be regarded as partially autonomous from the environments within which it develops, and it is for this reason that it can be analysed to some extent in abstraction from any particular social and cultural milieu.

To avoid the limitations of Piaget's approach it is necessary to see the cognitive structures which develop not as isolated achievements but as an articulation of the child's original global and at the same time fragmentary experience of the world. The child's concepts can then be seen as part of a total world-design by which s/he lives as a functioning totality in his own her own right. This emphasis on the totality of experience then allows for the role of synthetic modes of cognition such as empathy or 'indwelling' which are ignored by Piaget but which I have argued are just as important in scientific understanding as the ability to deal with abstractions. And relating the synthetic and the analytic modes of cognition it is necessary to give a central place to the role of analogical thought which Piaget's formalistic views about science have led him to ignore despite the fact that his own ideas about cognitive development are based on the analogy of organic self-regulation and growth. Since both the concepts of science and the concepts of the world-designs of traditional societies can all be seen as the articulation of analogies, the ability to think analogically can be taken as generic to the human species. Thus if analogical thought is taken as the ultimate achievement of cognitive development rather than the ability to think in the abstract concepts of Newtonian physics, the ethnocentricism of Piaget can be avoided. However these provisos do not undermine Piaget's claim that cognitive development is a self-stabilizing path of development which goes through four basic stages: sensori-motor intelligence, pre-operational intelligence, concrete operational intelligence and formal operational intelligence, with each stage developing out of and presupposing the preceding stages.

The central feature of this cognitive development is an increasing capacity of the subject to decentre him or herself from immediate experience. Since it is by this capacity that humans are able to transcend the achievements of other animals and are able to participate in the formative processes of culture, it is with the nature and development of this capacity that I will now be primarily concerned. I will try to show that decentring can be understood in terms of process philosophy as involving the development of different temporal orders with each stage of cognitive development being a temporal order which transcends in duration that which precedes it. Decentring will then be shown to be a temporal decentring whereby the subject is able to take a temporal standpoint which transcends the duration of his or her activities in the world. Consciousness will then be seen as a multilinear process of becoming, and it is this multilinearity which will be seen to account for its reflexivity.

The first stage of cognitive development, sensori-motor intelligence lasts for about two years. This intelligence is entirely practical, and the form of knowledge is always tied to the content of specific sensory inputs and motor actions. This is the behaviour manifest in the coordinated movements of lower animals in their reaction to food or danger, or, at a more advanced level, where the seen branch of a tree serves for the monkey's grasping or avoiding it when jumping. Similarly a baby's seeing a thing carries with it the total organism's tendency to move it, to touch it etc. In all these cases we can understand that the biological function of knowing a thing in the environment is to react to the thing in an adaptive manner. In Piaget's terminology, the assimilation of a sensori-motor schema is always simultaneous with an accommodation to the external aspect of things.

However this is also a period of rapid cognitive development in the child who from the beginning is a creature of curiosity. During this period the child develops from a state where s/he is capable only of a few reflex movements and where s/he experiences the world as a barely differentiated totality in which there is no discrimination made between him or herself and the world to a stage where s/he can experience him or herself as an embodied centre of action in a spatially ordered world of objects existing independently of him of herself. This involves a continuous process of development, differentiation and integration of schemata which leads to a gradual transition from a subjective unintegrated body-centred activity to a practical separation of means and ends to a final stage where we can infer a logic of action.

only be a vague feeling of duration. Differentiating actions into means and ends implies a cognitive act which has a duration transcending the immediate experience of the environment and this provides the reference point from which the end can be seen as a future not yet realized. The perception of an object as enduring self-identically whether it is being observed or not implies the existence of a cognitive activity which endures beyond each particular appearance of the object, and this then forms the standpoint from which experiences can be seen as before and after.

The pre-operational form of intelligence dominates from two years of age until about five or six. As far as we know this is the highest level of intelligence achieved by non-human animals. This period begins with the dissociation of schemata from particular content and is manifest in the ability of the child to keep in mind objects not involved in immediate activities. For instance Jacqueline was observed by Piaget to put an object behind her while engaged in some other task and then after five minutes to search for this object.(1) In this situation knowledge which knows by effective external action gives way to a knowledge which simply knows.

The most important feature of this form of intelligence is the development of the symbolic function. The child at this stage is capable of representing the known object.

(1) ibid.148

As long as all notions are centred on the self, space can only be parcelled out among parts of the body, and there can be no independent external spatial order of objects. This egocentricism was observed by Piaget in his daughter Jacqueline who simply lost interest in anything which disappeared from sight. Piaget concluded from this:

> Everything occurs as though the child believed that the object is alternately made and unmade... When the child sees a part of the boject emerge from the screen and he assumes the existence of the totality of that object, he does not yet consider this totality as being formed "behind" the screen; he simply admits that it is in the proces of being formed at the moment of leaving the screen.(1)

With increasing coordination of schemata of action and objectification of environmental events, understanding of spatial relations develops so that the child is able to reach a certain objective, make a detour and then return to his or her original place. In this process the child comes to see objects as things existing over a duration in a spatial order independent of him or herself.

This development of coordinated space indicates the first development of a temporally transcendent order. Where there is no differentiation of means and ends and the child simply responds to the environment as when itsucks its thumb or turns towards a sound there can be no reason to believe that the child has any perception of before and after, now and later, etc.(2) There can

(1) J. Piaget THE CONSTRUCTION OF REALITY IN THE CHILD (1937) Basic Books, N.Y. 1954 p.31
(2) John H. Flavell THE DEVELOPMENTAL PSYCHOLOGY OF JEAN PIAGET D. Van Nostrand, N.Y. 1963 p.147

In this respect symbols contrast with signals associated with sensori-motor intelligence. The signal functions as a substitute for a stimulus and the organism simply reacts to it. Thus an animal reacts to smoke as it would to fire, the smoke functioning as a signal for the fire. In this there is a rigid relation between the signal and any particular event, whereas since the relationship between the symbol and the world is mediated by knowing, there is no such fixed relation, even when the symbol is highly specific. For instance in reading: "The roof is going to fall on you this very moment" it is unlikely that you will even look up.

There are two aspects to symbols: their production and their comprehension. Piaget argues that deferred imitation, where imitative movements become separate from the context of the perceived original is the first manifestation of symbolic production. The schemata which enabled an accommodation to the original is required for such an imitation. A basic manifestation of symbolic behaviour is play as when two sticks at right angles are used as an aeroplane. Images are internalized forms of imition. This is exemplified in visual images where the overt movements of the eye that can be observed with the appropriate instruments become less large, less detailed during evocation of a visual image but are still directly related to the more easily observable movements of perceptual looking. Piaget uses the word 'image' to cover any sensory modality. The second aspect of symbols is their comprehension. The symbols are experienced as meaningful through being assimilated to the same schema of knowing by the which the known object or event which the symbol represents was constituted in the first place.

In distinction from the construction of the known thing which stays internal to the knowing activity, the symbol is constructed by means of the schema of knowing in order to make present, to represent, the known thing in a field in which the knowing activity takes place. It can have the independent status of the external world as is the case with play, gestures, written words or ceremonies, or it can be internalized as an image, but in all cases the symbol is independent of the knowing activity. While being tied to the knowing schemata assures the active relation of knower and representation, it is by having an aspect external to the knowing activity that enables the symbol to fulfil its function of representation, of making something present in a new medium. In this way the organism orients itself to a world which is experienced as having significance beyond the immediately experienced situation.

This symbolic function then makes possible the acquisition of language through which the child is able to extend his or her horizons through verbal communication. Despite this the child at the pre-operational level of intelligence has a vastly different world-design from that of an adult.(1)

(1) ibid. 156.ff

Though the symbolic function implies a process temporally decentred from the child's immediate involvement in the world which orders the representations or symbols, the child remains highly centred in this immediate involvement. This centredness is manifest in the inability of the child to take the role of the other person and to see his or her own viewpoint on the world as one among others. S/he is incapable of looking at a visual display and then representing what the display would look like from a different position. It is also virtually impossible for the child to treat his or her own thought processes as an object of thought and s/he is unable to reconstruct a chain of reasoning which s/he has just passed through. A feature of this centredness is the tendency for a single striking aspect of a situation to be focussed on to the exclusion of all else. For instance after it is admitted by the child that two thin containers hold the same amount of water, s/he will deny the equivalence when one quantity is poured before his or her eyes into a broad container, since s/he fixes his or her attention soley on the width of the second container. Closely associated with this, the child only focusses on successive states of a display rather than upon its transformations. The child also has an inability to think in any other way than through isomorphic, step-by-step images of concrete objects. Thus when asked to take the same number of sticks from a pile as a group of six sticks which had been placed in a row, the pre-operational children could only solve the problem by placing sticks beneath the sample and matching the sticks one by one. They could not count the row of stocks and then count out six sticks from the pile because they could not travel along a cognitive route and then reverse directions to find an unchanged point of departure. That is, mental operations are irreversible.

Another feature of pre-operational thought is the concrete and action ridden nature of the child's concepts and the absence of the concept of individuals which possess identity over time and in different contexts and the concept of classes of similar individuals. The child does not see an object such as a ball as identical in different contexts so that a ball-under-an-armchair is seen as different from a ball-somewhere-else. And identical objects tend to be seen as not members of a class but as different appearances of the same being. Comparison between objects can be made, but only one feature is considered, and things are seen to be either identical or totally different. This leads the child who has identified an object as similar to another to expect it to have all the characteristics or the original object. Reasoning is not deductive, but simply involves the association of elements juxtaposed within a global all encompassing schema. Things are seen as simply going together. There is an inability to form the idea of superordinate classes, and the child who has acknowledged that all of a group of beads are wooden, some being brown and the majority being white, is unable to see that there are more wooden beads than white beads.

The immediacy of the child's relation to his or her experience also prevents him or her from distinguishing play from non-play. Thus a child is upset when someone tramps on a stone which s/he has designated as a turtle.

Play is seen as reality and reality is a game which the child is prepared to play without any distinction being drawn between the two.

A new world-design is achieved through the development of structures which are increasingly dissociated from immediate content and reversible in operation. These structures enable the various compensating changes which result from a transformation to be composed into a single system in which an underlying invariance or constancy can be experienced through seeing one change as counterbalancing another. This enables the superficialities of immediate experience to be corrected for by means of successive, quick moving decentrings without producing the sort of disequilibrium whereby the original assimilatory organization is lost. When such a structure has been achieve, the child enters the phase of concrete operational intelligence.

Operational intelligence begins to predominate from the age of six years onwards. This form of intelligence develops through the ordering of coordinating action schemata in such a way that forms of action can take place which do no involve interaction with the environment. Action is 'interiorized' as structures are dissociated from their immediate context. The objects of action are not objects constituted in the world to which the organism then acts in an adaptive manner, but objects of knowledge which are acted on to transform them from one reality state to another so as to lead to explicit knowledge of the state. For instance a perceived ball is transformed in thought so that it is seen as an instance of a portable object, thus allowing further inferences to be drawn. Such actions are called operations by Piaget.

Such thought is not simply a minipulation of symbols or images and is not just an internal dialogue. Symbols are at most made use of in the thinking process but are not essential to it. Thus deaf and dumb children have been shown by Hans Furth not to be disadvantaged in the development of operational intelligence.(1)

The interiorization of action, in freeing thought from the immediate content, provides the essential condition for the ability to retrace or reverse a cognitive route. Thus a child can see that if a liquid is poured from one container to another, that it can be poured back again. This ability is at the basis of most of the developments in intelligence associated with operational thought. Reversibility enables the child to see that an object is identical through different contexts. Also the child is able to organize his or her experience by moving from an instance to a class, or from a sub-class to a higher class and then to reverse the direction so that an individual is seen as only one example of a class. This leads to different individuals being seen as instances of a class rather than as different appearances of the same being. Following from this Piaget has shown, both through a logical analysis and through observation of children's behaviour that the comprehension of the system of numbers presupposes the operation of classes

(1) H.G. Furth THINKING WITHOUT LANGUAGE: PSYCHOLOGICAL IMPLICATIONS OF DEAFNESS Free Press, N.Y. 1966

and of the ability to put things in serial order, and is a synthesis of the two operations.

It is in dealing with this stage of cognitive development that Piaget's limitations come to the fore. Piaget focusses on the manipulation of class concepts ignoring the fact that classifications are a differentiating of experience which not only relates that which has been classified to other members of a class, but also by negation relates it to everything which is not a member of that class. Classifications are not simply an identification of the common characteristics of entities in the world but a particular way of articulating the global experience of the world. Piaget's emphasis on classes reveals his ethnocentricism, since the exclusive concern with sharply defined classes is a characteristic of Western thought which has been dominated by visual metaphors since the time of Pythagoras. Heraclitus pointed out that becoming is a feature of the world that cannot be grasped by thinking in terms of class membership. Piaget was also concerned with the development of the ideas of there being a permanent quantity of substance (as in the case of liquids poured from container to another), a uniform space and temporal order and the ability to analyse processes into causal relations. Since the concept of substance was only developed after a great deal of effort by the Greeks(1) and the concepts of uniform space and time were also developed in the same way in the sixteenth and seventeenth

(1) Bruno Snell "The Origin of Scientific Thought" in THE DISCOVERY OF THE MIND: THE GREEK ORIGINS OF EUROPEAN THOUGHT tr. T.G. Rosenmeyer, Harper & Row N.Y. 1960, pp.227-245.

centuries, it is unlikely that these concepts will be developed autonomously by young children. The acquisition of such concepts is far more likely to be a matter of cultural acquisition. Furthermore as suggested earlier, there is more to cognitive development than is suggested by Piaget's approach. Piaget does not consider the development of such synthetic modes of perception as 'indwelling' and the ability to make tacit inferences or judgements which tend to be associated with this and which were studied earlier by the Gestalt psychologists.

Nevertheless the abilities which develop at the level of concrete operations are an important part of cognitive development, and if the details of this development are culturally specific, the general features are likely to be generic to the human species. They reveal the increasing ability of the human organism to decentre from experience through the development of new levels of ordering which unify into one duration a sequence of cognitive acts based on lower level structures. Sensori-motor schemata form the basis for the development of operational schemata and are implicit within them. For instance a ball known as an object carries with it an implicit functional potential as something that can be rolled, thrown, punched, kicked and so on. But by seeing a ball as an object is to constitute it from the point of view of a temporal order which transcends involvement with any particular functional potential. And reversible concrete operations unify into one duration a sequence of cognitive acts.

The last stage of intelligence dealt with by Piaget is formal operations which begin to develop between the ages of eleven and fourteen or fifteen in rich cultural environments and later in other environments. Up to the age of eleven children are limited to general systems of groupings such as classification, seriation and numbering and thought is confined to objects considered to be real. With formal operations, operations are performed on operations. This is exemplified by combinatory systems where the actual state of affairs is considered as one among other hypothetical possibilities. Such a form of intelligence makes possible the putting forward of hypotheses about the world and it is this which Piaget regards as the foundation for scientific thinking and criticism of the status quo. However, as it was pointed out in Chapter II, the development of science involves more than the formulation of hypotheses. It involves both the development of abstract systems of thought and a striving to 'indwell' in the world as fully as possible. In this process analogy has a primary role, synthesising disparate realms of thought and facilitating the development of alternative conceptual schemes. Yet while the use of analogies is not examined by Piaget, this ability is likely to be closely associated with the formal operations he does consider since it involves thinking about the cognitive structures which are taken for granted in children who are only capable of concrete operations. Both analogical thinking and those types of formal operations considered by Piaget imply a new level of ordering, and associated with this, a new level of temporal decentring from immediate experience.

It can be seen from this that with cognitive development the consciousness of the subject becomes increasingly polyphonic. It is this multilinearity of the process of becoming of consciousness which accounts for its increasing reflexivity which is unintelligible in terms of a unilinear conception of time. As Nathaniel Lawrence wrote:

> The smooth slippage of closed events in a continuous progression along a time line is not adequate to the facts. Consciousness accumulates large patches of temporality into a variety of "nows" of many sizes. It synthesizes them in a great many way...and thereby generates the raw materials from which many abstract meanings for time can be derived: mathemetical, physical, perceptual etc. In short, the conveyor belt metaphor of temporal sequence does not accommodate to the multiple modes of arrest and synthesis by which consciousness establishes both its open-ended quasi-identity and the continuous summation of the world-in-relation-to-consciousness.(1)

This temporal multilinearity of consciousness accounts for its ability to alienate itself from itself which, by revealing to each individual his or her particularity impels him or her to strive to transcend this by participating in the processes of culture. I will now consider how decentredness produces the three dialectical patterns described earlier: the development of the moral order through the struggle for recognitiion; the development of the symbolic order through the struggle for orientation and communication; and the development of technology through the struggle by people to control their destinies.

(1) Nathaniel Lawrence "The Illusion of Monolinear Time" in PATTERNS OF THE LIFE WORLD. ed. James M. Edie, Francis H. Parker and Calvin O. Schrag, N.W.U.P., Evanston, 1970 p.309.f.

THE EMERGENCE OF THE SELF, THE STRUGGLE FOR RECOGNITION AND THE DEVELOPMENT OF THE MORAL ORDER

In this section I will try to show how the moral order develops on the basis of the decentring of the subject which takes place with cognitive development. I will show how this decentring leads to the emergence of the self which in turn leads to a struggle for recognition by the child. This struggle for recognition will in turn be seen to underlie the moral order and to account for its dynamics. While to begin with I will be focussing on how the very young child matures in interaction with adults in an already constituted moral order and how s/he comes to adopt a moral attitude towards him or herself and others, I will then go on to consider how with the development of formal operations people attain the potential for adopting a critical attitude towards this moral order and how this affects their relation to it.

As it has already been pointed out the child begins developing relations with others before s/he begins to develop the sort of cognitive capacities described in the last section. For instance a child reacts much earlier to the face of its mother than to a coloured spot or to a ball. (1) The importance of the fact that the child is born of a mother and is for a long time closely bonded to her both physiologically and psychologically has been pointed out by Stephen Strasser. (2) Strasser has argued that prior to the development of cognition the child simply

(1) Stephen Strasser THE IDEA OF A DIALOGAL PHENOMENOLOGY Duquesne Uni. Press, Pittsburgh, 1969, p.81.
(2) ibid. p.77f.

experiences him or herself in the presence of the mother rather than objectifying her as another being in the world and in support of this contention he quoted the conclusion reached by the psychologist Heinz Remplein on the nature of early childhood experience:

> Above all, there is lacking the split between I and you that gives a characteristic tension to the experience of the adults. The 'I' and 'you' are still encompassed by the wholly undivided unity of the 'we experience'. This is particularly true of the original form of contact with fellow-man, namely, the relationship between mother and child.(1)

It might be argued that the child shows evidence of being aware of the mother when s/he cried on the mother's leaving of the room. However Merleau-Ponty suggests that this involves no such perception and rather indicates that the child is left with an "impression of incompleteness."(2) In the bonded experience with the mother, the unity and completeness when she is present is experienced by the child as a state of delight, satisfaction, as having guaranteed security and as having power over the surrounding world. This is threatened if the mother is not present. In this relationship the child immediately participates in the feelings of the parents: their unconscious standpoints, their joy and irritability, their anxiety and satisfaction. As noted earlier there is a "contagion of feeling."(3)

(1) ibid. p.84 from Heinz Remplein DIE SEELISCHE ENTWICKLUNG DES MENSCHEN IM KINDES - UND JUNGENDALTER, Munich, 14th ed. 1966, p.184
(2) M. Merleau-Ponty "The Child's Relations with Others" in op.cit. (1964) p.124
(3) Strasser (1969) op.cit. p.85

The mother's behaviour arouses in the child in basic form many of the emotions known to us: love and hate, joy and anguish, triumph and despair, and their nature is more comprehensible when this is taken into account.(1) First, it is evident that emotions always appear in situations of an existential nature. For instance, an infant does not experience anger because s/he is hungry but because s/he feels that his or her existence is threatened. Dread arises when the child experiences him or herself being threatened by the unknown. Second, emotional behaviour is eruptive and expressive in nature and is thus immediately noticeable. Third, it is a primitive form of reaction to a situation in which the surrounding world is seen not by way of objectification, but immediately in the light of existential needs and dreads. Thus in later life when a person is overcome by emotion s/he loses the distance which characterizes the adult's relation to his or her physical and social world and which gives him or her the ability to take a detached attitude towards people, things and situations in this world. In the light of this it can be seen that the common form of dualism argued for and exemplified in the work of Piaget in which cognition is seen as having the function of interpreting the world while emotion provides the energy source for action must be rejected. Drives or needs might bring about emotions as for instance frustrated hunger leads to anger, but they are not emotions. Nor do emotions imply motives, since motives are often independent of any emotion, while emotions do not impel one to any form of action. Rather emotions are a feature of the holistic forms of perception by which the meaning

(1) ibid. p.86f.

of the world for the organism is grasped, and this form of perception precedes and underlies the more abstract forms of cognition described by Piaget. Emotional perception is the condition of reason and the foundation on which objectification develops.

Thus it is this primitive participation in a 'we' relationship involving an essentially emotional relationship to the world that the individual develops, and the relationships between people should be understood as being ultimately grounded on and developing out of this form of involvement with the world. Since this immediate 'we' relationship between people must be taken as paradigmatic with other forms of relationships between people being explained as a development from the immediate state of unity with others, there can be no problem with overcoming solipsism and establishing the existence of other minds. The problem is to explain the separation of subjects from this immediate unity, not how subjects can become aware of other subjects.

With the development of action and perceptual schemata through activity, the child begins to differentiate him or herself from the anonymous collectively experienced as 'we'. The originally fragmentary consciousness of one's body gradually becomes integrated to form a precise corporeal schema, and with this there develops a global consciousness of the body's position in the world. These two developments are indissociable as noted by Merleau-Ponty who pointed out that: "the perception of one's entry into the world and of one's own body form a system."(1) This achievement then enables one to decentre oneself from immediate experience so as to become aware that one has a body which is a centre of action and which can be seen from the outside. This self-awareness immediately creates an imbalance in experience which leads to the recognition of others as autonomous, embodied beings. To be aware that one has a body and that the other's body is animated by another subject are two operations which form a unified system, though the former is achieved first.(2)

With this new mode of being in the world these arise for the first time the emotions of jealousy and sympathy. Jealously occurs when a person "sees his existence invaded by the success of the other and feels himself dispossessed by him."(3) This involves a confusion by the individual of him or herself and the other in which s/he only defines him or herself in terms of what the other has or has achieved. This can give rise to cruelty on the part of the one who is jealous, and later to sulking where the child renounces what it wanted to be and accepts the anguish of repressed action. Sympathy on the other hand is founded on mimesis in which the individual is caught up by the other so that the other's gestures and ways of doing things are assumed by him or her. Here perception arouses in the individual

(1) Merleau-Ponty "The Child's Relation with Others" (1964) op.cit. p.122
(2) ibid. p.121
(3) ibid. p.143

a reorganization of motor conduct through 'postural impregnation' by the other without the individual having ever learnt these gestures.(1) Sympathy occurs when through this postural impregnation one lives in the behaviour of the other without actually carrying out the behaviour for which one has been mobilized. It can be seen from this that both jealousy and sympathy involve some form of dissolution of the boundaries of the individuals involved. Yet it is only because such differentiation has been achieved that there are such boundaries. Thus the existence of such emotions is evidence that consciousness of self and consciousness of others have been distinguished from one another.

Though the child at the end of the sensori-motor level of cognitive development differentiates him or herself from the other, this is a structuring of relations which occurs from situation to situation. The child has no sense of being a continuous person through time from situation to situation. Each situation is taken in its most immediate meaning, though this involves cancelling everything that happened prior to each new situation.(2) Since the child is incapable of constituting the world as a uniform environment within which it is possible to take a number of distinct perspectives, it is impossible for him or her to switch from one perspective to another without erasing the first one. Thus external perception is reduced to what can be perceived from a single point of view and so no two perspectives can be related.

(1) ibid. p.145
(2) ibid. p.147

A new stage is reached with the development of preoperational thought. Here the child is able to decentre from immediate experience, to constitute an object as self-identical over a duration and to see such objects as being in an enduring spatial order. This makes it possible for the child to recognize that others can also have perspectives on the world. At this stage the child ceased to refer to him or herself only by name or by the pronoun 'me' which simply requires that one sees oneself as an object in the world, but also begins to use the pronoun 'I', thus indicating that s/he recognizes that s/he has her own perspective on the world as distinct from others. This recognition of the independent perspectives of others is still very rudimentary however, since as Piaget pointed out, it is only when the stage of concrete operations is reached between 5 and 7 years of age that the child is able to describe a situation as it would appear to someone else in a different position.

The development of the self from this stage is part of the process of developing the relationship between the self and particular others to a general self-other relationship. Strasser has described this development of the relationship to the other through the relativization of the family situation:

> Inevitably the child finally also assigns a place to his parents in his world that has become more realistic and more objective. The "you" becomes Mother and later Mother becomes _a_ mother, that is, _my_ mother is _a_ mother like other mothers, like mothers of Johnny, Pete and Peggy. Here lies the beginning of the process of "becoming an other"...As a consequence of this process

> the "you", which was unique in the original dyad, becomes the other in reference to me through objectification, and finally one among many similar others.(1)

The generalization of the other enables the individual to define him or herself from an increasingly objective point of view. To begin with the child learns to see him or herself from the point of view of his or her parents, siblings and close friends, but through the generalization of the other, the child is able to take the perspective of the whole community towards him or herself. S/he is able to see him or herself from the objective point of view of the 'generalized other'.(2)

In this process of coming to define the self from an increasingly objective standpoint, a crisis occurs in the child. At about three years of age s/he stops lending his or her body and thoughts to others and confusing him or herself with the role or situation in which s/he is involved and begins to understand him or herself as someone above and beyond any situation or role. This involves the emergence of a new self-sustaining process in which there is an intense struggle on the part of the child to establish his or her autonomy. This phase is characterized by unmanageability, wilfulness and protest with a strong tendency to say 'No!'. The fragile status of this developing autonomy is evident in the way the child for the first time becomes sensitive to the look of the other which s/he generally finds annoying. However the ambiguity of the individual

(1) Strasser (1969) op.cit. p.95
(2) George Herbert Mead MIND, SELF AND SOCIETY ed. Charles W. Morris, Uni. of Chicago Press, Chicago, 1934, p.154ff.

in relation to the social context from which the autonomous self emerges and on which at the same time it is dependent is manifest in that while the child is so wilfully independent and irritated by the look of the other, s/he also feels the need to be recognized in order to reestablish the experience of unity with the other. The child now struggles to gain the attention of the other and will misbehave to get it. The demand for autonomy and the quest for recognition go hand in hand. It is this double quest which goes to make up the struggle for self-substantiation and it is the achievement of this which gives the individual a sense of being a person. Failure on the other hand leads to the experience of depersonalization and schizophrenia.(1) With this development of the emergent self emotions come to be centred not so much on the existence of the individual as a biological organism but on the existence of the individual as a self. In this situation it is threats to the objective status of the self which are the prime cause of anxiety.

After this initial phase of coming into being of the autonomous self the child will attempt to substantiate him or herself by acknowledging the significane of others and undertaking tasks recognized by them as important. By consciously willing what is so recognized, the child retains his or her autonomy while achieving recognition, and in this way is able to recreate the 'we' experience with the others in a way which affirms his or her distinctiveness and antonomy. In this process the child develops a conception

(1) As argued by R.D. Laing in THE DIVIDED SELF Penguin Books, Harmondsworth, 1966.

of him or herself defined in terms of the perspectives of others. Successful achievement of recognition from these others consolidates this self-conception, which then becomes the principle on which the unity and autonomy of the self is based. Each action is seen by the individual as an expression of him or herself, and the integrity of the self is achieved by acting in accordance with his or her self-conception. This involves the development of two emotions: shame and guilt which follow the awareness that the integrity of the self has been undermined by acts not in accordance with the self-conception in the eyes of an explicit or implicit audience.

This self-conception which defines the individual's place in the world then forms the basis on which plans for action must be worked out. This is a general feature of people in all societies as noted by the anthropologist A. Irving Hallowell who wrote:

> In so far as the needs and goals of the individual are at the level of self-awareness, they are structured with reference to the kind of self-image that is consonant with other basic orientations that prepare the self for action in a culturally constituted world.(1)

While the original audience in terms of which individuals orient themselves are significant others and reference groups, with increasing decentring from immediate experience, the audience becomes the generalized other. In taking the perspective of the generalized other the individual comes to participate in the moral order of the community or the society as a whole and defines him or herself as a significant part of the community. The moral order

(1) A.Irving Hallowell CULTURE AND EXPERIENCE Uni. of Pennsylvania Press, Philadelphia, 1955, p.76

is the complex of ideals, moral notions, institutions, customs and laws, roles and role relationships, rights and duties, prescriptions and proscriptions which mediate people's interactions on the basis of reciprocity. Within traditional societies the moral order is usually founded on kinship relations while in modern societies it has been differentiated into such realms as the family, the economy, politics and the law. The relationship between the individual and the moral order exemplifies the relationship between wholes and parts in which the whole constrains the parts by providing the environment within which they function, and in doing so, changes the nature of the parts. The moral order transcends individuals and orders their behaviour by providing the reasons by which they can act to substantiate themselves in the eyes of the generalized other, thus transforming them into moral agents. The relationship must also be understood in temporal terms as the individual must be seen as participating in a higher temporal order through taking the perspective of the generalized other and acting in accordance with this perspective. The individual's actions and life are then raised from their particularistic immediacy to become part of the temporally transcendent process of becoming of the moral order, and in this way take on an objective significance transcending the contingent existence of the individual organism. At the same time these different temporal orders make possible the reflexivity required for an individual to integrate his or her disparate engagements into the unity which is him or herself. The nature of this has been analysed by G.H.Mead whose ideas on this topic have been summarized by M.K. Tillman:

> To internalize the viewpoint of the generalized other is to remain with one's own subjective, immediate stream of time consciousness and simultaneously to incorporate the intersubjective time dimension of society...The unique self, then, emerges from society....at the point of intersection of multiple temporal systems in social experience.(1)

With the development of formal operations, the moral precepts uncritically adopted in the process of attaining the perspective of the whole community and the sense of being a substantial self become questionable as the actual state of affairs comes to be seen as one among other hypothetical possibilities. This ability to question past certitudes produces a radical change in the individual. Prior to this s/he had thought of him or herself as a practical ego and others were seen as "empty heads turned towards one, single, self-evident world where everything takes place..."(2) Reflection destroys this self-evidence as "man turns his gaze inwards and finds in himself a world of thoughts, feelings, dispositions, passions, inclinations, tendencies and desires; he discovers his inner self."(3) This turning inwards isolates the individual who now sees his or her world as an island separated from the worlds experienced by others. There dawns an awareness of what Sartre called the "plurality of solitudes." (4) The consequence of this is to undermine the feeling of certainty about the nature of the world and to dissolve the immediate sense of self worth and community achieved at an earlier age in the context of one's immediate social

(1) Mary Katherine Tillman "Temporality and Role-Taking in G.H.Mead" in SOCIAL RESEARCH Vol.37, 1970, p.544
(2) M.Merleau-Ponty (1962) op.cit. p.355
(3) Remplein as cited by Strasser (1969) op.cit. p.97
(4) Cited by Michael J. Chandler in "Relativism and the Problem of Epistemological Loneliness in HUMAN DEVELOPMENT 18, 1975, p.172

environment. This identity crisis leads to the dual struggle to re-orient oneself in the world and to re-substantiate onself as an objectively significant being.

How people react in this situation will largely depend on the moral order in existence and its relation to other processes. If the moral order is coherent, justified by the prevailing world-view and part of a social order which is adequately coming to terms with the problems confronting society, then the individual will be able to think it through and reappropriate it and his or her identity crisis will be transient. Where it is incoherent and contradictory to the prevailing world-view and where society is heading for disaster individuals are most likely to be condemned to lives of quiet desperation in a continuous state of ontological insecurity. However the efforts of people to overcome this identity crisis leads to a constant struggle by individuals for inter-subjectively valid or objective grounds to live by, and this is a constant impetus towards the recreation and development of the moral order towards greater rational coherence and universality. The increasing objectivity associated with this universalization of the moral order does not imply emotional detachment but an extension of emotional involvement into an ever broader community.

ORIENTATION, COMMUNICATION AND THE DEVELOPMENT OF SYMBOLIC UNIVERSES

In this section I will try to describe how decentring from immediate experience and the associated differentiation of the self from an immediate unity with others leads to an awareness of the world as something shared with others and as largely beyond one's grasp. I will then try to show how this leads to a need to communicate one's own experiences of the world in order to have them affirmed by others, and a need to develop an orientation to the world as a whole rather than to one's immediate environment. Since the individual not only requires affirmation by others of this common orientation, but must understand the orientation of others in order to orient him or herself, the struggle for communication and the struggle for an orientation to the world cannot be examined separately. The development of the symbolic universes can then be understood as part of the process by which people strive to develop a common orientation to the world.

It was seen that the child originally does not differentiate him or herself from his or her experience of the world and other people within it. Differentiation begins with the cognitive development which takes place with activity, and this in turn leads to a differentiation of the self from the immediate experience of unity in the 'we' relationship with others. Where the child has not distinguished his or her own perspective on the world from that of others s/he 'is apt to recognize himself in everything."(1) This is manifest in the way in which

(1) M.Merleau-Ponty "The Child's Relation with Others" (1964) op.cit. p.150

the child will use the world 'hand' in a way which makes no radical distinction between his or her own and the hand of others. With the pre-operational level of cognitive development the child comes to distinguish his or her own perspective from that of others, and at the same time to distinguish all perspectives from the external object. This makes the child's own viewpoint questionable from the viewpoint of the other and opens up the issue of the relationship between these viewpoints. To overcome this problem and to regain the sense of communality with the other the child is impelled to express him or herself to validate his or her own perspective in the eyes of the other and to question others to relate this perspective to theirs. By achieving such affirmation of the child's own viewpoint, his or her experience of the world takes on the aspect of common reality. But this reveals to the child that his or her surrounding world is only a small part of the world, and s/he is further impelled to question the other to see what his or her place is in this world. With further cognitive development enabling the individual to take the perspective of the generalized other, the world comes to be experienced as shared not only with those with whom one comes into face to face contact, but with all the anonymous contempories who make up and contribute to the functioning of society and with all predecessors and people not yet born. With this development the child is impelled to relate the immediacy of his or her surrounding world to ever larger contexts. That is, the child must develop a world-view or world design. That people require such a conception of the world within which they can define their position has been argued by Crane Brinton and Erik Erikson who quoted him:

> ...all normal people are metaphysicians; all have some desire to locate themselves in a 'system', a 'universe', a 'process' transcending at least the immediate give-and-take between the individual and his environment; for all normal people the conscious lack or frustration of some such understanding will result in a kind of metaphysical anxiety.(1)

This conception of the world is developed almost entirely through communication with others and is understood as reality only as long as it can be confirmed by such communication.

The possibility of the development of such communication derives from the development of the symbolic function with the development of pre-operational thought. As was pointed out in the section on cognitive development, the symbolic function makes possible the representation of the known thing in a field that is different not only from the original thing, but also from the field in which the knowing activity takes place. For this reason the symbol can have a double aspect: it can be both meaningful to a person and can be some aspect of the physical world and for this reason it can be intersubjective. Communication involves expression through the production of such symbols, whether these be spoken sentences, paintings or buildings. Such expressions then become part of an intersubjective order of symbols with transcends the particular act of

(1) Erik Erikson YOUNG MAN LUTHER: A STUDY IN PSYCHOANALYSIS AND HISTORY Norton & Co. N.Y., 1962, p.110

communication. To participate in this order the individual must become a hermeneutical agent, interpreting the meanings of speech, actions and products of others, and be capable of expressing him or herself in a way that can be understood by these others. As a hermeneutical agent, the individual does not simply reduplicate the intentions of the communicator in his or her own mind, but actively tries to assimilate what is meant by the expressions of the others to his or her own developing world-view. But at the same time, the individual is impelled to express him or herself in terms of his or her understanding of the world so as to validate this understanding. By becoming an articulate member of the symbolic order in this way the individual circumscribes a variety of states of affairs into his or her perspective, and by doing so becomes comfortably situated in interpersonal space and time. It is by developing the ability to adjudicate any state of affairs that the individual is able to encompass the entire world within his or her purview and so attain a comprehensive world-view.

Orientation through communication is not simply a matter of being informed about the state of the world. Communications are also performances by which people give orders, place themselves under obligations or define relationships with each other. The multiple uses to which language can be put have been traced out by J.L. Austin. However the fact that language has such multiple uses does not mean that communication about the nature of the world is not an extremely important characteristic of dialogue. The pragmatic use of language to form new relationships between people, to redefine social status and to give directions is only possible where there is already a largely shared understanding about the nature of the world in general and the immediate situation in particular.

Language is not the only medium through which people communicate and by means of which they orient themselves to each other. Communication takes place through body language, gestures, dress, ceremonies and facial expressions. Wearing a uniform, putting on a wedding ring, standing on a dais and building a house all involve communicating something. Economic exchanges are at the same time communicative exchanges, and the style with which one does things communicates something about one's social background. Even in the act of speaking itself, accent and tone of voice communicate something over and above the meaning of the words. The products of activity are also important communications. This includes not only works of art but also signals such as traffic lights, or less obviously such features as the layouts of buildings which indicate where different things should be done. The use of language is one form of communication among others, albeit the most refined form, and is generally associated with a great many other forms of expression including the activities which have gone into making the physical environment in which speaking takes place.

With the development of the symbolic order, there is constituted the world of shared understanding, the common world. The common world as such is not an object of experience, but is the ultimate unmoved basis presupposed by every experience and embraces all possible objects of both our own and other's experience.(1) It includes not only naturally occurring things such as trees and rocks, but objects such as roads, villages, spoons and so on which have been moulded by the human action which they serve and each of which "spreads round it an atmosphere of humanity."(2) It is also a world of families, organizations, institutions and crowds, of typified situations which require typified responses to typified expectations,(3) of rights and obligations, or moral notions and injustices, of collective projects and commitments such as promises and feuds. That is, the common world is not only the world shared by virtue of its existence independent of people or by virtue of this independent world being understood in the same way, but it is a world which largely comes into being by virtue of the establishment of a common understanding as to what are the relationships between people. In other words, people's understanding of the world, sustained by the production of symbols in the process of communication is itself a part of the world which must be understood by each individual.

The symbolic order has numerous dimensions. Apart from the meanings intended to be communicated by symbols, the symbolic order involves a number of sign sets of which language is only the most refined. The symbolic

(1) Ludwig Landgrebe "The World as a Phenomenological Problem" in PHILOSOPHY AND PHENOMENOLOGICAL RESEARCH, Vol.1, 1940-41, p.49f
(2) Maurice Merleau-Ponty PHENOMENOLOGY OF PERCEPTION tr. Colin Smith, Routledge & Kegan Paul, London, 1962 p.347
(3) Maurice Natanson THE JOURNEYING SELF: A STUDY IN PHILOSOPHY AND SOCIAL ROLE, Addison-Wesley, Reading, Massachusetts, 1970, p.167

order also entails creative activity such as the production of sentences by which symbols are produced, the activity of understanding symbols, and the material bases of symbols of varying durability and efficacy which make communication possible. Various facets of this order have been examined in isolation from the total context, and efforts have been made to delimit these facets as distinct and self-contained fields of study. For instance the tradition deriving from Herder and von Humboldt has focussed on the individual subject and his or her creativity, hermeneutics has focussed on the process of understanding while structuralism has focussed on the sign systems as such. While these approaches have frequently been fruitful, the effect of this specialization has been to distort understanding of the symbolic order.

The dominant school of thought at present which attempts to understand the symbolic order, and the school which is most important both in the contributions that it has made and inthe distorting effect that it has had on the understanding of human communication is structuralism. The founder of this school was Ferdinand de Saussure who defined the basic position which came to be developed as structural linguistics in his book COURSE IN GENERAL LINGUISTICS.(1) In this work, Saussure drew a distinction between language-speech (langage) - the sum of all the phenomena involved in the realization of verbal activity, and its two components: language

(1) Ferdinand de Saussure COURSE IN GENERAL LINGUISTICS (1916) tr. Wade Baskin, Fontana/Collins, 1974

as a system of forms (langue), and the individual speech act, the utterance (parole). He argued that it is impossible to treat speech scientifically, and that only language as a system of forms could be adequately defined to allow for such treatment:

> Taken as a whole, speech is many-sided and heterogeneous; straddling several areas simultaneously - physical, and psychological - it belongs both to the individual and to society; we cannot put it into any category of human facts, for we cannot discover its unity.
>
> Language, on the contrary, is a self-contained whole and a principle of classification. As soon as we give language first place among the facts of speech, we introduce a natural order into a mass that lends itself to no other classification.(1)

Language considered as such is social rather than individual and as a "relation between simultaneous elements"(2) is ahistorical or synchronic. This is sharply distinguished and separated from historical or diachronic phenomena involving "the substitution of one event for another."(3)

It is the notion of such a synchronic relationship between elements, referred to as a system or structure which has formed the basis of structuralism. A system in this sense is defined as "an autonomous entity characterized by internal dependencies."(4) and as such is charactertized by three basic features:

(1) ibid. p.9
(2) ibid. p.91
(3) loc.cit.
(4) James J. Dagenais MODELS OF MAN: A PHENOMENOLOGICAL CRITICISM OF SOME PARADIGMS IN THE HUMAN SCIENCES, Martinus Nijhoff, 1972, p.123

> ...first, by its being a totality, that is, whatever the "composing elements" in the system, they are subordinated to the laws which define the system as system. Second, a system is characterized by multiple transformations interdependent with each other and with the totality, that is, they are dependent upon the structure itself. This points to a third characteristic of structure, that it is self-regulating, tends towards the conservation and enhancement of the system itself, on the one hand, and closedness towards all other systems on the other.(1)

Saussure treated language in such terms but also suggested that linguistics must be regarded as "only a part of the general science of semiology"(2), a subject which would deal with the life of all types of signs within society. This science has since been developed as semiotics, the underlying ideas of which have been outlined by Edmund Leach:

> ...all the various non-verbal dimensions of culture, such as styles in clothing, village lay-out, architecture, furniture, food, cooking, music, physical gestures, postural attitudes, and so on are organised in patterned sets so as to incorporate coded information in a manner analogous to the sounds and words of sentences of a natural language. I assume therefore it is just as meaningful to talk about the grammatical rules which govern the wearing of clothes as it is to talk about the grammatical rules which govern speech utterances.(3)

The effect of basing semiotics in general and linguistics in particular on this concept of structure has been to ignore or even reject the significance of the people who are struggling to orient themselves and communicate

(1) loc.cit.
(2) Saussure (1916), op.cit. p.16.
(3) Edmund Leach CULTURE AND COMMUNICATION C.U.P., Cambridge, 1976, p.10

by means of these sign sets. The laws governing the behaviour of signs are taken as the prime reality of cummunication, while the meaning of signs is ignored. The final result of this way of thinking is a form of reductionism to the whole in which people are seen as nothing but cyphers of semiotic structures. This had led structuralists to claim that people are spoken by their language rather than that they speak, or that they are thought rather than that they think.(1)

In reaction to this formal objectivism, Noam Chomsky has attempted to develop a theory of linguistics which concentrates on the individual and his or her linguistic competence, that is, on the ability to produce and understand strings and combinations of words which have never before been heard. This emphasises individual creativity, but Chomsky's approach is to postulate the existence of a depth structure underlying the superficial structures of particular languages. The superficial structures are then thought to be produced by transformational or generative procedures from these deeper structures, so that grammatical sentences are produced in any language. This approach led Chomsky to suggest that the depth structures are innate, existing prior to the learning of any particular language, and as such, the same for all people, and concluded that linguistic universals must "be a biological property of the human mind." and that there will "definitely someday be a physiological explanation for the mental processes

(1) J.P. Sartre "Replies to Structuralism" in TELOS No. 9. 1971, p.113

that we are now discovering."(1) He argued that without such a pre-existing tacit knowledge of linguistic universals, it would be impossible for a child to learn a language.(2) This implies that the capacity to speak grammatically is a single, unitary characteristic deriving from a particular structure of the brain which is a product of evolution and which exists prior to and independently of the learning of language. Such abstraction from the social context within which language is used then has a tendency to lead to the understanding of this social context in terms of brain physiology rather than in terms of conscious human beings in continuing social practice.

The two forms of reductionism are combined in Levi-Strauss whose efforts to understand kinship relations and mythology in structuralist terms were a major impetus behind the development of French structuralism. Levi-Strauss followed the Prague school of linguistics and in particular he accepted that structural analysis involves the four operations described by N. Troubetzkoy.(3) First, it shifts from the study of conscious phenomena to their unconscious infrastructure; second, instead of treating terms as independent entities the relations between terms is taken as the basis of analysis; third, it is necessary

(1) Cited by George Steiner in EXTRATERRITORIAL: PAPERS ON LITERATURE AND THE LANGUAGE REVOLUTION (1971) Penguin Books, Harmondsworth, 1975, p.123
(2) Noam Chomsky ASPECTS OF THE THEORY OF SYNTAX M.I.T. Press, Cambridge, Mass. 1965, p.27
(3) Claude Levi-Strauss STRUCTURAL ANTHROPOLOGY tr. Claire Jacobson and Brooke Grundfest Schoepf, Penguin Books, Harmondsworth, 1972, p.33

to regard the whole domain as a system; and finally it should aim at discovering general laws. Like Chomsky, Levi-Strauss thought of the unconscious infrastructure which manifests itself in the construction of sign chains as "an original logic, a direct expression of the structure of the mind (and behind the mind, of the brain.)"(1) This evolutionary basis limits what is humanly possible, and for this reason Levi-Strauss concluded that the possibilities can be specified:

> The customs of a community, taken as a whole, always have a particular style and are reducible to systems. I am of the opinion that the number of such systems is not unlimited and that - in their games, dreams or wild imaginings - human societies, like individuals, never create absolutely, but merely choose certain combinations from an ideal repertoire that it should be possible to define. By making an inventory of all recorded customs, of all those imagined in myths or suggested in children's games or adult games, or in the dreams of healthy or sick individuals or in psycho-pathological behaviour, one could arrive at a sort of table, like that of the chemical elements, in which all actual or hypothetical customs would be grouped in families, so that one could see at a glance which customs a particular society had in fact adopted.(2)

To analyse the sign systems of societies Levi-Strauss drew a distinction between the paradigmatic and syntagmatic aspects of sign production. The nature of this distinction is best illustrated by analogy with music.(3) The paradigmatic aspect of music is the harmony in which different instruments play the same music which is then heard in combination, while the syntagmatic aspect is the melody

(1) Claude Levi-Strauss TOTEMISM (1967) to Rodney Needham, Penguin Books, Harmondsworth, 1969, p.163
(2) Claude Levi-Strauss TRISTES TROPIQUES (1955) tr. John and Doreen Weightman, Penguin Books, Harmondsworth 1976, p.229
(3) Claude Levi-Strauss THE RAW AND THE COOKED: INTRODUCTION TO THE SCIENCE OF MYTHOLOGY Vol.1 (1964) tr. John & Doreen Weightman, Harper, N.Y. 1975 pp. 14-30

in which one note follows another. Paradigmatic association occurs when notes are played in different keys or where a sequence of notions is interpreted as a sequence of finger movements which then becomes a sequence of sound waves reaching the ear. This can be thought of as involving a series of metaphors where the same symbol is transposed into a different manifest form. The sequence of notes is a syntagmatic chain, and this can be the sequence of notations or the sequence of sounds. The elements of a syntagmatic chain are signs, and they are bound together through simple contiguity or metonymy. Communication involves both paradigmatic association and syntagmatic chains together. It is argued that since all kinds of human action: dancing, building, worshipping and so on serve to convey information each of these can be a paradigmatic transformation of the others. Structuralist analyses attempt to unravel the syntagmatic chains and paradigmatic relationships involved. Many actions can only be understood as very complex relations between the syntagmatic chains and the paradigmatic transformations which take place. This is exemplified by Edmund Leach's analysis of how it is that people come to believe in the efficacy of magic and sorcery.(1) However to illustrate the sorts of analyses made by structuralists I will consider syntagmatic chains and paradigmatic transformations separately.

For there to be syntagmatic chains, there must be a number of elements which can be discriminated from each other. As Leach put it:

(1) Leach (1976) op.cit. p.29

> The indicies in non-verbal communication systems, like the sound elements in spoken language, do not have meaning as isolates but only as members of sets. A sign or symbol only acquires meaning when it is discriminated from some other contrary sign or symbol. (1)

Levi-Strauss believes that the most fundamental structure of the mind and the common ground of all human though impels people to develop sign sets in the form of binary oppositions. He was particularly concerned to understand kinship relations in these terms, but numerous other sign sets have been analysed to show that they are based on such oppositions. These include types of clothing, buildings or rooms in a house, food, traffic lights and so on. The syntagmatic chains are the sequence of elements constructed according to some grammar. Thus in kinship relationships marriage is seen as an exchange of women where the kin relationships between these women are discriminated according to binary oppositions, and the marriage rules are understood as the grammar governing the sequences of exchanges which take place. In this way Levi-Strauss tried to delimit all the possible forms of kinship relations and their associated marriage prescriptions and proscriptions. Thus syntagmatic chains can be anything from sequences of marriages, to a sequence of words in a sentence. Often the duration required for the manifestation of a full chain is so long that the parts are not thought of as being related to each other. For instance wearing white symbolizes a woman's entry into marriage in contrast to wearing black which symbolizes leaving it. Both these actions are part of a single syntagmatic chain.

(1) ibid. p.49

Simple examples of paradigmatic transformation are: where social status is represented metaphorically by elevations, the person of greater social status being physically elevated above those of lesser status; or where black is taken to stand for what is bad, while white is taken for purity and goodness. More complex transformations occur in rituals and ceremonies in which the participants transmit collective messages to themselves. However paradigmatic transformations have been most carefully studied in the field of mythology. In the myths of traditional societies the world of things is understood metaphorically as a world of persons, and relations between things are understood in terms of relations between persons. It is largely on this basis that it is believed that the physical world can be affected through symbolic activity. Reciprocally nature is used as a mataphor to interpret the human order, thus giving rise to totemic institutions. The natural distinctions observed between biological species as collections of different types of individuals are used to classify people into different groups. In this way, through metaphor or paradigmatic transformation, nature and society are seen to mirror each other. The consequences of this have been described by Maurice Godelier:

> Spontaneously, by systematically covering all the possible analogous parallels between Nature and Culture, thought constructs a gigantic mirror-effect, where the reciprocal image of man and the world is reflected ad infinitum, perpetually decomposing and recomposing in the prism of Nature-Culture relations. Using analogy to bring together all aspects and levels of Nature and Culture, thought in its spontaneous or primitive state is immediately and simultaneously analytic and synthetic and has the ability both to totalize all aspects of the real in mythical representation and to pass from one

> level of the real to another by the reciprocal transformations of its analogies. By analogy the whole world makes sense, everything is significant, everything can be explained within a symbolic order where all the positive known facts transposed into subject matter for myths, may take their place with all their rich abundance of detail.(1)

Since the syntagmatic chains which are paradigmatically transformed to produce myths must be based on elements discriminated as binary oppositions, this mirror effect will give rise to a conception of the world in which everything is divided into oppositions. Thus the primitive world tends to be divided into such opposites as culture and nature, domestic and wild, friend and foe, good and evil, male and female, secular and sacred, up and down, left and right and so on in various complex relationships.

Such duality is most clearly revealed in Marshall Sahlin's analysis of the Maolan Islanders of Eastern Figi.(2) In this society the population is divided into two groups: the Land people who were the original settlers, also known as the Animal people; and the Chiefs. The Land people are seen to be the original inhabitants, and concentrate on growing food, while the Chiefs are seen to have arrived later by sea, conquered the Land people and now concentrate on fishing. As Sahlins notes:

> One can already sense the symbolic productivity of the dualism. A difference of social groups

(1) Maurice Godelier PERSPECTIVES IN MARXIST ANTHROPOLOGY (1973) tr. Robert Brain, Cambridge U.P., Cambridge 1977, p.213.
(2) Marshall Sahlins CULTURE AND PRACTICAL REASON Uni. of Chicago Press, Chicago, 1976, p.24ff.

> corresponds to the distinction of land and sea on the geographical plane, itself an instance of a general spatial differentiation of interior and peripheral, correlated with oppositions of indigenous and foreign, earlier and later, even animal and cultural; the same groups again are inferior and superior politically, ritual and secular functionally. As it were, the myth of origin is a temporal rendition of these basic distinctions, the setting of a binary logic of time, to reproduce it as narrative.(1)

It can be seen from this that the Maolan's whole world is structured so that everything is a paradigmatic transformation of everything else, and the way everything is undertaken is then designed to metaphorically represent the way everything else is undertaken. And since it is necessary to divide things into binary oppositions to form the elements of the syntagmatic chains, all these paradigmatic transformations are based on binary oppositions. The result of this is that the entire world of the Maolan has come to be understood in terms of such oppositions. Both Edmund Leach and Marshall Sahlins have shown how similar oppositions are also widespread in our own culture.

It can be seen from this that the final result of the form of structuralism inspired by Levi-Strauss is to see societies as organized by the projections of the biologically based innate structures of the mind. In this way of interpreting societies, there is no place for the efforts of people as subjects to understand their world or for the struggles between people to justify one way of looking at the world rather than another, and there is no place for historical developments within societies.

(1) ibid. p.24

The achievements of the structuralists are undeniable. The most important of these is to have revealed the all pervasiveness of the communicative process, to have revealed the 'grammars' of this communication and to have analysed the process by which people produce grammatical utterences. But both forms of reductionism have led to the role of subjects being ignored and to treating communication as though the people communicating were mere cyphers for their symbols. They are illustrations of what Whitehead called 'The fallacy of misplaced concreteness.': the abstracting out of one facet of a context and then treating this as the total reality.

This fallacy is most obvious in Saussure's treatment of language as a self-contained synchronic system independent of the people who speak. The artificial nature of this abstraction has been severely criticised by V.N. Vološinov who pointed out that there is no moment in time from which a synchronic system of language could be constructed. As he wrote:

> From a truly objective viewpoint, one that attempts to see language in a way completely apart from how it appears to an given individual at any given moment in time, language presents the picture of a ceaseless flow of becoming.(1)

To the historian of language, a synchronic system is simply a construct from which to measure deviations occurring.

(1) V.N.Vološinov MARXISM AND THE PHILOSOPHY OF LANGUAGE (1930) tr. Ladislav Matejka and I.R.Titunik, Seminar Press, N.Y., London, 1973 p.66

This leaves open the possibility of considering language as a synchronic system from the point of view of the speaking subject. If this were the case language would be experienced by the speaker as a system of fixed and inert norms to which the speaker must conform in order to be understood. However what is of interest to the speaker is the adaptability of linguistic forms to express new meanings in a given concrete context. And understanding a speaker's utterances is not simply the recognition of a form but involves understanding its meaning in a particular concrete context. As Vološinov put it:

> ...the constituent factor for the linguistic form, as for the sign, is not at all its self-identity as signal but its specific variability; and the constitutent factor for understanding the linguistic form is not recognition of "the same thing," but understanding in the proper sense of the word, i.e., orientation in the particular, given context and in the particular, given situation - orientation in the dynamic process of becoming and not "orientation" in some inert state.(1)

It can also be seen from this that it is impossible to abstract language from the efforts of people to communicate.

The relationship between speech or dialogue and language can best be understood as two processes with different temporalities. People in their struggle to communicate with each other and to orient themselves participate in the language with its vocabulary, grammatical

(1) ibid. p.69

rules and so on which transcends the temporal duration of their efforts. Language is not static since it develops with use, but such development is very slow relative to the duration of any dialogue. Understood in these terms, both language and speech presuppose each other. People can communicate because there is language, while language is sustained and develops because people are struggling to communicate with each other, and neither can be adequately understood in isolation from the other.

The other form or reductionism originates in the concentration on the production of grammatical sentences or syntagmatic chains by individuals in abstraction from the social context in which such production takes place. It was seen that this led to the individual being ascribed an innate, biologically based generative structure to account for such performances.

What is meant by Chomsky and Levi-Strauss in their references to brain physiology to account for the nature of sign systems is difficult to determine. Few would doubt that without the highly developed brains of humans there could be human language. But there seems to be more implied than this, namely that the capacity to speak grammatically is a single, unitary characteristic deriving from particular structure of the brain which exists prior to, and independently of the learning of language or any other sign system. Initial support for such a thesis would seem to be provided by the evidence for there being a speech centre in the brain located in the left hemisphere. However people with a congenital absence of the corpus callosum which connects the two hemispheres of the brain have been found to develop speech centres in both hemispheres.(1) This means that the centre in the right hemisphere which would normally be a specialist centre for spatial perception develops as a speech centre, leaving the individual deficient in such tasks as putting a jigsaw puzzle together, but without the much more serious deficiencies of people who have had the corpus callosum cut in later life by surgery.(2) This means that the order in the brain which gives rise to the ability to produce and understand language is not innate. There is a plasticity of neural maturation, the brain having the potential to develop in the way required for the organisms's adaptation to its environment. That the capacity to speak is only something which develops in a social context has also been argued by Vygotsky on the basis of his study of the development of inner speech. He wrote:

> If we compare the early development of speech and of intellect - which, as we have seen, develop along separate lines both in animals and in very young children - with the development of inner speech and of verbal thought, we must conclude that the later stage is not a simple continuation of the earlier. The nature of the development itself changes, from biological to socio-historical. Verbal thought is not an innate, natural form of behaviour but is determined by a historical-cultural process and has specific properties and laws that cannot be found in the natural forms of thought and speech.(3)

(1) R.W.Sperry "Plasticity of Neural Maturation" in EMERGENCE OF ORDER IN DEVELOPING SYSTEMS ed.Michael Locke, Academic Press, N.Y. and London, 1968, p.320
(2) ibid. p.325
(3) L.S.Vygotsky THOUGHT AND LANGUAGE (1934) tr. E.Hanfmann and G.Vakar, M.I.T. Press, Cambridge, Mass. 1962 p.51

If linguistic structures are not innate, being somehow embodied in the physiology of the brain, the question arises as to what is the relationship between them and brain processes. The implication of Chomsky's manner of conceiving depth structures is that there is some unitary and specific physiological property which is in some sense isomorphic with these structures. This manner of conceiving of the relationship between the mental phenomena and brain processes was criticised in the last chapter where it was argued that mental phenomena can only be understood in terms of the relationship between the organism and its environment, and that it is necessary to understand the central nervous system only as an essential constituent set of processes which enables such an organism-environment relationship to take place. In the case of language structures, these must be seen as developing out of the relationship between people who are striving to communicate with each other, and the developments in the brains of each which enable them to construct and understand sentences should be understood in relation to this. That the growing child confronts people who already speak a language does not alter this analysis. As in the examination of Saussure's ideas, it must be concluded that all linguistic phenomena must ultimately be understood in relationship to the struggle between people to communicate in particular social and physical contexts.

This suggests the inadequacy of Levi-Strauss's concentration on the formal aspects of the communicative process. This formalism is evident in Godelier's description of myth where a disembodied thought is seen to be transforming analogies between nature and society. The emphasis on the form of communication leads to the structuralists to consider communication only in terms of what is 'good to think', that is, the binary oppositions which are supposed to be manifestations of the structure of the human mind. But if the central feature of communication is the efforts of people to orient themselves and to communicate, then it is also necessary to consider what people are trying to communicate and why. It is necessary to consider the content of communication.

The limitations of structuralism can be overcome simply by reverting to the normal way of thinking about the relationship between people and the sign sets which have been developed in the struggle to communicate. Rather than seeing people as the puppets of their sign sets, the sign sets would then be seen as means used by people to communicate with each other. On this basis the insights of the structuralists would retain their validity but would be put into perspective. What binary oppositions there are should be seen not as reflecting the structure of the mind but as arising out of the necessity to differentiate signs in sign sets in order that communication can take place. That things in the world which are used as signs then tend to be conceived of as part of a pattern of oppositions and that this has led many societies to conceive of the world in these terms is an important insight, but when seen in perspective it should not be surprising that some societies free themselves from this tendency. While paradigmatic transformations have been shown by the structuralists to by all pervasive in society, they have not shown why they are made. It was argued that the ability to use analogies is something which develops along with formal operations. But these analogies are not the product of a disembodied thought, but are developed in order to understand the world so that people can orient themselves within it.

The inadequacies of the purely formalistic approach to the symbolic order are most clearly evident in the case of Western thought. However they are also revealed by Roy Willis's studies of the role of animal symbolism in traditional societies. These studies were mentioned in relation to this subject in Chapter I. Willis attempted to show how three different African societies: the Nuer, the Lele and the Fipa have used the ox, the pangolin and the python respectively to symbolize the ultimate meaning in life. However these animals were seen to function as more than symbols. They are the basis of analogies or metaphors on which the world-view or world-design of the different societies are built. They are the root metaphors in the same sense as used in my account of metaphysical systems, and as such, orient the individuals in these societies to the world and to each other. The consequent differences of the different analogies are characterized by Willis:

> The Nuer sense of distance from, and equality with the counterposed world of wild nature contrast markedly with the Lele sense of the dependence and moral inferiority of the village in relation to the forest, and again with the Fipa sense of the village's properly dominant role in relation to the surrounding bush. These cultural differences in the perceived structure

> of the universe correlated with differences in ideas of time of historical consciousness or lack of it, and in ideas of the self.(1)

The end of the use of these analogies is not simply an intellectual comprehension of the world as Levi-Strauss would have us believe "but an involvement of the whole being."(2)

With the child's mastery of sign sets through the development of linguistic structures and through coming to understand the meaning of the elements of these sets, s/he is able to become a participant in the symbolic order, and in this way, to appropriate the community's world design. This enables him or her to overcome the disorientation caused by the awareness that his or her experience of the world is only one limited perspective, and that other people also have their limited perspectives on the world. The child can now locate him or herself within a common world shared with others, and is at the same time able to regain the lost unity with others through the assurance that others experience the world in the same way as s/he does. But with the development of formal operations this assurance is lost as the individual attains the ability to see the existing interpretations of the world as one among other hypothetical possibilities.

To overcome the lost sense of assurance a number of strategies can be adopted. Probably the most common

(1) Willis (1975) op.cit. p.8
(2) ibid. p.128

in traditional societies has been to attempt to reinforce the existing conception of the world by expressing it in as many symbolic forms as possible. This is exemplified by the Maolan's discussed earlier. Such societies are likely to have extended communication to encompass all forms of social life, and in this way to have been innovative in developing new symbolic buildings, paintings, statues, writing and so on. It is these societies which are most likely to be amenable to the analysis by structuralists.

An alternative strategy is to attempt to develop or improve on the existing ways of understanding the world. Such a strategy was obviously that adopted by the ancient Greeks and has predominated in modern Europe. But some traditional societies have also adopted this strategy. As Roy Willis wrote:

> ...the Fipa universe is an open one in which the frontiers of the known expand constantly, and in theory, without limit...Fipa are committed by their basic values to the active endeavour to extend the field of the known, or to incorporate more of the unknown within the compass of the known...[T]he intellectual picture of the universe is always provisional...Instead of maintenance and extension of social distinctions and cognitive categories, we find Fipa constantly seeking to subsume existing discriminations and categories within more inclusive and fundamental concepts.(1)

Such societies are also likely to have been responsible for the development of new symbolic forms, particularly those which enable an individual to express him or herself rather than the group.

Along with the developments of new symbolic forms, and closely associated with these, people have also developed

(1) ibid. p.84 and 123

new material bases for communication. The most revolutionary of these developments was that of a light weight but enduring material which could be written on. This has vastly extended the scope, both spatially and temporally of communication and has generally supported the strategy of trying to develop or improve on the existing conception of the world rather than of conserving old ideas.

With the emphasis on development both of symbolic forms and of material bases for communication in civilized societies there has tended to develop a sharp differentiation of symbolic universes, each of which has tended to specialize in that at which it has been most competent. Because of writing natural philosophy and science developed focusing on the nature of the world as it is independent of human existence, while art forms such as drama and painting try to embody otherwise indefinable experiences, mainly concerning our emotional relationships to the world and each other. This division has been reinforced by positivistic ideas which have projected science as something which is completely objective. However in the light of process philosophy in which the sharp division between subjective realms and objective realms has been rejected, and in which emotions are seen as having a valid role in the understanding of the world and our place within it, this division cannot be upheld. Science and other symbolic forms should be seen as complementary, each aimed at deepening our understanding of the world, communicating this understanding, and so orienting us in the world and in relation to each other. Van Gough's paintings should be seen as having given expression to the process view of nature along with Bergson's philosophical writings and David Bohm's writings in physics.

The enduring nature of the material bases of the symbolic forms which have been developed by civilization and the rapid reproducibility of these forms and the increasing capacity to reach a large audience means that we now are all able to participate in a developing symbolic order which transcends all national boundaries and is world-wide in scope. It is in terms of this international symbolic order that the mature individual must orient him or herself if s/he is to overcome the contingency of his or her own perspective.

THE STRUGGLE FOR POWER AND THE DEVELOPMENT OF TECHNOLOGY

In the immediacy of the 'we' experience, the young child identifies with its mother's power over the environment. But with cognitive development which develops the child's own power over the world, this vicarious sense of power begins to be undermined. This two way tendency is intensified as the child's cognition develops beyond the abilities of the higher animals. The child develops the capacity to use instruments, but at the same time becomes more aware of the extent to which the world is beyond his or her control, and of the contingency of his or her own existence. Furthermore the child finds him or herself confronted by the will of others who not only limit his or her own power, but have the capacity to reduce him or her to an instrument of their will. It is only by participating in the common projects of the community, that is, in the general will, that the individual is able to transcend the powerlessness of his or her contingent existence. The combined capacity of people to enter into common projects and to develop the instruments of control has resulted in the development of technology. In this section I will try to describe in more detail the uniqueness of human activity which makes possible this development and then briefly consider the nature of technological development.

With the decentring from immediate experience facilitated by cognitive development, the individual ceases to simply respond to the immediate situation but acts according to criteria which transcends this immediacy. The nature of this achievement can best be understood by comparison with individuals who have lost this ability, that is, brain damaged patients. Merleau-Ponty characterized the response of a brain damaged patient to the world in the following way:

> The bench, scissors, pieces of leather offer themselves to the subject as poles of action; through their combined values they delimit a certain situation, an open situation moreover, which calls for a certain mode of resolution, a certain kind of work. The body is no more than an element in a system of the subject and his world, and the task to be performed elicits the necessary movements from him by a sort of remote attraction...(1)

The patient is unable to transcend this immediacy and his actions are interpreted to have said:

> 'I experience the movements of being as a result of the situation, of the sequence of events themselves; myself and my movements are, so to speak, merely a link in the whole process, and I am scarcely aware of any voluntary initiative... It all happens independently of me.'(2)

The patient is aware of space as the matrix of habitual action and his body is a means of ingressing into familiar surroundings. This contrasts with the normal person who

(1) M.Merleau-Ponty PHENOMENOLOGY OF PERCEPTION (1945) tr. Colin Smith, Routledge & Kegan Paul, London, 1962, p.106
(2) ibid. p.105

experiences space as an objective setting and his or her body as a "means of expression of a gratuitous and free spatial thought."(1) This difference is manifest in the patient's inability to knock on an imaginary door. Whereas the action of the patient is performed against the background of the world as it is given in perception, the abstract movement of which the normal person is capable is performed against a background that is 'built up' and which transcends this. All action of the normal person is performed against such a background which is "immanent in the movement, inspiring and sustaining it at every moment."(2)

What this means is that normal human action involves a definition of the situation(3) and a formulation of goals in terms of this. However it is important to avoid conceiving action in a way that leaves an unintelligible gap between the throught that goes into defining a situation and action. Humans are in continuous interaction with their environment, and the contemplative spectator on the world should be seen as a secondary phenomenon made possible by decentration from immediate experience. Contemplation is an internalized form of action in which the individual

(1) ibid. p.104
(2) ibid. p.110
(3) William I. Thomas "The Definition of the Situation" in SYMBOLIC INTERACTIONISM 2nd ed. eds Jermome G. Manis and Bernard N. Melzer, Allyn and Bacon, Boston, 1972, p.331ff .

is able to reconstitute his or her world, which s/he then responds to. In other words, thought should not be understood as an immaterial activity in which an ideal formula for action is worked out and then put into practice by an act of will, but should be seen as a continuation of action in an internalized form which can lead to re-orientation in the world and thus to new courses of action.

The decentration from immediate experience in enabling the individual to define the situation before acting also enables him or her to interpose instruments between him or herself and the world. How this transcends the capacity of animals to use instruments and the significance of this has been pointed out by Merleau-Ponty:

> A nest is an object which has meaning only in relation to the possible behaviour of the organic individual; if a monkey picks a branch in order to reach a goal, it is because it is able to confer a functional value on an object of nature. But monkeys scarcely succeed at all in constructing instruments which would serve only for preparing others;...having become a stick for the monkey, the tree branch is eliminated as such - which is the equivalent of saying that it is never possessed as an instrument in the full sense of the word. Animal activity reveals its limits in the two cases: it loses itself in the real transformations which it accomplishes and cannot reiterate them. For man, on the contrary, the tree branch which has become a stick will remain precisely a tree-branch-which-has-become-a-stick, the same <u>thing</u> in two different functions and visible <u>for him</u> under a plurality of aspects.(1)

This enables humans to use natural processes against these processes themselves to bring about their own ends.

(1) Maurice Merleau-Ponty THE STRUCTURE OF BEHAVIOUR (1942) tr. Alden L. Fisher, Beacon Press, Boston, 1967, p.175

As Hegel put it: "[Consciousness] lets nature wear itself down, quietly watches it do so, and only with a slight effort controls the whole: cunning. The broad flank of brute force is attacked by the sharp point of cunning."(1)

With the capacity to define situations and to treat things as instruments in this way together with the capacity to see the world from the perspective of others, humans are able to develop high levels of cooperation. The reciprocity of perspectives enables individuals to take account of each other's intentions, to define common problems and goals and then to coordinate their actions to utilize various instruments to bring about commonly desired results. However the same capacities also enable people to use other people as instruments for their own purposes.

Beyond the spontaneous cooperation or domination of people, the fluid interactive process between people tends to become crystallized through the conceptualization of relationships between people, problems, goals and instruments. This involves the development of action systems in which the multiplicity of different actions required of individuals are defined in terms of roles. These roles then relate individuals to each other, to the instruments used by the action system and to the problems to be overcome or the goals to be achieved. This complex of organization, knowledge about the world and instruments is what goes to make up the technological order of society.

(1) Hegel JENENSER REALPHILOSOPHIE II, SAMTLICHE WERKE, Vol.20, p.199 ed. Lasson, Leipzig: 1923, cited by Jurgen Habermas (1974) op.cit. p.155

The technological order temporally transcends the lives of the individuals in society. This is true not only of technical knowledge which can be handed on from generation to generation and the transformations of nature which serve as instruments such as tools, machinery, buildings, roads and so on, but the action systems which embody such knowledge and use such instruments in their functioning. As instruments have an intersubjective existence since what has been fashioned as such embody the rules according to which natural processes can be dominated at will in the same way by anyone, so also action systems as crystallized schedules of social coordination have an existence independent of the particular people whose activities are ordered by them. The roles which define the participant individuals' relation to the rest of the action system as well as the instruments used by it involve groups of typified expectations and typified responses, and a person filling a role is provided with epistemologies, basic categorial schemes, preference systems, and methodologies to organize the encountered experiences and to provide explanations for them. This gives the role an independence from the individuals who fill them enabling these individuals to be replaced. Thus roles are the concrete points at which collective histories and personal identities intersect. They are "the nodal junctures through which men are able to interact in society and to lead a socially relevant life."(1)

(1) Fred R. Dallmayr "Plessner's Philosophical Anthropology" in INQUIRY Vol.17, 1974, p.61

The most important action systems of a society are those centred around the production of the means of life. These include the organizations for the distribution of what is produced as well as the organizations for the production of goods through interaction with the rest of nature. The whole organized process of interaction with the environment together with the distribution of products is the production process of a society. The organized nature of this indicates that humans cannot be thought of as living on their environment. Rather the human community brings the environment under social control. The production process is society's metabolism.

The biggest limiting factor to the power of individuals or groups over their environment has always been other people. In the face of scarcity, people have had to develop action systems and weapons to preserve their territories. However with the development of the means of production to a level at which workers can produce more than is necessary for their subsistence, this conflict with others is intensified. It is then possible for groups of people to enslave others and use them as instruments of production. This means that warfare is not simply a matter of preserving territories but of which party will be reduced to an instrument. The technology of warfare has thus always closely followed the production process in importance. The subjugation of others has also required the development of a technology of social control.

Apart from the action systems of the production process and warfare, action systems are likely to be developed in societies to resolve a number of problems. Societies vary according to what they define as problems and the effectiveness with which action systems are organized to meet these. For instance the Dobuans do not define as problematic or have any means of dealing with insane and delinquent people.(1) When an individual in Dobuan society runs amuck, people simply say that the afflicted person will be right the next day. On the other hand, the Ifaluk of the central South Sea have a highly organized society with a system of distribution which provides care for the aged, ill and bereaved. These action systems are designed to overcome the contingencies of life and provide people with a greater power over their destiny.

The process of attaining power is never complete and there is generally a continuous struggle by people to augment their power. And where individual societies do reject technological advance they tend to be destroyed or enslaved by more technologically advanced societies. While technological advances are occasionally lost, there is a general tendency for these to accumulate. Furthermore technological advances are likely to be able to form the basis of further technological advances, either through providing problems requiring solution or through the advances being able to be generalized to new situations. This is not only the case with instruments and with technical knowledge but also with action systems. For instance the development of a large number of action systems generates

(1) S.Kirson Weinberg "Social Action Systems and Social Problems" in Arnold M. Rose ed. HUMAN BEHAVIOUR AND SOCIAL PROCESSES Houghton Mifflin, Boston 1962, p.407

the problem of their coordination requiring the development of political institutions which can then serve other functions than those which inspired their creation. Lastly, new developments in production are likely to develop new demands. This point was made by Marx who wrote:

> Production not only provides the material to satisfy a need, but it also provides the need for the material...The need felt for the object is induced by the perception of the object. An obet d'art creates a public that has artistic taste and is able to enjoy beauty - and the same can be said of any other product.(1)

All this indicates that the process of attaining power in the environment, that is, the technological order must be seen as having a dynamics transcending the individuals whose struggle for power generates it. By participating in this process of the becoming of the technological order people develop themselves as they form and reform their relationships to the physical world and to each other. As Marx wrote:

> ...Labour is, in the first place, a process in which both man and Nature participate, and in which man of his own accord starts, regulates, and controls the material re-actions between himself and Nature. He opposes himself to Nature as one of her own forces, setting in motion arms and legs, head and hands, the natural forces of his body, in order to appropriate Nature's productions in a form adapted to his own wants. By this acting on the external world and changing it, he at the same time changes his own nature. He develops his slumbering powers and compels them to act in obedience to his sway.(2)

(1) Karl Marx A CONTRIBUTION TO THE CRITIQUE OF POLITICAL ECONOMY Progress Publishers, Moscow, 1970, p.197
(2) Karl Marx CAPITAL: A CRITICAL ANALYSIS OF CAPITALIST PRODUCTION 3 Vols, Vol.1 (1887) tr. Samuel Moore and Edward Aveling, ed. Frederick Engles, Progress Publishers, Moscow, 1974, p.173

THE RELATIONSHIPS BETWEEN THE DIFFERENT CULTURAL PROCESSES

It was stated in the introduction to this chapter that the three formative processes of culture had some autonomy from each other, but that they were interdependent making their separate treatment artificial. This had given rise to attempts to reduce all three cultural processes to one of them. In this section I will consider the extent of the autonomy of the cultural processes and then try to show how closely related they are.

The most common form of cultural reductionism is the attempt to explain all in terms of the technological order and the least common is the attempt to explain all in terms of the moral order and the struggle for recognition. The autonomy of the moral order is the least recognized, and its significance least acknowledged. It was pointed out in Chapter I that the moral order is closely associated with the world-view by which people orient themselves and it is frequently assumed by anthropologists that what counts as moral is simply what is thought as such by each society on the basis of their beliefs about themselves. Among most Marxists the moral order is that aspect of what is designated as the superstructure which is taken least seriously.

These ideas reflect a gross underestimation of the struggle for recognition and self-substantiation and the impetus it has given to the development of the moral order. In fact the struggle for a sense of one's own significance is frequently the major motive force not only of people who participate in the struggle for a better understanding of the world and those who struggle for power, but also in those who struggle to increase their consumption. The autonomy of the moral order is evident in the development of modern Western societies. Despite the undermining of the beliefs on which the moral order is based, there have been major developments in morality over the last three hundred years. The most important aspect of this has been the increasing universalization of the moral order so that it can now be said that there exists a nascent world moral order. One has only to compare the moral order dominating the Roman world with the moral order of today to see what advances have been made. While the Roman society was based on continuous warfare to capture slaves who were then so ill treated that they did not reproduce themselves, the modern era has seen the abolition of slavery as such throughout the world, and a concern with international justice, human rights and the plight of the poor nations of the world. Those who point to the crimes of the Nazis in the Second World War should remember that such worship of war and slaughter of innocents was commonplace in the Middle Ages, and that in those days there was no world-wide revulsion against it. There is a tendency to be pessimistic about the world moral order because of the few people who take it seriously and the ease with which nations and multinational companies violate its principles. But creative processes frequently require a long duration to develop and this development is therefore difficult to perceive, while destructive activities are of short duration and easy to perceive. To see that there is progress in the development of the world moral order one must consider a longer time span and consider the fact that three centuries ago there was no world moral order at all and that relations between nations were based entirely on power politics. That the development of the moral order is simply a reflection or manifestation of the development of the technological order is undermined by the vastly different degrees of justice in societies such as Sweden, U.S.S.R., U.S.A. and South Africa, each with much the same technological development.

Some attempts have been made to explain the ideas by which people orient themselves in terms of the struggle for recognition. In particular metaphysics is often dismissed as the attempt by people to deceive themselves to avoid facing up to the reality of their own insignificance; as though our potential for understanding, intimacy and creativity did not make us any different from lumps of inanimate matter. But far more commonly ideas are seen to be inseparable aspects of the technological order, either as ideologies to legitimate the social arrangements on which this order is based or as knowledge which enables us to control things. The implications of such a reduction are that it is impossible to criticise the technological order since criticisms must themselves be simply manifestions of the developing order. But like all forms of relativism, such reductionism undermines itself since if people believe it, they have no grounds for believing that their own beliefs are any superior to other peoples' opposing beliefs since they are no less the product of the technological order than their own.

The reduction of science to technical knowledge implies that it is impossible to really understand the world, that it is only possible to know how to control it. This is characteristic of many Marxist philosophers of science. Thus J.D. Bernal conceives of physics as being primarily concerned with "the extension of the human sensory-motor arrangement."(1) And the pragmatists go beyond this in defining truth entirely in terms of what ideas are useful.(2) Such a notion of truth would support reductionist materialism since it is this conception of the world which reveals most adequately how things can be controlled. But pragmatism is clearly inadequate to account for why scientific theories are accepted. For instance it is impossible to account for why either the Copernican theory of Einstein's theory was accepted since by the time they could be regarded as useful, they had already been accepted.

While there is an obvious close association between science and technology, there are good reasons for rejecting anything more than an association. In particular, it is necessary to reject the idea that the development of technology necessarily involved the development of science. An example of technology not giving rise to

(1) J.D.Bernal THE EXTENSION OF MAN: A HISTORY OF PHYSICS BEFORE 1900, Paladin, Herts, 1972, p.16
(2) William James "Pragmatism's Conception of Truth" in PRAGMATISM: THE CLASSIC WRITINGS ed. H.Standish Thayer, Mentor Book, N.Y. 1970, esp.p.230

science and illustrating the distinction between science and technology was given in Chapter II. Here it was pointed out that Babylonian astronomy which was developed in order to establish a calander, fix the dates of festivals, and predict such heavenly events as eclipses which were regarded as omens, far surpassed the predictive ability and accuracy of observation of the Greeks, yet the Babylonians still referred to the heavenly bodies as gods and made no advance in understanding the nature of the cosmos.

Another approach which attempts to reduce science has been the efforts of such thinkers as Borkenau, Lukács, Simmel and von Martin to show how the scientific ideas which arose during the Renaissance were reflections of the new economic order. Thus the monetary economy in which everything was reduced to quantitative relationships was seen to have inspired the attempt to understand the world in such terms. However as Dijksterhuis pointed out, the beginnings of the developments of mathematical physics pre-dated the beginnings of capitalism.(1)

What this suggests is that science cannot be seen as a manifestion of the technological order but must be seen as part of the at least partially autonomous process in which people are struggling to orient themselves in the world. While the development of science might be hindered or facilitated by particular types of moral order or economic formations, it cannot be reduced to these but must be understood in its own terms.

(1) E.J. Dijksterhuis (1961) op.cit. p.241f.

Very few efforts are made these days to explain the technological order as simply a manifestation of the moral order or the symbolic order since in modern societies it is the technological order which most clearly has a dynamics of its own. While it can be shown that the moral order and the symbolic order have prevented the development of technology in societies, these societies have generally succumbed or are in the process of succumbing to those societies which have developed their technology.

While these three cultural processes do have some independence from each other, they still presuppose and largely constitute each other. For instance the moral order requires the symbolic order to raise people's perspectives above their own particularity, to legitimate moral precepts and to indicate what goals are most worth striving for if it is to satisfactorily provide its participants with a sense of their own objective substantiality; and it is through participating in society's creative processes of the technological order that individuals are most able to achieve what is recognized by the moral order as important. The nature of this relationship is indicated in Hegel's study of the relationship between the Master and the Bondsman.(1) Hegel saw this relationship developing out of the struggle for recognition. The Master subdues the Bondsman and in this way should attain success. However in reducing the Bondsman to a thing and treating him or her as an instrument, this recognition is deprived of any significance. The Bondsman on the other hand can

(1) G.W.F.Hegel THE PHENOMENOLOGY OF MIND (tr.1931) op.cit. p.234ff.

see in the Master something which s/he wants to become. But more than this, the Bondsman in constant fear of death is shaken from concern with his or her particular existence to take the point of view of the universal, and at the same time in being forced to work for the Master attains mastery over nature and impresses him or herself upon it. By creating a standing reflection of him or herself as a universal being, the Bondsman becomes such a being and attains self-substantiation in a way which is denied to the Master whose relation to nature is mediated by the Bondsman.

The symbolic order presupposes the moral order to regulate participation in it. As Jacques Monod recognized, this is so even of reductionist science which implies the invalidity of all ethics. As he put it at the end of his defence of reductionist biology:

> True knowledge is ignorant of values, but it has to be grounded on a value judgement, or rather on an axiomatic value. It is obvious that the positing of the principle of objectivity as the condition of true knowledge constitutes an ethical choice and not a judgement reached from knowledge, since, according to the postulte's own terms, there cannot have been any 'true' knowledge prior to this arbitrary choice.(1)

And the technological order is not only required to preserve the society which contains the symbolic order, but is increasingly important in the development of means of communication which are more extensive or more durable.

(1) Jacques Monod CHANCE AND NECESSITY: AN ESSAY ON THE NATURAL PHILOSOPHY OF MODERN BIOLOGY tr. Austryn Wainhouse, Collins/Fount, Glasgow, 1977 p.163

The technology of information processing is now one of the main branches of technology.

Finally, the technological order needs to be regulated by moral principles and requires high levels of communication to regulate people's behaviour and to enable them to coordinate their activities. Societies based on technological orders in which people are controlled as instruments rather than as moral agents, and in which people are disoriented and unable to believe in anything are unlikely to be able to deal with the technical problems confronting society for any length of time and are prone to disintegrate or to be destroyed by other societies.

Being both mutually dependent and partially autonomous from each other means that there is frequently tension between the different formative processes of culture. There is no inherent reason why the dynamics of each process should lead to developments which are compatible with the other processes. This is clearly the case with developments in understanding during the Renaissance which undermined the conception of the universe which had supported the moral order of the previous epoch, and the developments in the organization of productive relationships during the same period which conflicted directly with this moral order. Similarly in the present era rapid technological advances have changed society in ways which make it increasingly difficult for its participants to achieve any sense of their own significance. For such reasons advances in some processes have often been prevented or hindered so as to retain the unity of the total culture as in the past the proponents of the new science were persecuted in the Renaissance by people defending the old moral order, while today proponents of a new moral order are frequently attacked by those who want technological development to go on unhindered.

In this chapter I have tried to show the distinctively human processes which have evolved to form the human order. I showed how cognition developed in humans beyond the levels achieved by any other animals so far understood and that this development was characterized by the ability of individuals to decentre themselves from immediate experience. The imbalance this produced in the growing child was then seen to impel him or her to struggle for recognition from others, to struggle for a common orientation to the world, and to a struggle for increased power over his or her destiny. These struggles were then shown to engender the developments of the moral order, the symbolic order and the technological order respectively. These formative processes of culture were seen to be both partially autonomous and mutually dependent.

These cultural processes should not be hypostatized and thought of as independent of the people struggling to make sense of their lives. Their dynamics and the relationships between them must be understood in terms of the efforts of individuals to achieve recognition and self-substantiation, to orient themselves and communicate with each other, to attain control over their lives and so to form themselves by participating in these processes. Participating in these processes individuals must take into account different principles. They must interpret their projected actions within the context of the moral order to attain substantiation, in relation to sign sets if they are to know how their actions will be understood, and within the context of the social struggle to control the environment if they are to ensure their actions will be effective. In this way their activities are constrained by three distinct orders. Each of these requires the other: individuals must be able to orient themselves in order to act morally and coordinate their actions with others, there must be some morality underlying communication and coordinated activities before people can trust what is communicated to them and enter into joint projects and people must have some power over their lives to preserve themselves, to express themselves and to act in ways which will substantiate themselves. The inadequacies of the different cultural processes and the contradictions between them are then experienced by individuals as an incoherence in their lives.

But humans are not enmeshed in a life cycle as are animals. Having the ability to decentre themselves from immediate experience, mature humans can question everything; their conceptions of themselves, the way the world is understood, their own interpretations of the situations in which they find themselves. Every belief and every projected action are open to question. Humans have to live their lives by making decisions and making commitments to a fragile web of intersubjective meanings, and where the struggles for recognition, orientation and power over destiny are frustrated, these meanings will be questioned. Thus the various types of moral orders, symbolic systems and technological orders in which people participate and through which they attain the capacity for living authentic lives are continually being transcended.

If this description of the cultural order were a complete description of the human order one would expect a continuous development towards societies which provide greater opportunities for their members to achieve a sense of their own significance, a deeper understanding of the world and the place of humanity within it, and greater power for individuals to control their own destinies and to participate in the creative processes by which these societies develop so as to provide their members with such conditions. This indicates the extent to which this analysis is an abstraction from the total human order. Apart from the contingencies of the natural environment, it is always open to individuals to react irrationally to their situations and destroy the achievements of culture rather than augment them. Thus in reaction to limited success in achieving recognition and power and the failure of the most advanced ideas about the nature of the world to orient people in life, people are likely to turn to irrationalist movements which appeal directly to the emotions and provide a short lived satisfaction of these ends. Thus the people of Nazi Germany turned to racial and cultural myths to orient themselves and achieved a sense of their own significance and of power through participating in the Nazi war machine and attempting to subjugate other groups of people.

But even such irrational reactions to the frustrations of life do not account for the deviations from the path of continuous cultural progress. People's struggles give rise to dynamic processes which are the unintended consequences of their actions, and all purposive actions occur within environments which are largely the product of these. It is necessary to understand such processes before an adequate account of the nature of human being can be achieved. These processes will be the subject of the next chapter.

CHAPTER VII

THE DYNAMICS OF SOCIETY

> Whenever life progresses beyond the animal level to that of the spirit, and spirit progresses to the level of culture, an internal contradiction appears. The whole history of culture is the working out of this contradiction. We speak of culture whenever life produces certain forms in which it expresses and realizes itself... But although these forms arise out of the life process, because of their unique constellation they do not share the restless rhythm of life, its ascent and descent, its constant renewal, its incessant divisions and reunifications... They acquire fixed identities, a logic and lawfulness of their own; this new rigidity inevitably places them at a distance from the spiritual dynamic which created them and which makes them independent.
>
> Georg Simmel
> THE CONFLICT IN MODERN CULTURE

In the last chapter I attempted to show how humans have evolved in a way that distinguishes them from other animals. It was shown how the capacity for decentering from immediate experience which is attained through cognitive development gives rise to three formative processes of culture. These three processes were seen to be interdependent and largely coextensive while each process was seen to have its own autonomous dynamics and logic of development irreducible to any other process. While it might seem plausible to account for the dynamics of society solely in terms of these cultural processes, it was pointed out that all these formative processes of culture give rise to processes which transcend people's intentions. It is in the environment largely formed by these autonomous processes that the struggles of individuals and groups for recognition, orientation and communication, and control over their destiny take place. In this chapter I will examine these autonomous processes.

To begin with I will describe the nature and various types of social processes which develop autonomous dynamics beyond the intentions of the people whose activities sustain them. This will provide the basis for an analysis of the dynamics of society as a whole. But rather than simply attempting to describe the dynamics of society in terms of these processes I will critically examine the ideas of Marx and the Marxists. My own view of the dynamics of society will then be defined largely in opposition to the various interpretations of Marxism. My reason for working in this way is that Marx has had such a pervasive influence in the attempt to understand social dynamics. Whether or not Marx's understanding of the capitalist process was adequate in every detail is not really important. His study of capitalism is the single most important contribution to the social sciences, and the greatest social scientists since Marx have defined themselves in relation to Marx's work. (1) This gives Marx a similar place in the social sciences as Newton or Einstein have in physics and Darwin has in biology. To ignore this for ideological reasons is as absurd as the Nazis' rejection of Einstein's ideas or U.S.S.R.'s rejection of Mendel's ideas on genetics. Furthermore, more attempts have been made to interpret Marx's achievements than have been made to interpret any other work of social science. The effect of this has been that nearly all philosophical schools which have developed since the time of Marx have been represented in the history of the interpretation of his texts. Thus a history of Marxism can almost be taken as a history of philosophy insofar as it is relevant to understanding the nature of social dynamics.

(1) Irving M. Zeitlin IDEOLOGY AND THE DEVELOPMENT OF SOCIOLOGICAL THEORY Prentice-Hall, Englewood Cliffs, N.J. 1968 has argued this.

Also the name of Marx has usually been associated with the notion of a 'materialist' interpretation of history, and many of the early Marxists were in fact materialists in the sense against which much of this thesis is directed. By showing the problems associated with the different versions of Marxism, and showing how these can be overcome by adopting the ideas based on a philosophy of becoming I will have provided good grounds for accepting the approach of process philosophy.

I will then develop this account of social dynamics by showing how the relationship between the various processes of society can be analysed in terms of different temporalities. In this I will discuss the achievements of the ANNALES school of historians, and in particular, the ideas of Braudel. It will be seen in this that while this enables the relationship between cultural processes and the processes which develop as the unintended consequences of people's action to be understood,this still does not provide an exhaustive account of society. It will be seen that the members of society cannot be completely reduced to these processes. As conscious agents individuals must make judgements and commitments without sufficient grounds and they are capable of making mistakes, of acting irrationally as well as rationally, and of being evil as well as good. Society can only be fully understood by taking into account the concrete struggles of the unique individuals who make up society.

PROCESSES GENERATED AS THE UNINTENDED CONSEQUENCES OF PEOPLE'S ACTIVITIES

As with activity generally the intentional activity of people has a tendency to generate processes which constrain this activity and so perpetuate and maintain themselves. These processes can have different relationships to the activities which generate them. Some bear no relationship to what is intended and require analysis to reveal the nature of the processes to their participants. Others being the intended products of human activities such as human relationships, organizations, symbols or instruments then take on a dynamics of their own independent of the intentions of their participants. Finally there are processes which are unintentionally made possible through the intentional activities of individuals but involve the intentional activity of people to exploit these possibilities.

These processes can involve the intentional behaviour of people involved in all of the cultural processes described in the preceding chapter, but also the activities involved in each formative process of culture generate their own autonomous processes. For instance the struggles for recognition frequently generate aberrant relationships, little understood by their participants, yet which still perpetuate themselves. Such processes are illustrated by the studies by Eric Berne of the games people play. The alcoholic exemplifies such game playing. (1) Typically the alcoholic thinks of him or herself as trying to control an innate problem of addiction to alcohol, and attains recognition through his or her struggle

(1) Eric Berne GAMES PEOPLE PLAY: THE PSYCHOLOGY OF HUMAN RELATIONSHIPS, Penguin Books, 1967, p.64ff.

to overcome this problem. The alcoholic's wife or husband attains recognition through suffering the trials of living with such a person and through helping the alcoholic in his or her struggle. Other people can also be involved in this: the family doctor who plays the role of rescuer and the delicatessen man who extends the alcoholic credit and drives him or her home. Each attains a sense of significance from the role s/he plays in the game. As the alcoholic reaches full recovery the players in the game lose the sense of their own significance so that the alcoholic finds him or herself impelled to go on another binge. And so the game perpetuates itself.

Other processes are those which emerge as the products of people's intentions take on a life of their own. For instance the most fulfilling achievement of the struggle for recognition is attained in a relationship of love in which people experience both the unity of the 'we' relationship and affirm the uniqueness and automomy of each other. But such emotional commitments are fraught with possibility of failure to attain requital which can severely weaken one's being as a significant autonomous agent since one is then left defining oneself from the perspective of a person who considers one to be of little significance. This is likely to be severely exacerbated where jealousy is involved, particularly sexual jealousy. So unless there are developed moral prescriptions and proscriptions in relation to interaction between the sexes to maximise the possibility of forming such relationships and minimise the possibility of failure and of jealousy, people are unlikely to risk making such emotional commitments in the first place. Sexual morality can thus be understood to have been developed to serve an important function.

But such a morality is likely to attain a dynamics of its own so that instead of serving its original function it is taken to imply that all sexual relationships are at best a necessary evil, thus largely undermining its original purpose.

And then there are processes whose dynamics are based on individuals taking advantage of the conditions created by the intentional activity of others. For instance in traditional societies law develops as a crystallization of the moral norms regulating people's interaction, attaining explicit community recognition along with the sanctioning of force as a means of enforcing compliance with these norms. As such the original function of law is to ensure that justice prevails in society. To begin with the mediation between disputants and the enforcement of such laws was left to the individuals involved, but more complex societies have developed specialized institutions for such purposes. While the intention behind such developments is no different than the intention behind the original laws of traditional societies, the existence of such institutions provides an environment which can be exploited by individuals either for their own benefit to establish and enforce an unjust social order or to extend the capacities of society by more effectively regulating the behaviour of its members. These developments provide people with a vested interest in maintaining and developing the institutions, especially where a social order is created in which if people do have any choice, it can only be between being an exploiter or being one of the exploited. By thus providing the social environment in which people must live, the legal institutions attain a capacity for self-maintenance and development of their own independent of the original intentions behind their creation.

Similar processes develop in the struggles for communication and orientation. The sign sets themselves, and in particular language, tend to develop in ways which can be predicted but which are in no way intended by the users of the sign sets. More significant are the symbols which were originally intended to communicate experience of the world which take on a life of their own and come to be taken as a substitute for the world. Apt phrases become cliches which then operate spontaneously. Artworks which revealed new ways of experiencing the world become fetters on the mind which prevent people perceiving their own surroundings. And scientific theories developed to enable the world to be understood become things to be recited by lecturers and regurgitated by students in exams, attaining the status of grammars and vocabularies of foreign languagestaught in schools which pass on from generation to generation without the people involved ever learning to speak or read the language. Finally the development of the means of communication, particularly the daily press and television create the conditions whereby individuals are able to control and manipulate the thought of society to create a self-sustaining world of fantasy to benefit those in control of the media.

However it is in the realm of the struggle by people for control over their destinies that the most important unintended processes are generated. This is exemplified by advances in technology changing the organic bases of society in unintended ways as where agricultural technology results in the destruction of the ecosystem or salting of the soil and medical technology results in overpopulation. Organizations established for a particular purpose take on a dynamics of their own. Thus radical political movements lead to the development of organizations characterized by an inherent tendency towards ossification into rigid hierarchical order, or as Michels called it, the iron law of oligarchy. (1) But most pervasive are the unintended effects of instruments which, having been fashioned to serve a purpose, endure independently of their original creators and constrain people in ways beyond the intentions of their creators.

Instruments harbour the purposes for which they have been made within them. The essential features of most of the objects with which a person comes into contact are not their material components but these purposes. Thus a chair is defined by the intentions which it serves and which form the organizing principles of the material parts, not by the materials from which it was built. This sedimented meaning is referred to by Sartre as the 'practico-inert.' (2) There is nothing sinister about the practico-inert if it facilitates the projects of the individuals concerned as when a table or a chair are simply experienced as useful. But the practio-inert has a tendency to impose its logic upon the people who come into contact with it, depriving them of any authentic activity. People become appendages to machines rather than using machines for their purposes or they can be defined as superfluous by the machines which do all the work. The practico-inert can also destroy the moral unity of people by reducing their relationships to one of 'seriality.' (3)

(1) Robert Michels POLITICAL PARTIES: A SOCIOLOGICAL STUDY OF THE OLIGARCHICAL TENDENCIES IN MODERN DEMOCRACIES tr. Eden and Cedar Paul, The Free Press, N.Y. 1966.
(2) Jean Paul Sartre CRITIQUE OF DIALECTICAL REASON I THEORY OF PRACTICAL ENSEMBLES (1960) tr. Alan Sheridan-Smith, New Left Books, London, 1976, passim.
(3) Ibid., p. 256ff.

For example the practio-inert ensemble which makes up a city unites the individuals living in it into a relationship of reciprocity through involvement in this world of sedimented meanings designed to control the environment, but it then defines each individual in a particular situation such as lining up at a bus queue as interchangeable, in opposition to each other, and isolated. As Sartre wrote:

> isolation becomes, for and through everyone, for him and for others, the real, social product of cities. For each member of the group waiting for the bus, the city is in fact present... as the practico-inert ensemble with which there is a movement towards the interchangeability of men and of the instrumental ensemble... (1)

What characterizes all processes is that they maintain themselves with some degree of autonomy from their environment. Processes can be of varying degrees of stability and can be either homeostatic, stabilizing around a point, or homeorhetic, stabilizing along a time line. The processes which are the unintended consequences of people's actions can also be characterized in this way. Those games people play studied by Berne tend to perpetuate themselves but do not develop, while the capitalist system develops its technological domination of nature. One case which illustrates the tendency of a developing process to buffer out deviations so as to maintain a path of development or chreod is the growth of bureaucracy. C. Northcote Parkinson pointed out the tendency of these to grow at a constant rate independent of the amount of work to be done. Parkinson illustrated this by showing how the British Colonial Office grew from 1935 to 1954 at a steady rate despite the reduction in its responsibilities. (2)

(1) Ibid., p. 257.
(2) C. Northcote Parkinson PARKINSON'S LAW: OR THE PURSUIT OF PROGRESS (1957) Penguin Books, Harmondsworth, 1965, p.18f.

Developing processes can increase or decrease their degree of stability. Where processes are becoming increasingly unstable it is inevitable that there will eventually be what has been conceptualized by Thom as a catastrophe. When a catastrophic situation is approached the situation becomes unpredictable. The catastrophe results in the dissolution of the old process and its replacement by a new one. An example of a process engendered by the unintended consequences of people's actions becoming increasingly unstable and then giving rise to a new process is the arms race which occurred before the First World War. This arms race rapidly increased the instability in the relations between nations and made war almost inevitable despite the intentions of the nations involved simply to defend themselves. (1) The catastrophe occurred and the process of arms development was replaced by the destructive process of all out war.

Thus it can be seen that apart from the formative processes of culture, society consists of a multiplicity of different types of processes generated in various ways by the unintended consequences of people's actions. These frequently involve more than one cultural process and are related to each other in various complex ways. The existence of such processes makes history inexplicable in terms of human action alone. Rather society must be seen as dense, opaque and partly impenetrable to the individual, consisting of non-human complexities as well as intelligible action. To understand this as a whole is therefore extremely difficult. The most significant attempt to comprehend the totality of human society was that made by Marx, and it is his ideas which I will now examine.

(1) David Thomson argued this in EUROPE SINCE NAPOLEON (1957) Pelican, Harmondsworth, 1967, p.552f.

MARX AND THE MARXISTS

Marx's study of capitalism was the most important attempt to understand the dynamics of society as a whole in terms of the unintended consequences of people's actions. Marx tried to show how the capitalist process emerged to confront people as a second nature, how it reproduces itself, constraining the behaviour of its constituent members, how it is inclined to develop along a certain path in which there is a rapid development of society's productive power, an increasing instability in the process as a whole, and the generation of a class of people, the proletariat who would be in a position to take advantage of this instability to appropriate the developed productive powers and replace capitalism with communism.

Marx began CAPITAL by analysing the nature of commodities, exchange and money, the most commonplace features of life in capitalist society. He then went on to show how the processes involving the exchange of commodities using money made possible the development of capital, that is, the ownership of the means of production by people other than those who use them, and how this involved the development of labour power as something to be sold. It is by treating labour power as a commodity in this way that the capitalist is able to extract surplus-value from the labourer. Through this analysis Marx showed how the relationships between these commodities which seem so normal to people living in a capitalist system is in fact a fetishistic objectification of human social relationships which hides the exploitative nature of the capitalist process. With this objectification social relationships come to be conceived of as relationships between things while relationships between things are understood in terms appropriate only to understanding the relationships between people. What is involved in this is the reification of aspects of the social totality so that commodities, money and capital are conceived of as having an intrinsic value rather than being seen as derivative aspects of the social process of the production of use-values. The relationships between people are then mediated by these reifications. Marx then went on to show how this mystification of social relationships forms the basis of a dynamic process resulting in the growth of capital, the development of technology, business cycles of increasing intensity and the growth of the proletariat.

These dynamics were clearly understood by Marx as those of an emergent process which must be understood sui generis. As he wrote:

> ...the exchange of commodities breaks through all local and personal bonds inseparable from barter, and develops the circulation of social labour; and..develops a whole network of social relations spontaneous in their growth and entirely beyond the control of the actors. (1)

In this the dynamics are seen to result from the unintended consequences of people's actions. The nature of this was analysed by Engels:

> ...the conflicts of innumerable individual wills and individual actions in the domain of history produce a state of affairs entirely analogous to that prevailing in the realm of unconscious nature. The ends of the actions are intended, but the results which actually follow from their actions are not intended...(2)

These unintended results were understood by Marx as a self-ordering process which is continuously reproducing itself:

(1) Karl Marx CAPITAL Vol.I, Progress Publishers, Moscow, 1974, p.114.
(2) Frederick Engels "Feuerbach and the End of Classical German Philosophy". in KARL MARX AND FREDERICK ENGELS: SELECTED WORKS Vol.II, Foreign Languages Publishing House, Moscow, 1962, p.391.

> Capitalist production, therefore, under its aspect of a continuous connected process, of a process of reproduction, produces not only commodities, not only surplus-value, but it also produces and reproduces the capitalist relation; on the one side the capitalist, on the other the wage labourer. (1)

Such self-reproduction of the capitalist process was then explained by Marx in terms of the constraining effects of the whole upon its constituents members:

> The social relation of individuals to one another as a power over the individuals which has become autonomous, whether conceived as a natural force, as chance or in whatever other form, is a necessary result of the fact that the point of departure is not the free social individual. (2)

And it is not only the exploited of society who are constrained by their situation but also the capitalists. Marx emphasised this point:

> The self-valorization of capital - the creation of surplus-value - is therefore the determining, dominating and overriding purpose of the capitalist; it is the absolute motive and content of his activity. And in fact it is no more than the rationalized motive and aim of the hoarder - a highly impoverished and abstract content which makes it plain that the capitalist is just as enslaved by the relationships of capitalism as is his opposite pole, the worker, albeit in a quite different manner. (3)

Marx did not mean by this that the autonomous power of the capitalist system controls individuals independently of their conscious intentions. He emphasised that: "...the individual moments of this movement arise from the conscious will and particular purposes of individuals..." (4)

(1) Karl Marx CAPITAL op.cit. p. 542.
(2) Karl Marx GRUNDRISSE, tr. Martin Nicolaus, Penguin Books, Harmondsworth, 1973, p. 197.
(3) Karl Marx "Results of the Immediate Process of Production", Appendix to CAPITAL Vol.I, tr. Ben Fowkes, Penguin Books, 1976, p. 990, c/f. CAPITAL (1974) op.cit. p.555.
(4) Karl Marx GRUNDRISSE, (1973) op.cit. p. 196.

The whole constrains the individuals by determining the situation to which they must accommodate themselves.

It is because the capitalist process transcends the intentions of individuals that Marx thought of it as something that could be described as developing according to laws. But these laws only have meaning in the context of the particular self-maintaining process of capitalism, and in opposition to other economists Marx stressed that what had generally been taken as the laws of society were not valid outside the capitalist process. And the necessity implied by the notion of law was not meant to imply that people are not purposeful agents, but that it can be expected that most individuals will act intelligently and therefore predictably in the situations produced by capitalism. (1) This does not imply any form of reductionism.

Also Marx did not think of capitalism as an eternal order but saw it as developing. In other words it is characterized by a chreod. This development involves the accumulation of capital and the concentration of wealth, increasingly large and disruptive business cycles, the socialization of the means of production, and a growing capacity of the working class to take over the reigns of power. This means that it is a process which is becoming increasingly unstable. The chreod is thus shown to be leading towards a 'catastrophe' in which the proletariat will be in a position to replace capitalism with a truly human order.

Marx's achievement was to have enabled us to understand the most important autonomous process to have ever developed within the human order. But

(1) The place of necessity in Marx has been analysed by Helmut Fleischer in MARXISM AND HISTORY (1969) tr. E. Mosbacher, Harper, N.Y. 1973, Ch.4.

this left the task of how to go about understanding new developments in society. What happened in Marxism after the death of Marx is described by Karl Korsch:

> The critical principle of Marx's social science was during the subsequent development of Marxism converted into a general social philosophy. From this first misconception it was only one step further to the idea that the historical and economic science of Marx must be based on the broader foundations not only of a social philosophy, but even of an all-comprehensive 'materialistic philosophy' embracing both nature and society, or a general philosophical interpretation of the universe. (1)

But if Marx's work was to serve as more than a doctrine, and if his approach to understanding society was to be justified and if his ideas were to be advanced to interpret the changes taking place in capitalism, then such a development of Marxism was inevitable and appropriate.

The development of Marxism into an all encompassing philosophy began with the work of Engels. Engels, who was closest to Marx's thinking, argued for a form of process philosophy which he took to be the last of three stages in the development of ideas. The first stage Engels argued was that of the founders of Greek philosophy who presented a picture of the world:

> in which nothing remains what, where and as it was, but everything moves, changes, comes into being and passes out of existence. This primitive, naive, yet intrinsically correct conception of the world was that of ancient Greek philosophy, and was first clearly formulated by Heraclitus: everything is and also is not, for everything is in <u>flux</u>, is constantly changing, constantly coming into being and passing away. (2)

While Engels accepted this as the correct overall view, he argued that it "does not suffice to explain the details of which this picture is made

(1) Karl Korsh KARL MARX Russell & Russell, N.Y. 1963, p. 168.
(2) Frederick Engels HERR EUGEN DUHRING'S REVOLUTION IN SCIENCE (ANTI-DUHRING) International Publishers, N.Y. 1939 p.26f.

up, and so long as we do not understand these, we do not have a clear idea of the whole picture." (1) This then led to a second stage of thought.

The second stage of thought according to Engels attempted to rectify the shortcomings of the first view by concentrating on details. But to understand details "we must detach them from their natural or historical connection and examine each one separately, its nature, special causes, effects, etc." (2) This had been the task of natural and historical research. But for Engels this way of approaching things has led us to an opposite failing:

> this method of work has left us as legacy the habit of observing natural objects and processes in isolation, apart from their connection with the vast whole; of observing them in repose, not in motion; as constants, not as essentially variables; in their death, not in their life. (3)

The final stage of thought can be seen as a reaction against this static view of nature resulting in the restoration of the dynamic totality of the Greeks. Engels argued that Darwin's theory of evolution is the culmination of this reintroduction of dynamics into nature. However this dynamic totality is not understood in its primitive naivete, but as enriched by the achievements of science. As Engels put it:

> Thus we have once again returned to the mode of outlook of the great founders of Greek philosophy, the view that the whole of nature, from the smallest element to the greatest, fromgrains of sand to suns, from Protista to man, has its existence in eternal coming into being and passing away, in ceaseless flux, in unresting motion and change. Only with the essential difference that what in the case of the Greeks was a brilliant intuition, is in our case the result of strictly scientific research in accordance with experience, and hence also it emerges in a much more definite and clear form. (4)

(1) Frederick Engels "Socialism: Utopian and Scientific" in KARL MARX AND FREDERICK ENGELS: SELECTED WORKS, Vol.II, (1962), op.cit. p. 129.
(2) Loc.cit.
(3) Ibid., p. 130.
(4) Frederick Engels DIALECTICS OF NATURE tr. Clemens Dutt, Progress Publishers, Moscow, 1954, p. 30f.

Thus in opposition to traditional materialism, Engels affirmed that "the world is not to be comprehended as a complex of ready made things, but as a complex of processes..." (1)

Engels' ontology is essentially non-reductionist. Mechanical, chemical, biological and psychical characteristics were held to be qualitatively distinct forms of motion. The higher forms were thought to have evolved from lower forms and were not regarded as being reducible to the forms from which they had evolved. This meant that the whole of nature was merged with history, human history being a special case as the evolutionary process of self-conscious organisms.

However Engels conception of being as dynamic and creative was developed in terms of 'dialectics' which he claimed that he and Marx had rescued from Hegel's idealist philosophy. (2) He defined dialectics as "the science of the general laws of motion and development of nature, human society, and thought." (3) and argued that there are three such laws:

> The law of transformation of quantity into quality and vice-versa;
> The law of interpenetration of opposites;
> The law of the negation of the negation. (4)

However such an understanding of dialectics represents a gross confusion between the logic in terms of which the world is conceived and the world itself.

Hegel had tried to develop a dialectical logic as a logic adequate to

(1) Frederick Engels "Feuerbach and the End of Classical German Philosophy" in KARL MARX AND FREDERICK ENGELS: SELECTED WORKS, Vol.II, (1962) op.cit. p. 387.
(2) F. Engels ANTI-DUHRING (1939) op.cit. p.15.
(3) Ibid., p. 155.
(4) Frederick Engels DIALECTICS OF NATURE op.cit. p.62.

describe the achievements of the human intellect in its creation of modern culture in opposition to traditional logic which did not address this issue and made such achievements inexplicable. He wrote of this logic:

> Logic might have been defined as the science of thought, and of its laws and characteristic forms. But thought, as thought, constitutes only the general medium, or qualifying circumstance, which renders the Idea distinctively logical. If we identify the Idea with thought, thought must not be taken in the sense of a method or form, but in the sense of the self-developing totality of its laws and peculiar terms. These laws are the work of thought itself, and not a fact which it finds and must submit to. (1)

However Hegel was an idealist and conceived of the world as a self-developing Spirit. Thus he took the real world to be the realm of rational ideas, writing: "The idealism of philosophy consists only in this, in not recognizing the finite as a real being." (2) Therefore he could assume that being itself had a dialectical form. Nature was seen to be posited by Spirit as the Other of itself, (3) and the dialectic of Nature as the deduction of the concepts in terms of which Nature must be understood to reveal the Reason implicit within it, and thus through which Spirit reappropriates itself. (4) While Hegel regarded Nature as a system of stages, these were taken to be stages in the development of thought, not evolutionary stages. Hegel argued that Nature does not evolve. (5)

(1) HEGEL'S LOGIC Part I of ENCYLOPAEDIA OF THE PHILOSOPHICAL SCIENCES (1830) tr. William Wallace, Clarendon Press, Oxford, 1975, s 19, p.25.
(2) G.W.F. Hegel SCIENCE OF LOGIC (1812) op.cit. p. 168.
(3) G.W.F. Hegel PHILOSOPHY OF NATURE op.cit. s 246 Zusatz, s 247 Zusatz and s 248 Remark.
(4) Ibid. s 247 Zusatz.
(5) Ibid., s 249 and Remark to 249.

Of Engels' three laws the second and the third pertain to dialectical logic itself while the first is a statement of the categories which have been deduced by dialectical logic. Since Engels rejected the unity of thought and being his treatment of logical laws as laws of nature is a confusion. (1) The idea of the interpenetration of opposites is a point made in relation to ideas or concepts where A and not A must be seen as implying a third concept in terms of which they are related as contradictories. However such a contradictory is something entirely different from an opposition of forces in the real world where as Kant pointed out in the CRITIQUE OF PURE REASON there is real conflict. (2) The reality of such oppositions was affirmed by Marx in his CRITIQUE OF HEGEL'S DOCTRINE OF THE STATE where he wrote in opposition to Hegel's notion of mediation:

> Real extremes cannot be mediated precisely because they are real extremes. Nor do they require mediation, for their natures are wholly opposed. They have nothing in common with one another. The one does not bear within its womb a longing, a need, an anticipation of the other. (3)

Where Marx does use a dialectical logic is in his analysis of the relationships between the concepts underlying the capitalist system i.e. commodity, money, capital etc. which mediate people's interactions. That is, it is accepted that dialectics has its valid place in the realm of culture, but as I will argue later Marx did not regard the dynamics of the capitalist system as a dynamics of culture. Engels' third law, the

(1) This confusion has been carefully analysed by Lucio Colletti in "Marxism and the Dialectic" in NEW LEFT REVIEW, No.93, Sept-Oct. 1975 pp.3-29.
(2) IMMANUEL KANT'S CRITIQUE OF PURE REASON op.cit A.273, B.329, p.284.
(3) Karl Marx EARLY WRITINGS tr. Rodney Livingstone and Gregor Benton, Penguin Books, Harmondsworth, 1974, p.155.

negation of the negation, describes the process by which thought develops more adequate concepts and it is again a confusion to think that this could describe the dynamics of nature. Only where there are subjects to appraise the adequacy of concepts can there be a development of this sort. If the third law has any validity in relation to nature it would be that this is how the process of understanding nature develops, not nature itself. It is for this reason that Hegel who being an idealist could not acknowledge forces independent of the dialectical development of Spirit was led to reject the idea that nature evolves. Finally the first law according to which quantity transforms into quality and vice-versa abstracted from the whole Hegelian scheme by which the categories were supposed to be deduced does not carry any conviction beyond its being a plausible description. There is no more reason to accept it as it stands than to accept the opposite position espoused by such thinkers as Democritus and Galileo that qualitative changes are only appearances which can be explained in purely quantitative terms. In fact Engels had not fully emancipated himself from classical materialism and thought of all beings as being 'in' space and time, (1) and this committed him to the view that things have a simple location. Consequently Engels was not in a position to conceive of beings in the world as interrelated or of nature as developing new emergent qualities. His dialectical laws were nothing but a cover for the inconsistency of his ontology.

After Engels' death the general world-view which he was trying to develop came to be known as dialectical materialism and as such was further

(1) F. Engels ANTI-DUHRING op.cit. p.60.

developed by such thinkers as Kautsky and Plekhanov into the 'orthodox' position. However this development involved a movement away from a process conception of being to a classical materialist outlook, and tended to represent Marxism as deterministic and reductionist. Kautsky tried to assimilate Marx to Darwin. In this scheme he acknowledged the existence of finalism in the organic world and tried to allow for the distinctive place of humanity and to reconcile freedom and necessity. However the 'peculiar laws' of society were lost sight of in Kautsky's overall vision. As Colletti wrote:

> Kautsky could not avoid the conclusion of compressing the historical-social world into the framework of cosmic-natural evolution, to such an extent that they were no longer distinguishable. Moral choice itself was reduced in the process to a mere instinct and the 'ethical law' to a natural impulse equivalent to the instinct of procreation. (1)

Kautsky's Darwinian position suffers from all the ambiguities in the materialist version of Darwin's theories discussed in Chapter 5. It is an anti-reductionist theory understood in terms of a reductionist framework of concepts. It is this ambiguity which enables Kautsky to introduce finality into the world while remaining essentially deterministic.

Plekhanov, who tried to understand Marx in terms of his interpretation or misinterpretation of Spinoza, did not allow for any autonomy of the human order. Thought and extension were seen to be "two attributes of one and the same substance." (2) Where a human acts, his or her activity was seen as determined, appearing "as an activity subordinated to the law of necessity." (3) Freedom was regarded by Plekhanov as nothing but

(1) Lucio Colletti FROM ROUSSEAU TO LENIN: STUDIES IN IDEOLOGY AND SOCIETY (1969) tr. Ben Fowkes N.L.B. London, 1971, p.72.
(2) Cited ibid. p.72 from Plekhanov.
(3) Cited ibid. p.68 from Plekhanov.

the "recognition of necessity". (1) As Colletti pointed out, for Plekhanov "man, who in his own consciousness imagines himself to be the cause, is in reality the effect and nothing but the effect." (2)

This epiphenomenal status given to human subjects was carried over into social philosophy in the form of an economic determinism which came to be known as historical materialism. This view of society was based on the Preface to Marx's CRITIQUE OF POLITICAL ECONOMY according to which the basic cause of change in society is the development of productive forces. Relations of production appropriate to the stage of development of the forces of production then form the foundation on which arises a legal and political superstructure and to which corresponds forms of social consciousness. The development of the forces of production break through the existing relations of product on to create new relations and this eventually results in the transformation of the entire superstructure, including forms of consciousness. This objective-logical construction leaves no place for active subjects. As Helmut Fleischer wrote of the Soviet social scientists' theories based on this:

> We are not told that producers and managers are faced with professional politicians, legislators and administrators, but that 'the economy' determines 'politics', that the latter has repercussions on the economic base, and that base and superstructure influence each other with unequal determinative force. We are not told that men, who among other things work, consume and quarrel, in the process develop theoretical ideas and make practical plans about the objects of their environment (some of them because that is their profession), but that economic development produces ideas that in turn influence economic development and play an 'active role'. It is not men who behave in this way or that in relation to things and to each other, but relations that behave in this way or that in relation to other relations. (3)

(1) Cited ibid. p.69 from Plekhanov.
(2) Ibid., p.68.
(3) Helmut Fleischer MARXISM AND HISTORY (1969) tr. Eric Mosbacher, Harper Torchbooks, Harper & Row, N.Y. 1973 p.39f.

Such a social science is conceived to be value free and concerned with discovering the laws by which predictions about society can be made.

In other words the tendency of Marxist thought after Marx's death was to reduce Marxist theory to the positivistic materialism dominating society at the time, leaving Marxism with all those problems discussed in Chapter I deriving from the inability of reductionist materialism to conceptualize the place of the subject in the world. The paradox of this is that Marx can be seen as the culmination of the tradition which had been most concerned to overcome precisely this problem. Thus Kant had argued that science dealt only with the world of appearances while the subject was part of the noumenal realm or the real world. The activity of the subject according to reason was then conceived to be a 'causa noumena' and in this way ethics was provided with a foundation. To act morally was to act according to reason alone, and such acts were not explicable in terms of science and could not be reduced to the effects of a deterministic universe. Herder had rejected materialism completely and argued for a conception of being in which subjects, society and humanity as a whole were seen in the context of nature in non-reductionist terms as beings in the process of actualizing themselves. According to Herder there could be no dichotomy between facts and values in the knowledge of this world. Hegel then tried to overcome the dualism of Kant while retaining his emphasis on rationality by taking over Herder's conception of being as in the process of self-actualization. In his scheme the subject was given a pre-eminent position and the 'ought' was given a place in the world. But to achieve this synthesis Hegel adopted an idealist position, conceiving of being as Spirit and identifying thought and being. The Young Hegelians such as Feuerbach attempted to take over Hegel's achievements while rejecting his idealism, and this solution was initially accepted by Marx. But Marx then rejected the hypostatization of Man and History characteristic of these thinkers and tried to develop ideas which would deal not with 'Man' as such but men struggling in the world, and which would not project the speculations of philosophers onto the social world but would scientifically reveal the dynamics of this world. Without having developed a philosophical framework to describe the nature of his concrete investigations of capitalist society, Marx appeared to have succeeded in his efforts. His account of the capitalist order not only dealt with the concrete struggles of people in their everyday lives and showed how these struggles give rise to a dynamism which transcends the intentions of the individuals involved, but did so in a way which was explicitly evaluative and indicated to people how best to overcome the evils of capitalism. It is this unity of science and evaluation which has made Marx's work so attractive and which seems to justify thinking of him as having pointed the way to a satisfactory solution to the problems to which German philosophers had addressed themselves. The return to positivistic materialism by Marxists was thus a negation of this apparent achievement.

The result of this regression by the Marxists was that it became necessary to supplement Marx's writings with Kantian ethics. This approach was developed most consistently by Vorländer and was taken up by the revisionist Bernstein. (1) What was involved with this development was that in the face of the same problem which inspired Kant, there was a return to the

(1) Lucien Goldmann "Is There a Marxist Sociology" tr. Ian Birchall in INTERNATIONAL SOCIALISM Vol. 34, p. 14f.

same solution. Although an original synthesis of the orthodox and ethical forms of Marxism was effected by the Austro-Marxists, and in particular by Max Adler, (1) the unsatisfactory dualism of the Kantian position in turn led to a renaissance of Hegelian ideas. Thus the logical development of ideas which had occurred in classical German philosophy was repeated in Marxism. In the next section I will examine the Hegelian Marxists.

(1) Ibid., p.16f.

HEGELIAN MARXISM

As was argued in the last section, what motivated the revival of interest in Hegel by Marxists was that Hegel had attempted to provide a solution to Kant's dualism, thus giving a place to imperatives within the world. This enabled him to provide a theory of political practice which was itself grounded in the understanding of history. However while Hegel restored the union of theory and practice which had been divided by Kant, Hegel's system itself provided no guide for action. Instead the system was designed to show the ultimate harmony of reality with itself and the divine. Hegel was only concerned to show the rationality of events after they had happened, as he indicated in the Preface to his PHILOSOPHY OF RIGHT:

> One word more about giving instructions as to what the world ought to be. Philosophy in any case always comes on the scene too late to give it. As the thought of the world, it appears only when actuality is already cut and dried after its process of formation has been completed. The teaching of the concept, which is also history's inescapable lesson, is that it is only when actuality is mature that the ideal first appears over against the real and that the ideal apprehends this same real world in its substance and builds it up for itself into the shape of an intellectual realm. When philosophy paints its grey on grey it cannot be rejuvenated but only understood. The owl of Minerva spreads its wings only with the falling of the dusk. (1)

The task Hegel set his radical followers was that given that the system had overcome the disjunction between 'is' and 'ought', how could philosophical theory be related to political practice. The philosophers concerned with this issue came to be known as the Young Hegelians, and the Hegelian Marxists are those who have been preeminently concerned with the same problem. (2)

(1) HEGEL'S PHILOSOPHY OF RIGHT op.cit. p.12f.
(2) This is also how George Lichtheim interprets the return to Hegel by Marxists in FROM MARX TO HEGEL AND OTHER ESSAYS Orbach and Chambers, London, 1971 esp. pp.1-49.

The tradition of Hegelian Marxism which began with Lukacs, Korsch, Gramsci and the early members of the Frankfurt Institute had no unified outlook and its members diverged even further as they developed their positions. Those philosophers succeeding them took over themes and assimilated them to different traditions of thought such as phenomenology. Thus these philosophers cannot be identified by adherence to any specific basic views or assumptions. Rather there is a family resemblance between a large group of philosophers among whom a number of ideas have reverberated back and forth. For this reason I will concentrate my attention on that work of Marx which has been most used by these thinkers to justify their interpretations and which contains the most important ideas developed by them, that is, the 1844 MANUSCRIPTS.

As was pointed out in Chapter III, Hegel's ontology is based on the idea of a subject-object, Spirit, trying to attain full self-consciousness. Nature is posited by the divine Idea as something outside itself in order that by taking it back into itself it can attain subjectivity and Spirit, while history is the struggle of Spirit to free itself from the vestiges of Nature and to develop those objective institutions from which Spirit can attain an unobstructed view of itself as Absolute Spirit. Marx rejected Hegel's idealism and took the physical world as something having an existence independent of any subject, and emphasized the sensuous involvement of men with the world. In place Spirit, Marx took man as the subject-object which forms itself by transforming nature. As Marx wrote: "the entire so-called history of the world is nothing but the creation of man through human labour, nothing but the emergence of nature for man..." (1)

(1) Karl Marx ECONOMIC AND PHILOSOPHICAL MANUSCRIPTS OF 1844 tr. Martin Milligan, International Publishers, N.Y. 1964, p.145.

This development was understood to take place in three stages. Man's original state was understood to be one of immediate involvement in the world with non-antagonistic social relations. The second stage was seen to be man's progressive domination of nature. However this involved the alienation of man from his creative activity with the separation of labour from its means of production and the emergence of class societies. Instead of experiencing an increasing control over nature, man's creative essence appears as an external power to which he must submit. This situation also involves increasingly antagonistic social relations in which increasingly fewer owners of the means of production repress an increasingly alienated class of workers. But these workers are then in a position to overturn these antagonistic social relations and to appropriate the perfected means of control over the physical environment for their own ends. That is, the workers are the subjects who are in a position to regain man's alienated essence. The social order in which this will be achieved, the third stage, is communism which Marx described as the culmination of history:

> Communism as the positive transcendence of private property, as human self-estrangement, and therefore as the real appropriation of the human essence by and for man; communism therefore as the complete return of man to himself as a social (i.e. human) being - a return become conscious, and accomplished within the entire wealth of previous development. This communism, as fully developed naturalism, equals humanism, and as fully developed humanism equals naturalism; it is the genuine resolution of the conflict between man and nature and between man and man - the true resolution of the strife between existence and essence, between objectification and self-confirmation, between freedom and necessity, between the individual and the species. Communism is the riddle of history solved, and it knows itself to be this solution. (1)

(1) Ibid., p.135.

This system makes the ultimate goal of history man's self-actualization in communism, and conceives the process as yet to be achieved. Achievement must be brought about by action. Thus in place of Hegel's contemplative ideal, Marx's system implies a need for action and in this way philosophical theory is made relevant to political practice.

This system had much in common with Hegel's philosophy and is subject to many of the same criticisms. For instance, Marx grounded his concept of subjectivity in his ontology, taking it as paradigmatic. This means that while it forms the basis for explaining other phenomena, it is not itself something that can be regarded as in need of explanation. Thus Marx rejected any attempt to account for the origins of man as meaningless:

> When you ask about the creation of nature and man, you are abstracting, in so doing, from man and nature. You postulate them as non-existent, and yet you want me to prove them as existing. Now I say to you: Give up your abstraction and you will also give up your question. (1)

This assumption of the existence of the human subject is typically taken over by the Hegelian Marxists which means that they must simply ignore the fact that humans have evolved. Nature is only understood in relation to humans, not as that from which they have emerged. Thus Lukacs argued that "Nature is a societal category." (2) This failure to give a place to evolutionary theory is evident in even such distant descendants of Hegelian Marxism as Habermas. (3) Habermas interpreted Marx in terms of epistemology and rejected his emphasis on the control over nature. In place of this idea he argued that there are different ways of conceiving the world according to what interests are being served: technical, practical

(1) Ibid., p.145.
(2) George Lukacs HISTORY AND CLASS CONSCIOUSNESS: STUDIES IN MARXIST DIALECTICS tr. Rodney Livingstone, Merlin Press, London, 1971, p.234.
(3) Jurgen Habermas KNOWLEDGE AND HUMAN INTERESTS (1968) tr. Jeremy J. Shapiro, Heinemann, London, 1972, esp. 311ff.

or emancipatory. He argued that it is a mistake to reduce all knowledge of the world to that form which is based on the attempt to control it, that is, on technical interests. However such an approach to knowledge presupposes the existence of humans with those interests, and the presupposition is prior to all types of knowledge. There is no way that the nature of humanity or its origins can be questioned or pondered.

As in Hegel, the becoming of the world is seen as a dialectical unfolding of an inner essence which is immanent in each phenomena to be understood. This way of understanding Marx has been most fully developed and defended by Karel Kosik in his book DIALECTICS OF THE CONCRETE TOTALITY. (1) This conception of being implies that history is purely a cultural development in which the ultimate end is a rational necessity. This means that, as in Hegel, the individual tends to be seen as merely a cypher for the historical development of 'man'; as a participant in a drama rather than as an historical agent.

But Marx himself rejected the hypostatization of 'history' and 'man' involved in such a conception of historical development in his THESES ON FEUERBACH and in THE GERMAN IDEOLOGY. In relation to history he wrote:

> History does nothing, it "owns no tremendous wealth", it "fights no battles". Instead it is man, real, living man that does all this, owns and struggles; there is no such thing as "history" that uses man as its means in order to attain its ends - as if it were a separate person - for history is nothing but the activity of man pursuing his ends. (2)

and in relation to the meta-subject man:

(1) Karel Kosik DIALECTICS OF THE CONCRETE TOTALITY: A STUDY IN THE PROBLEMS OF MAN AND WORLD, Reidel, Dordrecht, 1976, esp. Ch.1 and pages 24 and 145.
(2) Cited by Helmut Fleischer in MARXISM AND HISTORY (1969) tr. Eric Mosbacher, Harper & Row, N.Y. 1973 p.17 from WERKE Dietz-Ausgabe, 1958ff. vol.2 p.98.

> The philosophers have set up as an ideal under the name of "man" those individuals who are no longer subsumed under the division of labour (and have regarded) the whole process as the process of development "of man", so that "man" was substituted for previous individuals at a different level of history and represented as the driving force of history. Thus the whole process was regarded as a process of self-alienation "of man..." (1)

Similarly Marx totally rejected the conception of the human species as a 'person' who "carried out the mysterious process of producing himself". (2)

Sartre attempted to solve this problem in his CRITIQUE OF DIALECTICAL REASON by taking individuals with needs in a world of scarcity as a starting point rather than the unfolding totality, and then attempting to show how such individuals constitute themselves into a dialectically developing totality. As Sartre described his project:

> ...it must be understood that there is no such thing as man; there are people, wholly defined by their society and by the historical movement which carries them along; if we do not wish the dialectic to become a divine law again, a metaphysical fate, it must proceed _from individuals_ and not from some kind of supra-individual ensemble. Thus we encounter a new contradiction: the dialectic is the law of totalisation which creates _several_ collectivities, _several_ societies, and _one_ history - realities, that is, which impose themselves on individuals; but at the same time it must be woven out of millions of individual actions. We must show how it is possible for it to be both a _resultant_, though not a passive average, and a _totalising force_, though not a transcendent fate, and how it can continually bring about the unity of dispersive profusion and integration. (3)

What Sartre described brilliantly in this work were the cultural processes by which individuals transcend their own situation to constitute and participate in collectives and how these collective movements crystallize

(1) Cited loc.cit. from WERKE Vol.3 p.69.
(2) Cited loc.cit., ibid. p.37.
(3) J.P. Sartre CRITIQUE OF DIALECTICAL REASON op.cit. p.36.

into organizations. He attempted to give a place to the apparent inertia of social reality with his concepts of the institution and the practico-inert in such a way that this inertia could be made intelligible in terms of dialectical reason. That is, he tried to avoid the idea that social reality might not be capable of being completely understood in terms of praxis, or that history was anything more than the types of formative processes of culture described in the last chapter. Sartre did not complete his work, writing only a few chapters of the second volume, but there is reason to think that he could not succeed in his task since he did not allow for those apparently inert features of social reality developing a dynamics of their own or for the dynamics of nature.

Marx himself increasingly emphasised that the dynamics of social reality is more than a cultural process in his studies of economics. While beginning with the assumption that humans are cultural beings whose relationships are defined conceptually, Marx's studies of economics led him to stress that the dynamics of the economic system, that is, its cycles of booms and depressions and its tendency to expand worldwide, could not be understood as a cultural process or as a dialectical development. Thus he wrote in THE GERMAN IDEOLOGY:

> In history up to the present it is certainly likewise an empirical fact that separate individuals have, with the broadening of their activity into world-historical activity, become more and more enslaved under a power alien to them (a pressure which they have conceived of as a dirty trick on the part of the so-called world spirit, etc.), a power which has become more and more enormous and, in the last instance, turns out to be the <u>world market.</u> (1)

And to stress that economic developments were not dialectical developments

(1) Karl Marx "The German Ideology" in KARL MARX, FREDERICK ENGELS: COLLECTED WORKS, International Publishers, N.Y. vol.5, 1976. p.51.

he pointed out in CAPITAL that for the most part, contradictions do not lead to development in society but simply co-exist:

> We saw in a former chapter that the exchange of commodities implies contradictory and mutually exclusive conditions. The differentiation of commodities into commodities and money does not sweep away these inconsistencies but develops a modus vivendi, a form in which they can exist side by side. This is generally the way in which real contradictions are reconciled. (1)

However not even in his later work did Marx overcome the idealist tendency to underestimate the dynamics of nature and the effects humans have on this. In the early Marx, nature is seen as the passive material to be transformed by man in the process of his self-formation while in the later Marx nature is seen as subject to laws which can be discovered and turned to man's advantage in production. Such a conception of nature does not do justice to nature as understood in terms of process philosophy which implies there is a far more dynamic relationship between the goals of men, the unintended consequences of their actions and the dynamics of nature.

Simple cases which reveal the inadequacy of any purely teleological conception of the relationship between man and the rest of nature are those in which humans undermine the conditions of their survival by upsetting the balance of the eco-system, exterminating animals on which they have depended, producing deserts, rendering soil infertile and so on. However the dynamism of the relationship of the environment to human society is more clearly illustrated by the studies by W.H. McNeill of diseases and their place in history. (2) This dynamism is particularly

(1) Karl Marx CAPITAL (1974) op.cit. vol.1, p.106.
(2) William H. McNeill PLAGUES AND PEOPLES Anchor Press, Doubleday, Garden City, N.Y. 1976.

evident where diseases have played an essential role in the social process as in the case of the early spread of civilization.

When diseases infect a society for the first time, it is likely to kill off a large proportion of the population. There are two reasons for this. One is that there is no resistance to the disease, and the other is that adults are infected. When children catch a disease it is usually less serious than if an adult between the ages of 20 and 40 catches it. Where a society loses a large proportion of its young adults, it is likely to have a far more disastrous effect on the society than if it loses the same number of young children. Children are more easily replaced. Thus new diseases tend to be catastrophic, as is exemplified in the Americas when the native population were exposed to European diseases. In Mexico, the population had been reduced from twenty-five or thirty million people to three million in 1568 less than fifty years after exposure to European diseases, and the population continued to decline to reach a low point of 1.6 million people in 1620. (1)

On the other hand populations tend to adjust to endemic diseases, so that their effect is nowhere near as lethal. However for a disease to be endemic, it is necessary for the parasites to be able to survive from one generation to infect the next. In some cases, humans are permanently affected by the diseases once they have caught it and yet are still able to survive. However in most cases a disease either kills its host, or the host recovers completely within a fairly short period of time.

(1) Ibid., p.203f.

This means that a large population is required to avoid the parasite dying out completely. It has been estimated that measles requires a population of about 300,000 to 400,000 to survive. (1) Although other diseases would not require such a large population, it is clear that such diseases are diseases of civilization. Different infections established themselves among different civilized communities of Eurasia, and once established, the children of any urban area were exposed to the disease. In these circumstances there would have been a rapid selection of individuals resistant to the disease, and nearly all adults would have become either immune to the disease through having contracted it in childhood or would have been resistant to infection in the first place.

When civilized societies had learnt to live with these 'childhood diseases', they acquired a very potent weapon. When contact was established with smaller communities for the first time, these would have been largely destroyed by disease. The members of the communities surviving such catastrophes would have lost faith in their own belief systems and so would have been able to have been incorporated into the civilized community. Disease would also have left a fringe of half-empty land on the margins of civilized societies. McNeill argued that "Only if one gives appropriate weight to the epidemiological patterns does the expansion of civilized cultural frontiers become intelligible." (2)

One of the examples McNeill used to justify and illustrate his argument for the importance of disease in understanding how civilization developed was that of India. (3) India is revealing because it has not conformed

(1) Ibid., p.60.
(2) Ibid., p.73.
(3) Ibid., p.73ff.

to the normal pattern in that it involves a plurality of cultures rather than a homogeneous culture. This is explicable when the nature of diseases are considered. Warmer climates tend to harbour more diseases than cold climates, so in the case of India the population groups that were incorporated into the civilization based on the Indus River were as disease ridden as the civilized society. The consequence of this was that there was not the same tendency towards the dissolution of the culture of these groups which were therefore incorporated with their culture intact. This resulted in the caste system involving a confederation of cultures in which new groups became semi-autonomous functioning entities.

McNeill's studies in this area clearly show the inadequacy and over-simplification involved in any account of the relationship between man and nature based on the ontology of the Marxist Hegelians. Nature is not something passive to be formed by humans in their process of self-formation. As Serge Moscovici argued: "so long as man and society are set outside and against nature, and nature is seen as static and uniform and societies as unique and dynamic, the problem of the relation of man and society to nature cannot be solved." (1) Or as Engels wrote:

> At every step we are reminded that we by no means rule over nature like a conqueror over a foreign people, like someone standing outside nature - but that we, with flesh, blood and brain, belong to nature, and exist in its midst... (2)

Nature is more than simply that which is humanized by man. Humanity is one process in a dynamic nature.

(1) Serge Moscovici (1972) op.cit. p.145.
(2) F. Engels (1976) op.cit. p.180.

These criticisms of the Hegelian Marxist position point to a general inadequate grasp of the dynamic complexity of the world. As a reaction to the exclusion of the subject from the world they have adopted a conception of being which gives the subject a central place and conceived of historical development in terms of the dialectical patterns of the formative processes of culture described in the last chapter, though emphasising the struggle for control of the environment at the expense of the other two dialectical patterns. But in doing this they have not done justice to the dynamics of nature nor to those aspects of society which develop an autonomous dynamics of their own transcending these cultural processes. The effect of this has been that despite their emphasis on praxis, the Hegelian Marxists have contrasted most with other Marxists by their political ineffectuality. Their inordinate involvement in the field of aesthetics indicates a recognition by them of the gap between their philosophies and the concrete world in which people must live, and their inability to bridge this gap. (1)

Despite the philosophical inadequacies of the Marxists who preceded the Hegelians, these thinkers were able to focus in an effective way on economics and politics, and acting on their theories they were able to play a major part in history. It is in order to recapture this heritage of socio-economic science that Marxists such as Della Volpe, Althusser and Colletti have attacked Hegelianism and this accounts for the attraction of these new intellectual trends among modern Marxists. In the next section I will therefore examine the work of Althusser and his coterie.

(1) See Perry Anderson CONSIDERATION ON WESTERN MARXISM, N.L.B., London, p.76f.

STRUCTURALIST MARXISM

The most significant school of thought within the Marxist tradition to reject the Hegelian interpretation of Marx has been structuralism. This is important not only in the context of Marxism but also due to its kinship with some of the most important movements of thought within social science outside Marxism such as general systems theory and Durkheimian structuralism. The ideas associated with these movements represent an attempt to avoid both reductionism to the constituents characteristic of classical materialism and reductionism to the whole. Bukharin and Oskar Lange have developed interpretations of Marx along these lines, but it has been the French structuralists who have developed this position most fully. Despite the fact that Althusser rejects the structuralist appellation, (1) it is Althusser and his coterie who have done most to develop the structuralist ontology for Marxism.

The ontology of structuralism as it has been developed by Althusser has much in common with process philosophy. Structuralists centre their analyses around the concept of structure and have developed the Spinozist conception of immanent causality. Thus a structure is defined as "a cause immanent in its effects in the Spinozist sense of the term... the whole existence of the structure consists...(and) is nothing outside its effects." (2) The effects produced by a structure are its own conditions of existence. Structures are also regarded as having a temporal dimension. As Balibar emphasized: "...the definition of the specific internal temporality of the structure is part of the analysis of that structure itself." (3) Society is then conceived of as consisting of a multiplicity

(1) Louis Althusser and Etienne Balibar READING CAPITAL (1968) tr. Ben Brewster, N.L.B. London, 2nd ed. 1977 p.7.
(2) Ibid., p.189.
(3) Ibid. p.288.

of structures each of which has some degree of autonomy. Since each structure has its own temporality, history must then be conceived of as multilinear, and this implies the inadequacy of the Hegelian notion of expressive causality. Althusser spelt out this position in the following way:

> As a first approximation, we can argue from the specific structure of the Marxist whole that it is no longer possible to think the process of the development of the different levels of the whole in the same historical time. Each of these different 'levels' does not have the same type of historical existence. On the contrary, we have to assign to each level a peculiar time, relatively autonomous and hence relatively independent, even in its dependence, of the 'times' of the other levels. We can and must say: for each mode of production there is a peculiar time and history, punctuated in a specific way by the development of the productive forces; the relations of production have their peculiar time and history punctuated in a specific way; the political superstructure has its own history...; philosophy has its own time and history...; scientific formations have their own time and history, etc....The fact that each of these times and each of these histories is relatively autonomous does not make them so many domains which are independent of the whole: the specificity of each of these times and of each of these histories - in other words, their relative autonomy and independence - is based on a certain type of dependence with respect to the whole. (1)

While the autonomy of the various structures and the crucial role different structures play at different times in history is acknowledged, which structure is dominant at any particular time is thought to be determined by the economic base which is then regarded as determinant in the last instance. However this is merely playing with words since neither Althusser nor Balibar offer any real analysis of how such causal relationships are possible, nor do they show the role of different temporalities in the relationship between structures. The lack of such

(1) Ibid., p.99f.

an analysis suggests that there are limitations in the basic concepts used by these thinkers. The very notion of 'structure' implies something which simply 'is', despite its definition in terms of immanent causality and temporality. Where the constituents of a whole are thought of as beings rather than activities of some sort, it becomes impossible to think of causality as supervening rather than intervening. Without such a notion of supervening causality, no significance can be given to the different temporalities of structures other than to note their existence. Under these circumstances, Althusser's assertions about the relationship between structures is little more than a description without the theoretical foundation which would make such relations intelligible.

This deficiency in Althusser's concepts generates other problems. One of these is that it is impossible for Althusser and his circle to identify structures which reproduce themselves. Rather than doing this, they have developed an abstract, atemporal model of society, based in the same way as Levi-Strauss's analysis of kinship structures on the ideas of linguistics, (1) in which all real and possible combinations of elements can be deduced. Three elements were isolated: the workers or direct producers, the means of production and the non-workers who appropriate surplus labour. These elements were seen to be combined by two relations: between the workers and the means of production in the relation of appropriation or production process, generally referred to as the forces of production; and between the workers and the appropriators of surplus labour to form the property relations or the exploitation process, generally referred to as the relations of production. All these combine to form

(1) This was noted by Andre Glucksmann in "A Ventriloquist Structuralism" in NEW LEFT REVIEW 72, 1972 p.77.

the mode of production. The content of the terms involved in the combinations and the relations between them were seen to vary according to the mode of production. This combinatory system is supposed to be capable of analysing all modes of production possible, and since the mode of production was thought to determine in the last instance all other aspects of society, all forms of society or socio-economic formations were thought to be explicable in terms of this simple system of combinations. (1)

This model hypostatizes the concepts developed by Marx in his analysis of the capitalist system. But even in his analysis of capitalism Marx did not think of the elements and relations described above as isolatable constituents. This is evident in the way he did not hesitate to describe the dissolution of relations of production (subjects in a specific objective unity) as "itself a development of the human productive forces." (2) And when these concepts are transferred to other socio-economic formations such hypostatizations are even more unacceptable. For instance it is possible to separate workers and means of production when analysing capitalism because it is a unique feature of the capitalist system that the workers and the means of production are radically separated, but in any pre-capitalist society such a separation is artificial. And in societies dominated by kinship relations, there is no obvious division between the forces of production, the property

(1) Althusser and Balibar (1977) op.cit. p.212ff.

(2) Karl Marx GRUNDRISSE tr. Martin Nicolaus, Penguin Books, Harmondsworth, 1973, p. 496.

relations, or even between infrastructure and supersturcture. (1)

In fact this approach to the attempt to understand society is very similar to that of Talcott Parson's systems approach in which the development of a universal model completely replaced the world to be understood. As C. Wright Mills wrote of this:

> Parsons has not been able to get down to the work of social science because he is possessed by the idea that the one model of social order he has constructed is some kind of universal model; because, in fact, he has fetishized his Concepts. What is 'systematic' about this particular grand theory is the way it outruns any specific and empirical problem. It is not used to state more precisely or more adequately any new problem of recognizable significance. It has not been developed out of any need to fly high for a little while in order to see something in the social world more clearly, to solve some problem that can be stated in terms of the historical reality in which men and institutions have their concrete being. Its problem, its course, and its solutions are grandly theoretical. (2)

This withdrawal from the world reflects the inadequacy of the basic concepts. Neither Parsons' concept of system nor Althusser's and Balibar's concept of structure can be defined in such a way that any instance of them can be identified as an entity in the world since in neither case is any analysis given of how it is that these entities maintain themselves. Only by doing so would it be possible to see that a system or structure had come into being, that it was maintaining itself, that it was unstable or stable, and that it could cease to exist, and only by seeing these

(1) Maurice Godelier PERSPECTIVES IN MARXIST ANTHROPOLOGY (1973) tr. Robert Brain, C.U.P. Cambridge, 1977, p. 67.

(2) C. Wright Mills THE SOCIOLOGICAL IMAGINATION Penguin Books, Harmondsworth, 1970, p. 58.

things could a system or structure be identified as an entity and its dynamics and relationship with other beings be analysed and understood. Without such a possibility these thinkers are forced to suppose that every society is articulated in the same way with the same basic relationships between their elements.

Another problem with the position of Althusser and Balibar is that they cannot give an adequate account of how a transformation could take place from one mode of production to another. One reason for this is that only structures have any ontological status in the Althusserian scheme, and these are defined in terms of producing and reproducing the conditions of their existence. With this definition the idea of a structure becoming progressively more unstable is unintelligible, and so there is no way to think of what a transformation would involve. Secondly, with the abstract approach of these thinkers societies are defined according to their mode of production and contrary to Marx who wrote "epochs in the history of society are no more separated from each other by hard and fast lines of demarcation than are geological epochs" (1) it is impossible for them to think of a new mode of production emerging and developing within the old mode of production and then slowly displacing it. Thirdly, and perhaps most importantly, Althusser and Balibar cannot conceive of people as anything but constituents of a structure and so cannot conceive of them as having any autonomy to transcend their situations to develop new modes of production. (2) These problems

(1) Karl Marx CAPITAL Vol. 1 (1974) op.cit. p.351.

(2) Althusser and Balibar (1977) op.cit. p.180 and pp.251-253.

are manifest in the work of Balibar who in his attempt to account for transitions wrote:

> All social production is subject to structural social relations. The 'transition' from one mode of production to another can therefore never appear in our understanding as an irrational hiatus between two 'periods' which are subject to the functioning of a structure...The transition cannot be a moment of destructuration, however brief. It is itself a movement subject to a structure which has to be discovered. (1)

Thus Balibar found himself having to introduce a second type of structure which he defined as producing the conditions of its dissolution in order to fill the gap between two modes of production which by definition had to be seen as eternal. (2) But this still did not account for how a transition could take place from a self-perpetuating structure to a transitional structure, and he was thus forced to fall back to the notion of accidental effects of extrinsic causes to account for these. (3)

These problems indicate the weaknesses in the ontology in terms of which Althusser and Balibar have tried to reinterpret Marx. While this ontology is closer to that of process philosophy than is that of either mechanistic materialism or Hegelianism in that it rejects both reduction to constituents and reduction to the whole, there are major differences. I will try to show in the following sections that since in terms of process philosophy it is possible to think of the relationships between people forming into self-perpetuating and self-developing processes and to think of individuals transcending their situations, it is possible to understand the opacity and intertia in society and at the same time see how radical changes can be produced within it. I will then show how this overcomes the problems of structuralism.

(1) Ibid., p. 273.
(2) Ibid., p. 274f.
(3) Ibid., p. 275.

THE ECONOMY IN SOCIETY

Whatever the ontology to which philosophers have attempted to assimilate Marx, they have all accepted that in some sense the economy is basic in the dynamics of society. In the orthodox interpretation the dynamics of the economic base is seen to determine all other aspects of society, in the case of the Hegelian version of Marxism the self-formation of man is seen as essentially a process of humanizing nature, while the structuralists regard the economy as determinant in the last instance. Thus if Marxism is to be taken as a general social philosophy over and above its analysis of capitalism it is necessary to clarify what is meant by taking the economy as basic.

Marx in fact conceived of the primacy of the economy in three distinct ways. The first way in which the economy is taken as basic pertains to capitalist societies in which civil society, the realm of economic transactions has attained an autonomy from all other institutions and has come to dominate the whole society as a power beyond the intentions of its members. Capitalism is taken to be unique in this and throughout CAPITAL the difference between capitalism and other socio-economic formations in this respect is emphasised.

This conception of the primacy of the economy is in accordance with process philosophy as has already been pointed out. What is involved here is the emergence of a new process which then develops according to its own dynamics, and then constrains all those activities from which it had gained its independence. This is a simple case of supervening causality. However Marx as well as the Marxists went far beyond this.

The second sense of the primacy of the economy is complementary to the first. What Marx was concerned with here was the generic features of the human order as such, that it must be involved in a process of interaction with its physical environment in order to survive. As Marx wrote:

> The labour-process, resolved as above into its simple elementary factors, is human action with a view to the production of use-values, appropriation of natural substances to human requirements; it is the necessary condition for effecting exchange of matter between man and Nature; it is the everlasting Nature-imposed condition of human existence, and therefore is independent of every social phase of that existence, or rather, is common to every such phase. (1)

This is then presupposed when it comes to explaining the unique characteristics of capitalism:

> It is not the unity of living and active humanity with the natural, inorganic conditions of their metabolic exchange with nature, and hence their appropriation of nature, which requires explanation or is the result of a historic process, but rather the separation between these inorganic conditions of human existence and this active existence, a separation which is completely posited only in the relation of wage labour and capital. (2)

This interaction with the environment is thus an essential constituent process of any social order and defines the limits to which all other processes must accommodate. It is therefore necessary for it to be understood first in order to be able to adequately understand the other processes in society and their relationships, though this does not mean that the production process determines all other features of society or

(1) Karl Marx CAPITAL op.cit. p.179.
(2) Karl Marx GRUNDRISSE op.cit. p. 489

that it is independent of them. As Marx wrote:

> (The materialist) conception of history thus relies on expounding the real process of production - starting from the material production of life itself - and comprehending the form of intercourse connected with and created by this mode of production, i.e., civil society in its various stages, and also explaining how all the different theoretical products and forms of consciousness, religion, philosophy, morality, etc. arise from it, and tracing the process of their formation from that basis; thus the whole thing can, of course, be depicted in its totality (and therefore, too, the reciprocal action of these various sides on one another). (1)

The reference to the reciprocal action of the various sides on one another is clearly contrary to any form of economic determinism.

The main problem with this conception of society is defining the meaning of 'production process'. Some Marxists understand by this term the process by which workers interact with their physical environment, transformed by labour or otherwise. However this does not define an autonomous process and can only seem an artificial abstraction from the total social process when anything other than a capitalist dominated society is considered. In opposition to this definintion Maurice Godelier has defined the production process so as to include all aspects which are essential to its functioning. He writes:

> A production process, in fact, consists not only of one or more labour processes (man's relationship to man on the material level in a determined environment on the basis of a determined technology) but man's relationship to man, producers and non-producers, in the appropriation and control of the means of production (land, tools, raw materials, manpower) and the products of labour (hunting, gathering, fishing, agriculture, breeding, grazing, planting, handicrafts, etc.) These relationships of production may be presented in the shape of kinship relations, of political or ideological subordination. (2)

(1) Karl Marx and Frederick Engels COLLECTED WORKS Vol.5, MARX AND ENGELS: 1845-47 "The German Ideology" International Publishers, N.Y. 1976, p. 53.
(2) Maurice Godelier PERSPECTIVES IN MARXIST ANTHROPOLOGY op.cit. p.24f.

Understood in this way, the process of production corresponds to the cultural process of controlling the environment described in the last chapter as part of the struggle for power. It is by virtue of its being a self-maintaining teleological order which can only be understood in its own terms that it is possible to consider the production process as more than an abstraction. When the production process does not have its own distinct set of institutions as is the case with capitalism there is no need to conclude that it is not a distinct process since it can be defined in terms of the ends which are striven for, including the maintenance of the production process.

In taking the production process as the foundation of society Marx has instituted the same sort of revolution in social science as occurred when medieval biology was replaced by modern biology. In medieval biology what were thought to be the salient features of an animal were described without any sense of what characteristics would be consistent with each other and with the survival of the animal. (1) In terms of modern biology there is an *a priori* assumption that an animal is sustaining itself through its metabolic processes and that it is in dynamic interaction with its environment, and any characteristics which are ascribed to an animal are only taken to be plausible if they are consistent with this assumption. The production process of a society is its metabolism as Marx indicated, and as such, limits its possibilities. But a society cannot be thought of as being reducible to its production processes any more than an animal can be reduced to its metabolism, and

(1) William J. Brandt THE SHAPE OF MEDIEVAL HISTORY (1965) op.cit.p.38f.

it is only possible to fully understand the functioning of the production processes against the background of the whole socio-economic formation of which they are part. However it is not only Marxist social science which is post-medieval in this sense. Anthropologists of the cultural ecology school and historians associated with the ANNALES also understand societies as being first of all in dynamic interaction with their physical environment.

But having accepted the validity of Marx's emphasis on production process of a society because it is an essential constituent of all societies, the question arises as to why the other generic features of humanity described in the last chapter should not be given equal status.
The answer is that while the struggles for recognition, orientation and communication are relatively free from external contingencies, the production process must involve accommodation to a dynamic physical environment. This then provides the limits to which all other social processes must be accommodated if the society is to survive. This is the opposite reason for taking the economy as basic in the case of capitalism where the economy is thought to have emancipated itself from other social processes and then to have developed according to its own dynamics largely free of external contingencies.

The meaning of this basic role of the production process is most clearly evident in traditional societies confronted with a change in their environment. An example of this was the adaptation of the Plains Indians of North America which occurred with the introduction of the horse and the gun. (1) This enabled them to live by hunting the bison.

(1) Symmes C. Oliver "Ecology and Cultural Continuity as Contributing Factors in the Social Organization of Plains Indians" in MAN IN ADAPTATION: THE CULTURAL PRESENT 2nd ed., ed. Hehudi A. Cohen, Aldine Publishing Co. Chicago, 1974, pp.302-321 and Maurice Godelier (1977) op.cit. p.4f.

What is significant here is the way the tribes which had originally been based on different production processes came to resemble each other as they all adopted the same production process. The limits imposed by the changed production process were such that the tribes had to disperse into bands in winter and to concentrate and depend on each other in summer. This meant that those Indians who were originally hunter-gatherers had to adopt a more hierarchical form of organization in order to impose the discipline necessary for the summer hunt, while those who were originally horticulturalists had to adopt a more fluid and egalitarian form of organization to allow for the need for individual initiative in winter when the group had to disperse. Thus there was a tendency towards convergence and standardization in the forms of social organization of all the Plains Indians which in less than a hundred years radically transformed the original societies.

However while the production process provided limits to which the social organization had to adapt, the consequent convergence never resulted in uniformity. The Comanche who had been hunter gatherers remained more anarchistic, with less authority given to leaders and with less formal councils than the formerly horticulturalist Cheyenne. And there were even greater differences in other aspects of life such as sexual morality. (1) While these changed, they did so in different ways in the different tribes. It is thus important to make the distinction between the claim that the production process defines the

(1) Thomas Gladwin "Personality Structure in the Plains" in MAN IN ADAPTATION: THE INSTITUTIONAL FRAMEWORK Yehudi A. Cohen, ed., Aldine, Chicago, 1971, pp.373-380.

limits of other social processes and that they determine them. The differences between the tribes indicates that there were a number of ways in which the limits could be accommodated for.

The third sense in which the economy is held to be primary can be seen as an attempt to bridge the gap between the other two senses and to account for the role of the economy in socio-economic formations in between those of traditional societies and capitalism. In traditional societies where the group is likely to be faced with an immediate struggle for survival and in the capitalist socio-economic formation where the economic system has emerged as an autonomous process transcending people's intentions and dominating the whole society, understanding the place of the economy in society is straightforward. However in the other socio-economic formations in which neither of these conditions exist, understanding the role of the economy presents problems, and it is not nearly so clear that a pre-eminent position can be ascribed to the economy. But this leads to the problem of how to account for the development from one such socio-economic formation to another and of how to characterize a sócio-economic formation so as to distinguish between changes within a socio-economic formation and change from one socio-economic formation to another. To solve all these problems there is a tendency to characterize the primacy of the economy as technological determinism, thus blurring the two senses of the primacy of the economy described above and providing a definition of the different types of socio-economic formation and an account of how change takes place from one to another.

Support for such determinism can be found in the writings of Marx. For instance he wrote:

> In acquiring new productive forces men change their mode of production; and in changing the way of earning their living, they change all their social relations. The hand-mill gives you society with the feudal lord; the steam-mill, society with the industrial capitalist. (1)

The productive forces were conceived by Marx to be in continuous development.

> ...every succeeding generation finds itself in possession of the productive forces acquired by the previous generation, which serve it as the raw material for new production, a coherence arises in human history, a history of humanity takes shape which is all the more a history of humanity as the productive forces and therefore his social relations have been more developed. (2)

The development of these productive forces was described as leading to the breakdown of one socio-economic formation and the replacement by another appropriate to the new stage of development of these forces:

> At a certain stage of development, the material productive forces of society come into conflict with the existing relations of production or - this merely expresses the same thing in legal terms - with the property relations within the framework of which they have operated hitherto. From forms of development of the productive forces these relations turn into fetters. Then begins an era of social revolution. The changes in the economic foundation lead sooner or later to the transformation of the whole immense superstructure. (3)

This technological determinism is clearly fallacious as Marxist historical studies have revealed. For instance as Perry Anderson pointed out, the water wheel and the reaping machine which were invented in the first century A.D. were not generally utilized in the Roman Empire despite

(1) Karl Marx THE POVERTY OF PHILOSOPHY (1847) Progress Publishers, Moscow, 1973, p. 95.
(2) Ibid., p. 157.
(3) Karl Marx A CONTRIBUTION TO THE CRITIQUE OF POLITICAL ECONOMY (1859) Progress Publishers, Moscow, 1977 p.21.

their potential. Anderson concluded:

> Both cases amply demonstrate that mere technique itself is never a prime mover of economic change: inventions by individuals can remain isolated for centuries, so long as the social relations have not emerged which alone can set them to work as a collective technology." (1)

Then in his study of the disintegration of feudalism Anderson showed the inadequacy of technological determinism to account for the development from one socio-economic formation to another:

> For one of the most important conclusions yielded by an examination of the great crash of European feudalism is that - contrary to widely received beliefs among Marxists - the characteristic 'figure' of a crisis in a mode of production is not one in which vigorous (economic) forces of production burst triumphantly through retrograde (social) relations of production, and promptly establish a higher productivity and society on their ruins. On the contrary, the forces of production typically tend to <u>stall</u> and <u>recede</u> within existing relations of production; these then must themselves first be radically changed and reordered <u>before</u> new forces of production can be created and combined for a globally new mode of production. In other words, the relations of production generally change <u>prior</u> to the forces of production in an epoch of transition, not vice-versa. (2)

In fact the technological determinist formulation of the basic role of the economy is nothing but a projection of the situation in capitalism in which technological development is impelled to take place at a rapid rate onto the whole of history. Marx himself cautioned against such distortions of history, writing:

> What is called historical evolution depends in general on the fact that the latest form regards earlier ones as stages in the development of itself and conceives them always in a one-sided manner, since only rarely and under quite special conditions is a society able to adopt a critical attitude towards itself... (3)

(1) Perry Anderson PASSAGES FROM ANTIQUITY TO FEUDALISM N.L.B., London, 1974, p.80.
(2) Ibid., p. 204.
(3) Karl Marx A CONTRIBUTION TO THE CRITIQUE OF POLITICAL ECONOMY op.cit. p. 211.

To understand what place the economy and technological development does have in other socio-economic formations it is necessary to examine these in their own terms.

Apart from traditional societies of primitive communism and capitalism, Marx referred to the Asiatic, and Ancient or Slave and the Feudal socio-economic formations. In order to show the problematic nature of the relationship between the economy and the rest of society in other than traditional and capitalist societies I will focus on the Asiatic socio-economic formation. This is important because there have been a number of examples of it and because its very name implies that Marx did not accept that history must develop according to a determinate path, but that some regions in the world could have developed differently.

The Asiatic socio-economic formation develops in situations in which there are a number of agricultural communities in which the land is held in common and where durable crops such as wheat, barley, rice or maize are produced over and above what is required for subsistence. This allows a group to unite these communities into a larger community which they themselves represent. All the land is then declared State property, and any which is returned to the original communities is done so as a gift from the State. In this way the original communities are bound to supply labour to work the land of the greater community or in some other way to support the members representing the greater community. As Marx described it:

> ...in most of the Asiatic landforms, the comprehensive unity standing above all these little communities appears as the higher proprietor or as the sole proprietor, the real communities hence only as hereditary possessors. Because the unity is the real proprietor and the real presupposition of communal property, it follows that this unity can appear as a particular entity above the many real particular communities, where the individual is in fact propertyless, or, property - i.e. the relation of the individual to the natural conditions of labour and reproduction as belonging to him, as the objective, nature-given inorganic body of his subjectivity -

> appears mediated for him through a cession by the total community - to the individual, through the mediation of the particular commune. The surplus product - which is, incidentally, determined by law in consequence of the real appropriation through labour - thereby automatically belongs to this higher unity... (1)

The basic nature of the Asiatic socio-economic formation is most clearly revealed in Godelier's analysis of the Inca State, which, when it was destroyed by the Spanish had only been in existence for two centuries. (2)

For this reason the break from the original socio-economic formation is most clearly evident. After having designated all land, rivers, mountains, herds of llama and game as property of the State, then having returned some land to the original communities on the condition that they worked the State lands, the whole system was represented as a greater community. For the forced labour, the State provided tools and seed, food and drink, and insisted that people go to work in holiday clothes with music and song. In this way the work required was represented in the same form, with the same ideology and associated ritual as the traditional communal mutual aid schemes based on reciprocal obligation. But in actual fact this was really a misrepresentation since the production process of the dominating class was quite different from that of the traditional kinship based on communities. This new production process required a bureaucratic strata to administer the system, a standing army to maintain it and a religious order based on the cult

(1) Karl Marx GRUNDRISSE op.cit. p.472f.
(2) Maurice Godelier "The Concept of 'Social and Economic Formation': The Inca Example" and "The Non-Correspondence Between Form and Content in Social Relations" in PERSPECTIVES IN MARXIST ANTHROPOLOGY (1977) op.cit. and "The Concept of the 'Asiatic Mode of Production' and Marxist Models of Social Evolution" in RELATIONS OF PRODUCTION: MARXIST APPROACHES TO ECONOMIC ANTHROPOLOGY ed. David Seddon, tr. Helen Lackner, Frank Cass, 1978.

of the Inca, son of the Sun in order to legitimize it. At the same time the production process of the traditional kinships based systems were obliged to adapt to the needs and logic of the new production process which dominated it.

One of the difficulties involved in working out the place of the production process in the dynamics of this socio-economic formation derives from the fact that two types of production process are involved, and yet the two processes cannot be treated separately. It is impossible to simply consider the communities as part of the natural environment which the dominating class must control, or vice versa, the dominating class as simply a parasitic part of the natural environment to which each community must come to terms since both classes are part of the same society, sharing the same world-view and recognizing each other as fellow-members of the society. Furthermore, while the dominating class is dependent on the work of the constituent communities, they can also improve the conditions of these communities by providing defence from outsiders, by supporting them in times of crop failure, and by organizing large scale projects which would have been beyond the capacities of any single community. This means that it is necessary to treat the socio-economic formation as a whole. Given this it can be seen that the productive process of the communities is important only in the sense that it provides the pre-requisites for the emergence of the new production process. The new production process is not self-sustaining as is the capitalist system but requires an external legitimating process and means for controlling the constituent communities.

With the development of the new production process, the new ruling class must struggle to consolidate their position. The consequences of this have been that in the early stages of the establishment of the Asiatic socio-economic formations has always been associated with a burst of creative activity. As Godelier wrote:

> If Pharaonic Egypt, Mesopotamia, the Mycenean kingdoms, and the pre-Columbian empires belong to the Asiatic mode of production, then here we have evidence that it corresponds to the most brilliant civilizations of the metal age, to the period when man definitively wrenches himself away from the economy of land occupation and once and for all passes to the domination of nature, invents new forms of agriculture, architecture, mathematics, writing, trade, currency, law, new religions etc. In our view, the Asiatic mode of production originally meant not stagnation, but the greatest possible process of the productive forces accomplished on the basis of the previous communal forms of production. (1)

However, this development is not an immanent feature of the production processes themselves but is a feature of the struggle of the new class to establish itself in control. The development of the productive forces is an effect of the political relationships rather than the cause of them.

The secondary role of the production process in the dynamics of the Asiatic socio-economic formation is even more evident after this early stage. According to factors other than the productive processes themselves, different socio-economic formations have developed differently. In China there was continuous scientific, technical, administrative, economic and artistic progress up until the sixteenth century. (2)

(1) Maurice Godelier (1978) op.cit. p.243.
(2) Joseph Needham THE GRAND TITRATION: SCIENCE AND SOCIETY IN EAST AND WEST George Allen & Unwin, London, 1969, p.210.

But this was not a consequence of the immanent dynamics of the type of production processes but of other factors. A large part of the reason for this progress was the development of a very efficient bureaucracy of scholars whose positions were not hereditary but were gained through being recommended for outstanding talent, or since the second century A.D. through success in competitive exams. At the same time the socio-economic formation as a whole was maintained much longer than other Asiatic socio-economic formations because of the world-view developed by the Chinese. Their outlook on life militated against the sort of intervention in the affairs of individual farmers and their peasant communities which would have led to feudalism, while merchants were held in low regard and their activities restricted, thus preventing the rise of the mercantile capitalism which preceded industrial capitalism in Europe.

That there was no inherent necessity for the Asiatic socio-economic formation to develop as in China is indicated by the fact that in many cases it did not develop but stagnated to conform to Marx's description of Asiatic societies in CAPITAL:

> The simplicity of the organization for production in these self-sufficing communities that constantly reproduce themselves in the same form, and when accidentally destroyed, spring up again on the spot and with the same name - this simplicity supplies the key to the secret of the unchangeableness of Asiatic States and the never-ceasing changes of dynasty. The structure of the economic elements of society remains untouched by the storm-clouds of the political sky. (1)

Such stagnation occurred in Egypt because of the rise of a very powerful religious caste who channelled the potential of the socio-economic

(1) Karl Marx CAPITAL Vol. 1 (1887) op.cit. p. 338f.

formation to such religious functions as the building of tombs. The result of this was that by the time of Herodotus, they were: "slavishly devoted to ritual, most scrupulous about ceremonial cleanliness and the prescribed forms, but without the slightest indication of spirituality or of a working ethics." (1)

The self maintaining properties of the production processes of the Asiatic socio-economic formation were not strong as is evident from the ease with which this formation has been transformed into a feudal socio-economic formation through the development of an aristocracy to whom individuals are bonded. This resulted in the complete breakdown in the original communal process of production and the reduction of the community's members to serfdom. The members of the aristocracy were then bonded to the king, producing an hierarchical society of bondage. This is apparently what happened in Japan, but it was also in the process of happening in the Inca State. Towards the end of its existence, private estates were being developed in the Inca State belonging to the emperor and his castes. (2) These were worked by the Yana, people attached to members of this nobility by hereditary personal links. By taking members away from the traditional communities and attaching them to nobles, these communities were being progressively weakened, while the feudal type of production process was being continually strengthened. The Inca society lacked the philosophy and

(1) Henri Frankfort et.al. BEFORE PHILOSOPHY (1946) Penguin Books, Harmondsworth, 1964, p. 91.
(2) Maurice Godelier PERSPECTIVES IN MARXIST ANTHROPOLOGY (1977) op.cit. p. 187.

the highly efficient bureaucracy which had preserved the Asiatic socio-economic formation in China.

It can be seen from the diverse ways in which the different examples of the Asiatic socio-economic formation developed that its dynamics are not related in any simple way to the economy. The changes which took place can only be understood through an examination of the political institutions and beliefs which developed with the production process of the ruling class. Only in terms of these features of society is it possible to understand the developments and relationships between the different production processes which go to make up the socio-economic formation. But if a socio-economic formation does not have a unique constellation of beliefs and institutions and it cannot be characterized as having a specific chreod or path of development, then what validity does the notion of a socio-economic formation have and how is it possible to say when change is change of a socio-economic formation and when is it change to a new socio-economic formation?

In the light of these problems it is clear that the notion of a type of socio-economic formation cannot refer to a type of self-maintaining process as such, but can only be taken to indicate the pre-eminence of a particular production process in any society. It is not necessary to assume that this process is responsible for dominating all other aspects of society and it is possible that it is only by virtue of other processes largely autonomous from the production process that the production process is able to maintain itself in existence, and there is no need to assume that there is only one production process in existence in any society. With this approach the focus of attention shifts away from the attempt to define the distinguishing features of the different socio-economic formations and towards the problem of showing which are the most important production processes, how they maintain themselves and what are their relationships to other processes, including other production processes in the society, and ultimately to the natural environment of the society and to other societies with which the society is in contact.

Such an approach is more satisfactory even in the case of capitalism in which the whole society is dominated by the chreod of the autonomous economic system. Production processes independent of capitalism have often continued to exist alongside the capitalist process, particularly in France where relations of production of a feudal or community type survived into the 19th century. (1) While the economic system has had an immense influence on all other aspects of society, it has not determined everything, and institutions have been able to maintain some autonomy from it. By taking the description of capitalism to mean only that the capitalist production process, involving a market system and ownership of the means of production, dominates the rest of society, the assumption of a unity to such societies which there is no reason to believe they have is avoided.

Where socio-economic formations are taken to refer to what production processes are dominant, it is no longer necessary to conceive of a type of production process being abruptly replaced by another type. Instead such a change can be seen as a slow weakening of one production process associated with the emergence from this unstable situation of new production processes, which having attained autonomy from the context of their formation, develop along a chreod which to a greater or lesser

(1) Maurice Godelier (1977) p.18.

extent transforms the rest of society. This was seen to be the way in which feudalism was developing out of the Asiatic socio-economic formation of the Inca. But it was also how Marx described the emergence of capitalism in CAPITAL. A considerable part of Volume I including almost all of Part VIII of this volume were devoted by Marx to describing how the capitalist production process emerged and came to predominate and transform the rest of society in the process. As he put it:

> ...the exchange of commodities breaks through the local and personal bonds inseparable from direct barter, and develops the circulation of the products of social labour...(developing) a whole network of social relations spontaneous in their growth and entirely beyond the control of the actors. (1)

It is not described as a sudden transformation or as the structuralists would call it, a 'conjuncture' between two 'structures'.

With this conception of socio-economic formations, Marx's predictions about the capitalist production process can be regarded as having been fulfilled in some countries. The autonomous economy developed, increasing its domination over all other aspects of society. The process became increasingly unstable with cycles of booms and depressions being produced with an ever increasing magnitude, eventually culminating in the Great Depression of the 1930's. With the instability produced by this, new productive processes could emerge and come to dominate society. Thus in Sweden the socialists took power in 1932, and in Denmark they took complete power in 1935 as a direct result of the depression. This did not mean the immediate taking of power by the working class, but it

(1) Karl Marx CAPITAL Vol. I, op.cit. p.114.

did involve the development of institutions and new forms of productive relations such as organizations for welfare and redistribution of income and increasing the power of workers in their workplaces which have resulted in increasing social control over the means of production. Where socialists have lost power in these countries for any length of time, the conservative governments have been unable to reverse this process.

However the weakening of the capitalist production process should not be regarded as inevitably producing a better society. This only occurred where the socialists better understood the situation than their opponents and acted accordingly. In Germany where socialists were committed to either waiting for the laws of history to produce the socialist society or to an extreme voluntarism in which the workers were supposed to rise up and seize power, the Nazis took power and established the facist production process involving a highly centralized bureaucratic control of the economy, legitimation through irrationalist mythology and a commitment to the domination of other societies through war.

What I have been doing here is interpreting Marx's achievements in the light of process philosophy in terms of which society is conceived of as a polyphony of both purposive and unintended processes. I have tried to show how this interpretation leads to fewer problems than are encountered when Marx is interpreted in terms of any different ontology. In process philosophy all societies are seen to have a production process as an essential constituent in the same way that all animals have a metabolism. But out of the basic teleological processes of society there develop various other processes which are self-sustaining and have their own dynamics. Such processes include the state administrative body which controls society in the Asiatic socio-economic formation, the social process involving the bonding of individuals to each other in a hierarchical relationship which occurs in feudalism, the military expansion with the capture of slaves characteristic of the Ancient socio-economic formation and the struggle for growth between firms controlling the means of production which occurs in the capitalist socio-economic formation. Only in the last is the economy really autonomous and does it function as a supervening cause which confronts people like a second nature to which they must adapt. In the next section I will try to develop this process conception of society further.

SOCIETY AS A POLYPHONY OF PROCESSES

Having attempted to show how process philosophy provides the best interpretation of the achievements of Marx, I will now try to work out in greater detail the implications of considering society as a polyphony of processes. I will begin by examining those thinkers whose ideas are most in accordance with this view and then suggest how the ideas I have been developing can contribute to the efforts of these thinkers.

As in the case of biology, if society is seen as a polyphony of processes, then the different temporal rhythms of these processes must be one of the main focusses of attention. George Gurvich who was strongly influenced by Bergson tried to develop the idea of the multilinearity of time in order to analyse society. He wrote:

> To each sphere of reality as well as to each science which studies it, there corresponds specific kinds of time which are not the same; for example, there are differences in the character of inanimate nature and animate nature, in that of plants and of animals, in that of different species; there are different kinds of time for the human body, as well as for the mental life (and for its manifestations in representation, affection, and willing) - and for its directions toward individual, interpersonal, or collective subjects; or lastly for social reality whose specific time is the most complex and most enigmatic to comprehend, one where the relations between past, present, and future are the most diversified. (1)

Gurvitch then went on to classify the various types of temporality of social reality.

However Gurvitch made no attempt to show the role of these different

(1) Georges Gurvitch "Social Structure and the Multiplicity of Times" in ESSAYS IN HONOUR OF PITIRIM SOROKIN ed. Edward Tiryakian, Free Press, N.Y., 1963, pp.171-184, p.173.

temporalities in the dynamism of social reality. Time was added after Gurvitch's analysis of the constituents of the social order, and this addition left the analysis untouched. As Fernand Braudel wrote of Gurvitch's system: "The mammoth architecture of this ideal city remains motionless. History is absent from it." (1)

It is historians, particularly those associated with the ANNALES, who have done most to show the importance of seeing history as being composed of a plurality of different temporalities, and Braudel has done most to develop these ideas. The historians of the ANNALES such as Lucien Febvre and Marc Bloch were particularly opposed to history which focussed only on the short term, the event. In opposition to this tendency, they tried to show the relevance of relatively unchanging features such as geography and basic ideas. Braudel uses the term 'structure' implying "organization, coherence and fairly stable relationships between social realities and masses." (2) By this he does not mean something outside time but something which pertains to the long-term. In opposition to structuralism he rejected the dichotomy between synchrony and diachrony, writing of synchrony: "a momentary stop, suspending all durations, is ... absurd or (which comes to the same thing) totally artificial..." (3) and of diachrony: "a descent down the slope of time is conceivable only as a multiplicity of descents down countless rivers of time." (4) Braudel also emphasised

(1) Fernand Braudel "History and the Social Sciences" in ECONOMY AND SOCIETY IN EARLY MODERN EUROPE: ESSAYS FROM ANNALES ed. Peter Burke, Routledge & Kegan Paul, London, 1972, p.37.
(2) Ibid., p.17.
(3) Ibid., p.26.
(4) Loc.cit.

the relationship between the different temporal levels. His general position was stated in the Introduction to THE MEDITERRANEAN AND THE MEDITERRANEAN WORLD IN THE AGE OF PHILIP II:

> Is it possible somehow to convey simultaneously both the conspicuous history which holds our attention by its continued and dramatic changes - and that other, submerged history, almost silent and always discrete, virtually unsuspected either by its observers or its participants, which is little touched by the obstinate erosion of time? ...Historians have over the years grown accustomed to describing this contradiction in terms of structure and conjunction, the former denoting long-term, the latter, short-term realities. Clearly there are different kinds of structure just as there are different kinds of conjuncture and the duration of either structure or conjuncture may in turn vary. History accepts and discovers multidimensional explanations, reaching as it were, vertically from one temporal plane to another. And on every plane there are also horizontal relationships and connections. (1)

Braudel also made some attempt to work out how these different 'rivers of time' affect one another, arriving at a position identical to that of process philosophy in which a process of longer duration affects processes of shorter duration by providing them with the environment in which they function:

> For historians, a structure certainly means something that holds together or something that is architectural; but beyond that it means a reality which can distort the effect of time, changing its scope and speed. Certain structures live on for so long that they become stable elements for an indefinite number of generations: they encumber history, they impede and thus control its flow. Others crumble away faster. But all operate simultaneously as a support and an obstacle. As obstacles, they act as limitation ('envelopes' in the mathematical sense) from which man and his experiences can never escape. Just think of the difficulty of breaking down certain geographical frameworks, biological facts or barriers to productivity and even certain constraints of a spiritual order (mental frameworks, too, are long-term prisons.). (2)

(1) F. Braudel THE MEDITERRANEAN AND THE MEDITERRANEAN WORLD IN THE AGE OF PHILIP II, Vol.I, tr. S.Reynolds, Collins, London, 1972, p.16.
(2) F. Braudel in Peter Burke op.cit. p.17f.

Braudel suggested that the historical totality involves a thousand levels, with a thousand explosions of historical time, writing: "sciences, techniques, political institutions, mental equipment, civilization (to use that convenient word) have all their own rhythm of life and growth." (1) He then gave examples of intermediate and long term processes which his associates or kindred spirits have studied to illustrate this. At the intermediate level, Ernest Labrousse has studied long term cycles, semi-intercycles and cycles in economics, showing their relationships. Lucient Febvre in his study of Rabelais showed how a set of concepts permeated life and art, thought and belief both long before and long after the time of Rabelais, and severely limited the intellectual adventures of the freest minds. Pierre Fracastel showed the permanence of geometrical forms of representation in painting from the beginnings of the Florentine Renaissance until the advent of cubism and conceptual painting in the twentieth century. In science the Aristotelian universe which had served for centuries was similarly replaced by the geometrized universe of Galileo, Descartes and Newton which only began to crumble with the Einsteinian revolution. Braudel also described the main features of mercantile capitalism; its unstable population, the domination of transport by water and the ship, the growth of commerce along the coastal fringe, the leading role of merchants and the importance of precious metals and so on; and argued that these did not change from the fourteenth century until the mid-eighteenth century. This was then replaced by the industrial revolution which is still in progress. All these studies

(1) Ibid., p.16.

illustrate the importance of considering history as involving both intermediate and long term processes.

Braudel argued that such long term processes should be the starting point in any historical study, that these form the depth and semi-immobility around which everything revolves, and that only then should one study the short term. These short term features are not to be regarded as simply manifestations of long term processes but make their own contribution to history. Braudel agrees with Sartre's point that after Flaubert has been 'placed' as a 'bourgeois' or Tintoretto as a 'petit bourgeois' there is still much to be said. (1) Thus he wrote: "there is a short time period for all forms of life, whether economic, social, literary, institutional, religious, geographical (even a gust of wind, a storm), or political." (2) However by adopting Braudel's approach to history, these are not seen as simply events, but as processes of short duration understood in the context of the environment of processes of longer duration which makes such processes possible.

A Marxist member of the ANNALES school, Pierre Vilar, has developed an analysis of the process which led to the French revolution which emphasises the importance of the relationship between processes of different temporal rhythm. Robert D'Amico sums up his achievement in the following way:

> As Vilar interprets Labrousse's work, the French revolution is seen as the "collision" between the long term economic progress of the eighteenth century, an "intercycle" of depressions from 1744-1788, and the short-term effects of price inflations in 1789. Thus we have the picture of the following "interlacing" cycles: Originally,

(1) Ibid., p.38.
(2) Ibid., p.14.

> there is the cycle of the feudal mode of production, characterized by an agricultural base, undeveloped technology of production, and direct appropriation of the producer's labour, founded on the physical control of land areas. This can be called a precapitalist "tempo". But it comes to co-exist with an emergent "industrial cycle" characterized by a long period of primitive capital accumulation (creating a monied bourgeoisie and an embougeoisified nobility), commercial depressions in prices and markets which have the effect of "freeing" the market from feudal constraints, and the short-term "breakdown" of feudal production in the form of scarcity, famine and rebellion against feudal appropriation. Thus Vilar concludes, "the 'collision' overturns the juridical and political structure of society, it is the most beautiful example one could wish for of an 'interlacing of times' as the process of the development of a mode of production, seen as the process of the passage of one mode to another. (1)

It can be seen from these examples that the historians of the ANNALES have developed a way of conceiving social dynamics which is in accordance with the ideas of process philosophy as it is being developed here. These ideas have been able to enrich the Marxist understanding of how the economy affects society and how revolutions occur. There are however a number of additions which can be made to this scheme. The first is that rather than simply identifying the different temporalities involved in a society, attention should be directed to understanding how the different features which endure manage to do so. That is, the self-maintaining processes of which they are part should be identified and their dynamics understood. The second addition is that a distinction should be made between those enduring processes such as biological characteristics and environmental features which are the stable constituents of the human order both making this order possible and acting as the limits to them, and processes such as the capitalist economy which are the ordering of activities and processes within the human order

(1) Robert D'Amico "The Contours and Coupures of Structuralist Theory" in TELOS 17, 1973 p.77.

but which act as supervening causes by providing them with the environment in which they function. These two points involve a clarification of the nature of causality from the point of view of process philosophy and an awareness of the different types.

Apart from these points there is a major problem to be considered. In my critique of Structuralist Marxism I suggested that one of its chief defects was its inability to give a place to the purposeful activity of historical actors. The Hegelian Marxists on the other hand could not take account of the importance of non-teleological features of society. In both these critiques it was implied that process philosophy is superior in that in terms of it there is a place for teleological processes, for the unintentional processes which develop in society, and for a dynamic nature. I will now consider in more detail the relationship between teleological and non-teleological processes.

The approach adopted here leads to the assumption that the actors of history act teleologically, but that their purposeful activity generates processes unintended by these actors which then constrain their behaviour. However there is a complicating factor in this relationship in that people are capable of coming to understand these unintended processes and then participating in them purposefully in order to bring about their own ends. Thus Adam Smith proposed pursuing one's own selfish ends in the economic system because the unintended consequences of everybody pursuing their own ends would be in the interest of society as a whole. It was Marx's intention that the proletariat should understand the dynamics of capitalism, continue to participate in it so as to further its trends, then as these trends led to greater instability, to overthrow the capitalist system and appropriate the means of production developed by it to create a truly human order. But this means that people are required to act purposefully on two different levels: participating in the day to day activities prescribed by the capitalist system, and then as members of a class using the dynamics of this same system of which they are a part in order to bring about a communist society.

In fact all stable institutions develop some degree of autonomy from the immediate intentions for which they were established, and at the same time this autonomy is always to some degree understood and used by its participants. This reflects the capacity for decentring from immediate experience enabling people to simultaneously participate in diverse processes and different temporalities without being entirely absorbed in any of them, and that they are able to transcend their situation in the world and to question their understanding of the world and of their place within it. The consequent dual nature of autonomous social processes suggests that the transcendence of human intentions by these processes is always a matter of degree. Since these processes will always exist, people's struggles for control over their environment must involve the attempt to understand these processes more fully to bring them under a purposeful order of a higher level. This in turn is likely to lead to the emergence of new processes beyond these intentions. It is utopian to believe that any group, let alone a complete society, could ever involve pure praxis. Even crowds have their dynamics which transcend the intentions of its participants.

In traditional societies, great insight into the social dynamics of the society is likely to be limited to a few exceptional individuals, and except where such societies are confronted by civilizations, the members of these societies are unlikely to be confronted by much which is radically new. However with the development of philosophy and science, people's understanding of themselves has been able to grow through history, while human societies and the nature they interact with have been changing at an ever faster rate so that people are increasingly faced with entirely new situations. With this state of affairs, understanding the dynamics of society becomes less and less a matter of understanding the dialectical patterns of culture and the processes generated by the unintended consequences of people's action. More and more it becomes a matter of how people respond to their situations: whether they strive to transcend the contingencies of these situations and attempt to participate in the highest developments of culture or whether they reject rationality and a critical attitude to their world and only concern themselves with their own immediate satisfaction, whether people have the courage to take responsibility for their destiny or whether they allow themselves to become cyphers for whatever social processes are dominating society at the time. That is, it is becoming increasingly impossible to reduce individuals to cultural and social processes. Individuals must be considered in their own right as in the process of becoming. It is necessary to consider how people respond to the openness of the future and the potentialities of the present, how they appropriate their cultural heritage, how they develop their understanding, how they take on ethical responsibility and the degree to which they are prepared to strive to overcome their situations and to realize their ideals.

CONCLUSION

In the previous two chapters I have tried to show how the human order can be understood as an emergent order within nature. The evolution of humanity must be understood as having been an evolution of individuals who were at all times part of a community, and evolution should be seen as an evolution of community at the same time that it has been an evolution of individuals. While this evolution is an evolution of the capacity for purposeful behaviour resulting in the progressive control by societies over their environment, the capacity for reciprocity of perspectives resulting in the progressive extension of the moral order, and the capacity for understanding and communication which has resulted in the development of a vast heritage of symbolic universes, it is also closely associated with the development of processes which are the unintended consequences of people's actions. Although the discussion of the human order was divided into two chapters with the first dealing primarily with intentional behaviour and the second with unintended processes, these must be understood as intimately related to one another. The final result which I have tried to attain is that of a vision of the human order as part of the process of becoming of the universe, yet with its own autonomous dynamism consisting of a polyphony of processes, both intentional and unintentional within which individuals and groups are challenged to make sense of their lives and to make rationality prevail over contingency.

However what has been written so far does not provide a concrete understanding of humans. It is necessary to consider them as existing subjects in the process of becoming to achieve this. But this existential dimension of human being can now be dealt with in the concrete physical, biological, cultural and social contexts which constitute the situations within which people must live. Taking people as beings-in-the-world in such concrete situations it is now necessary to consider how they should act, to show the relationship between individuals, ethics, and science. People's understanding of themselves and their world largely derives from science, and in the past the vast majority of social scientists have been positivistic and reductionist. The exclusion of any recognition of the role of the subject in this conception of society has meant that people as individual subjects are defined as of no significance. Knowledge of humans on this basis has only been knowledge of how to manipulate them. The implications of this are that there are no rational ends, there are only rational means, and this implies that the whole moral order is based on an illusion. Only nihilism is rational. The conception of the human order defended here gives a central role to the subject and implies that there are ends which are intrinsically worthwhile. A social science based on such a conception of the human order would be a critical, evaluative social science. In the next chapter I will consider individuals as existing subjects and show how the ideas developed here provide the foundation for a rational ethics and a critical social science, thus negating the nihilism which was shown in Chapter I to be advancing on the foundation of positivistic materialism.

CHAPTER VIII

ETHICS AND SCIENCE

> As long as man concentrates his interest contemplatively upon the past or future, both ossify into an alien existence. And between the subject and the object lies the unbridgeable "pernicious chasm" of the present. Man must be able to comprehend the present as a becoming. He can do this by seeing in it the tendencies out of whose dialectical opposition he can make the future. Only when he does this will the present be a process of becoming, that belongs to him.
>
> Georg Lukacs
> HISTORY AND CLASS CONSCIOUSNESS

In the introductory chapter of this thesis I tried to describe the nihilistic tendencies of modern culture. Nihilism was defined as the situation in which there can be no rational justification for moral judgements and where life is meaningless. It was then shown how the rise of science as the most reliable body of knowledge in our society has led to a general acceptance of nihilism. It was pointed out that this follows from the assumption that science is positivistic in its approach and justifies materialism. Positivism is the doctrine that science accumulates certain knowledge, based on experience and expressed in the form of general laws in terms of which everything that can be or will be experienced can be predicted, while materialism is taken to imply that everything is determined by the laws governing the interactions of the most elementary entities, whether these be atoms, quarks and leptons or space-time points. Positivism and materialism converge to justify a conception of the world as governed by the general laws of physics which determine everything that will happen.

Such a way of understanding the world makes it impossible for the individual to orient him or herself as a subject within the world.

Subjects and values are excluded from the world which is conceptualized in a way which facilitates its control and manipulation. The conception of man adopted by the social sciences were shown to determine the values implicit within them, and positivism and materialism, by conceiving of people as devoid of any intrinsic significance or of having any ends beyond their own subjective sensations of pleasure which could be regarded as intrinsically worthwhile, are implicitly nihilistic. Reductionist and positivist human sciences such as physiological and behavioural psychology and those social sciences which aim at discovering laws conceive of humans as things to be manipulated and controlled along with the rest of nature for ends which must be regarded as ultimately irrational.

Apart from its nihilistic implications, the attempt to grasp the world in terms of positivisitic materialism has been faced with a number of problems which have taxed philosophers since the rise of classical physics in the seventeenth century. The most important of these is that it is inescapably obvious to the vast majority of people that we are conscious subjects, yet it is impossible for materialism to form a conception of ourselves which acknowledges this. This forms the basis of the mind-body problem, and the inability to resolve this problem is behind many other problems. The disjunction between the subject of experience and the physical world results in the problem of explaining how we can have knowledge of the external world, and with the tenuous place allotted to the subject there is a second problem in explaining how we can have knowledge of other minds. Finally there are the problems of accounting for how our mental acts or decisions can have any influence on the material world and how can we act freely in a world governed by laws.

It was also pointed out that both positivism and materialism undermine themselves and in the final analysis are incompatible with each other. Positivism is committed to the view that the only valid claims to truth are either empirical or analytical, yet this claim is neither. Materialism is committed to viewing all beliefs as manifestations of and as determined by the behaviour of the physical and chemical constituents of people. But this implies that no belief can be held to be really any better than any other. Therefore materialism is a theory which implies the impossibility of rationally grounded theory. Finally positivism and materialism are incompatible in that positivism cannot give an ontological status to hypothetical entities such as elementary particles, while materialism cannot account for there being experience.

The recalcitrance of these problems indicates that there is something basically wrong in the attempt to base a world-view on positivistic materialism and it was suggested that there is a need for a new conception of the world to be developed. However to be plausible this must come to terms with the achievements of science. The approach adopted was to consider whether the popular conception of science is in fact valid, and since this was seen not to be the case, to show what conception of the world can be justified by science. In developing this alternative the aim was to overcome all those problems of philosophy which had proved so troublesome. To demonstrate the consistency of the new world-view the whole system was constructed in the form of a circle so that the starting point would be validated by the system developed from it. I will now consider to what extent these aims have been met before going on to deal with the existing individual, ethics and social science.

Rather than beginning with an abstract concept like Being as did Hegel, I took as the starting point the cultural heritage with which an individual in the modern world finds him or herself. Working on the principle that all the ideas of this heritage cannot be doubted at once, I took the soundest beliefs of this heritage, those associated with the natural sciences, as my point of departure. I began by showing what problems the scientific world-view as it is popularly conceived has led to, thus justifying a re-examination of the achievements of science. Firstly I showed that the achievements of science could not be accounted for in terms of a positivist epistemology and at the same time argued for an alternative. According to this alternative, the basic end of science is not making predictions but understanding, and in this probject science is inseparable from metaphysics. This implies that materialism is the ontology of one particular metaphysical system among others, thus justifying the attempt to develop an alternative ontology in the form of a version of process philosophy. After having shown the greater coherence of the process conception of being as opposed to the materialist conception, I then attempted to substantiate process philosophy by showing how the advances in a number of branches of science have broken out of the materialist framework of concepts and can best be interpreted from the point of view of process philosophy. Using the concepts of process philosophy I then attempted to develop a conception of the human order as an emergent process in nature. This conception

justified what had been implicitly assumed in the Introduction.
It has been shown that people in communication with each other struggle to orient themselves in the world and that it is possible for there to be rational progress in their understanding of the world and themselves in this struggle. Also, individuals were seen to be processes of becoming who only attain self-hood, an orientation to the world and control over their destiny through participating in the cultural processes of their society. As such, individuals can no more turn their backs on their cultural heritage than they can jump out of their skin. They are situated within society and they must begin any attempt to develop an alternative view of the world from within the dialogical process of which they are part. This does not mean that every idea in this heritage may not be criticised, but since any communication can only take place when there is a shared framework of assumptions, such criticism can only proceed from within the set of beliefs which generally prevail, and not all of these can be examined and criticised at once. My account of the individual situated within the process in which people communicate and orient themselves thus justifies the starting point adopted in this thesis. Furthermore, this conception of human beings as rationally involved in the struggle for orientation and communication also provides the possibility of explaining the rational enterprises of science and metaphysics as described in Chapter II as refinements of this struggle for orientation, thus accounting for science in terms of process philosophy and demonstrating the consistency of my ontology with my epistemology.

The epistemology and the ontology together enable the major problems facing philosophy since the rise of classical science to be resolved. The process ontology was shown to make it possible to conceive of an organism as an embodied subject, while the epistemology, by emphasising the primacy of understanding or 'indwelling' over representational thought or explicit knowledge indicates how science can grasp the actions of an individual as an expression of a purposefully acting subject embodied in a meaningful world to which the subject is continually orienting him or herself. Being able to conceive the subject as part of and in the world rather than as an inexplicable intrusion into it enables the other major problems of the positivistic materialist world-view to be resolved.

In presenting the mind-body problem, adherents of materialism conceive of the mind as a substance, and to this they attribute all those aspects of subjectivity which are inexplicable in terms of materialism. By being able to conceive of a person as an embodied subject the essential features of the mind-body problem is overcome. The subject is seen in relation to the body without being regarded as an extra substance and without being reduced to physiological processes or behaviour. However it should be recognized that what is normally meant by mind is not a substance. Expressions such as 'making up one's mind,' 'being in two minds,''change one's mind,' 'mindless conformist,' 'out of one's mind', 'a mind of one's own,' all suggest that what is meant by mind is the order of beliefs and associated projects of action to which one has committed oneself. This meaning is completely in accordance with the process view of what it is to be human where the subject is seen as forming him or herself through commitments to ways of understanding the world and to projects of action.

With the subject conceived of as an embodied being-in-the-world and with understanding or indwelling emphasised as the aim of science, the relationship between the subject and the external world presents no fundamental conceptual problems. The world which one experiences and understands is immediately experienced as independent of one, but is understood by means of metaphors and concepts. The individual experiences the world through these, and though it is possible to improve these and gain a deeper understanding of the world, there is no question of bypassing them altogether. By conceiving intellectual advances in this way there is no disjunction between beliefs in some inner realm corresponding to some independent external reality and consequently there can be no basic problem about the relationship between these beliefs and reality. All that one can talk about is greater or lesser understanding. This way of conceiving cognition without a dualism is further supported by the conception of the subject as part of the world through being embodied within it rather than as a detached spectator. Understanding is a way of being in the world rather than a representation of it.

While understanding is taken as the most basic concept in epistemology there need be no concern about the relationship between perception and knowledge. Rather both perception and knowledge must be seen in relationship to understanding. The way the world is experienced reflects the depth of one's understanding. The deeper one's understanding the more pregnant with information is one's perception of the world. Knowledge as 'knowing that such and such is the case' is formulated in the process of questioning the world and in the process of communication. But the aim of the formulation of such propositions is to achieve understanding, to communicate what one understands, or to arrive at an agreement as to how something is to be understood. In all cases knowledge must be seen only in relation to understanding and bits of knowledge should not be treated in isolation.

The problem of other minds also dissolves within this metaphysical framework. If understanding does not involve seeing reality as it is in itself, there is no longer the problem of wanting to experience the subject of the other before acknowledging its existence. Furthermore the subject is not a ghost in the machine but the process by which the organism constitutes its world and temporally transcends the immediate situation by attempting to realize its potentialities. To understand the other is to 'indwell' in this process so that he is experienced as being in a meaningful world, and his or her behaviour is experienced as being a meaningful response to this. To understand a person in this way is to think of him or her as a subject. The relationship to others is further clarified when it is realized that the 'we' experience precedes the experience of being an autonomous subject, and this latter experience arises through a differentiation of the more immediate 'we' experience. The experience of the other as a subject then follows of necessity from this differentiation. It is only with the development of a highly decentred attitude to the world and to others that the idea of solipsism can even make sense, and then only by ignoring the more immediate type of awareness on which this abstract form of consciousness is founded.

Finally the problem of free will and determinism can be resolved. The individual can only be thought to be determined if he is determined by something. In other words, determinism implies that human behaviour is an ephiphenomenon of physical interactions or social forces and is nothing in itself. The whole of process philosophy as developed in this thesis has been directed at showing the unacceptability of such reductionism and it has been repeatedly emphasised that the universe consists of a multiplicity of different types of processes, each of which, while being dependent on its environment and substructure has its own principles of development. As such each process is irreducible to the effects of other processes and must be thought of as an immanent cause of its own being. It is impossible to understand the behaviour of people except by taking into account that they are capable of acting rationally on the basis of their understanding of the world and their situation within it and as such, are partially autonomous self-forming agents. Freedom is then the ability to act on rational grounds. This is never absolute since it is limited by the individual's situation and his understanding of this and of him or herself, and this is only slowly achieved. As Thomas Szasz wrote:

> Among the many foolish things Rousseau said, one of the most foolish, and most famous, is: 'Man is born free, and yet everywhere he is in chains.' This high-flown phrase obscures the nature of freedom. For if freedom is the ability to make uncoerced choices, then man is born in chains. And the challenge of life is liberation. (1)

Unless people are completely controlled by external conditions, the better one's understanding of the world and oneself, the freer one is.

(1) Thomas Szasz IDEOLOGY AND INSANITY, Penguin Books, Harmondsworth, 1974, p.1.

The nature of this freedom becomes more intelligible if one considers the process conception of what it is to be a subject. The subject is no longer a substance outside the world but must be thought of in terms of the process of becoming of the organism in interaction with its environment. The subject is then not something over and above its acts but is the activity by which the world is constituted, potentialities understood and the present transcended as the individual projects him or herself into the future on the basis of this understanding. Self-awareness and the ability to experience oneself as an identity through diverse engagements was seen to be made possible by the polyphonic nature of consciousness and the ability to participate in a temporal order transcending the life of the individual. Since the individual is a process of becoming, activity must be seen as prior to detached reflection. Rather than a detached spectator reflecting on the world and by an act of will making the body move in a certain way, the embodied subject must be seen as being able to take an abstract or decentred attitude to his or her situation by participating in a different temporal order, and through this, being able to reorient him or herself for further action.

It can now be seen that the metaphysical system which I have developed is justified not only by being in accord with science, through its potential for revealing new dimensions of the world and by its internal coherence, but also by its ability to resolve all the major philosophical problems engendered by the development of science in the seventeenth century. Most importantly it has given a place to subjects as free rational agents in the process of becoming in the world. In this chapter

I will focus on the individual subject and the nature of one's being-in-the-world. This will then form the basis of an ethics. An ethics based on process philosophy will be seen to be indissociable from social science and I will go on to develop a conception of the social sciences embodying the epistemology and conception of the human order developed in this thesis. This social science will be seen to be implicitly evaluative and critical, thus fulfilling the role required of it by ethics. In this way nihilism which has developed on the basis of scientism will have been shown to be without any real foundation.

INDIVIDUAL EXISTENCE

In the last two chapters it has been emphasised that people must be thought of as subjects striving within the world. However while having shown how this leads to cognitive developments involving a decentration of the subject from immediate experience and the capacity to use symbols, how this decentration in turn engenders in people a striving for recognition, for a general orientation in the world and for control over their destiny, how these struggles engender the development of culture, and finally how this development is complicated by the processes which emerge within the human context but develop in ways which transcend people's intentions, I have not yet given a full account of the human order. Individuals cannot be fully understood in terms of their biological and cognitive processes and the cultural and social contexts through which they form themselves. It is also necessary to focus on individuals as such, as particular existing, unfinished processes of becoming with their own immanent causality. It is on this aspect of human being that the existentialists and existential phenomenologists have focussed and with which I will now be concerned.

As with all organisms, to grasp individuals as totalities it is necessary to see them as beings-in-the-world. But in the case of humans there are three modes or aspects of their world: the _Umwelt_, the _Mitwelt_ and the _Eigenwelt_ or the surrounding world, the social world and the self world. (1)

(1) These are described in Rollo May "Contributions of Existential Psychiatry" in EXISTENCE: A NEW DIMENSION IN PSYCHIATRY AND PSYCHOLOGY eds. Rollo May, et.al. Simon and Schuster. N.Y. 1958, p.61ff.

As with all animals humans live in a surrounding world, the physical and biological environment including the individuals' own biological processes, needs, appetites and so on. At the same time individuals live in a world of other subjects with whom they form various relationships based on a reciprocity of perspectives and mutual recognition. But since humans are also an object to themselves they also develop a relation to themselves through their involvement in the social world, but defined in opposition to it. This is the self world in which individuals distinguish themselves from the particular contexts within which they realize themselves. These three aspects are not three different worlds but three different modes of being-in-the-world lived simultaneously and are always interrelated and always condition each other.

As with the surrounding world of animals, the surrounding world of humans is a world experienced as meaningful in relation to threats to one's existence and to one's needs, appetites, skills and sensitivities. As Rollo May wrote:

> World is the structure of meaningful relationships in which a person exists and in the design of which he participates. Thus world includes the past events which condition my existence and all the vast variety of deterministic influences which operate upon me. But it is these as I relate to them, am aware of them, carry them with me, moulding, inevitably forming, building them in every minute of relating. For to be aware of one's world means at the same time to be designing it. (1)

Thus being-in-the-surrounding-world is not simply a matter of being located within it but of actively dwelling within it. However the nature of this is greatly altered by the social world. To begin with, the natural world is largely a humanized world, a world of buildings,

(1) Ibid., p.59f.

tables, roads and so on. But also the experience of the surrounding world is strongly affected by the nature of the social order and by the prevailing social conception of the world. Thus in a capitalist system the surrounding world tends to be seen as a world of commodities with a price on them, while the associated materialist conception of being denies the meaningfulness of the world and the subjective involvement of people within it. The world is then seen as something to be manipulated and controlled and experiences of unity with the world and aesthetic experiences are taken to be subjective illusions. The effect of such a social organization and world-view is to produce a radical alienation from the surrounding world. On the other hand a process view of the world with a social organization based upon it as exemplified by the Fipa can produce a much greater degree of 'indwelling' in the world than any other animal is capable of. However while individuals are constrained by their culture, they are not determined by it and each individual must make his or her own unique adjustment to the surrounding world.

The social world and its nature has been largely described in Chapter 6. However this was in terms of how the strivings of individuals engender the processes of culture. Focussing on this from the point of view of cultural development does not reveal all that is involved in the lives of individuals participating in this cultural development. The individual must make choices about the way in which s/he will strive for a sense of significance, for an orientation to the world and for control over his or her destiny, and how to balance these strivings. For instance a sense of significance can be attained either by closely conforming to a reference group or by attempting to achieve something which can be justified to an ideally rational observer. Orientation can be achieved by radically circumscribing one's world or by attempting to develop as full an understanding of the world as is possible. Control over one's destiny can be achieved by tyrannizing over other people or by developing one's own abilities and participating in the joint projects of society. And people can choose to balance these goals or concentrate on achieving one of them.

However allowing for idiosyncracies in the way people participate in the culture of their society gives little indication of the complexity of the individual's involvement in the social world. The social world consists of a multiplicity of relationships between people of varying degrees of intimacy and formality of organization. There are families, business organizations, churches, friendships, pilgrimages, parties, bureaucracies, educational institutions in which classes are taught, lectures given, research undertaken and seminars conducted, relationships through the mass media, including newspapers, books, wireless and television, and the realms of the arts involving such things as art exhibitions, concerts, plays, novels and poems. The individual must move between these, often being involved in a number at the same time. A person may be having breakfast with his or her family, listening to music on the radio and reading the paper. Each of these realms is a finite province of meaning with its own criteria of relevance requiring a particular tension of consciousness for participation. While participating in these finite provinces of meaning they are given the accent of reality which can then be completely withdrawn as the individual involves him or herself in another province of meaning. This in reading a novel or looking at a painting it is necessary to give these symbols the accent of reality. However this is then withdrawn as one involves oneself in the tasks of life. In other cases the accent of reality is not completely withdrawn but reduced as for instance when one switches from reading a newspaper about what is happening in the world at large and goes about one's work.

The difficulties involved in this are accentuated by the imperfect nature of culture so that different provinces of meaning are likely to involve implicit assumptions incompatible with the implicit assumptions of other provinces of meaning. This is particularly important when action is considered. People react to a situation according to how they define it, but this act of defining is not spontaneous. It tends to be imposed by others and the intentions embodied in human products. A certain way of defining a situation is made to appear 'objective' and the situation so defined takes on a 'real' or coercive nature. As Berger wrote: "the fundamental coerciveness of society lies not in its machineries of social control, but in its power to constitute and impose itself as reality." (1) In this way the individual's constraints and opportunities for freedom of action are largely socially constituted. But where the different provinces of meaning involve contradictory ways of defining reality the individual must live a contradictory and incoherent life unless these provinces of meaning can be related in terms of a

(1) Peter L. Berger THE SOCIAL REALITY OF RELIGION, Penguin University Books, Harmondsworth, 1973, p.21.

superordinate scheme of meaning. Such contradictions are apparent in relation to the realm of business and the realms of family or friends. In the realm of business it is understood that individuals must try to get the best of each other while in a relationship of friendship or family it is understood that one is obliged to a large extent to define the interests of the others as one's own. Where the business realm is clearly circumscribed the business mode of reality might not present great problems, but when attitudes associated with family or friendship are prostituted as means to attain success in business as in modern salesmanship, these boundaries disappear and the individual is left without any coherent understanding of how to relate to other people. In such circumstances the attitude of the market is likely to begin to pervade friendships and family relationships.

However it is the dynamics of the self world which is most completely lost sight of by any attempt to understand people without focussing on the individuals themselves. The ability to distinguish between the self and particular contexts enables individuals to strive for unity or integrity in their lives. The extent to which people attempt to attain integrity in life is the extent of their authenticity. There are a number of aspects to this. Failure to strive for authenticity involves a failure in the courage to be, (1) the courage to face the anxiety of non-being involved in becoming. Such failure on a large scale is manifest in such phenomena as the flight to totalitarian political institutions. (2) But being authentic is not a simple matter.

(1) The courage to be is analysed in Paul Tillich THE COURAGE TO BE (1952), Collins/Fontana, London, 1965.
(2) Such a flight is described by Erich Fromm in THE FEAR OF FREEDOM, Routledge & Kegan Paul, London, 1966.

It involves taking responsibility for one's beliefs, one's life and the world at large. It is a matter of striving to think things through to a conclusion and to be consistent in both thought and action. Such efforts are subject to failure as occurs in self-deception where individuals fail to spell out fully the implications of their actions and so allow themselves to act on their impulses while maintaining the belief that these actions are consistent with their self-images. Anxiety for the integrity of the self plays an important part in making this possible as it functions to steer the subject away from the sort of contemplation which would reveal the deception. (1) However authenticity is not only taking responsibility. Authenticity also involves making commitments. The detached sceptic who refuses to endorse any beliefs, causes, or projects and refuses to make commitments to people on the grounds that there is not enough evidence or that one cannot know how things will change in the future also manifests a failure in the courage to be. Finally it is necessary to act in order to realize the projects that one has committed oneself to, to insert oneself into the dynamics of the world in order to bring about changes.

An important aspect of the dynamics of the individual pertains to the relationship between the different modes of world. It is obvious that the social world presupposes and is limited by the surrounding world of physical and biological processes while the self world presupposes and is limit-

(1) Self-deception is analysed in these terms by Herbert Fingarette in SELF-DECEPTION, Routledge & Kegan Paul, London, 1969.

ed by the social world. Thus the possibilities for social relationships based on reciprocity of perspectives will be severely limited where the physical environment forces people into a full time struggle for survival, while it is far more difficult to be authentic in a world in which corruption is taken for granted and the prevailing world-view denies the possibility of there being a rationally grounded ethics. Conversely, people under stress deriving from their social relationships are likely to suffer biological illnesses, while individuals striving for integrity must go against the tide of those provinces of meaning based on assumptions conflicting with their own beliefs, and in doing so are likely to change social relationships. Denying the reality of the social world or the self world does not prevent the relationships to these worlds affecting the individuals involved. For instance where people's relationships to each other are understood in instrumentalist terms so that others are seen as part of the surrounding world to be controlled, individuals must suppress an implicit acknowledgement of the reality of the other subjects and the moral obligations this reality imposes upon them. And individuals who simply conform to whatever standards are prevailing in any context and move from one context to another without any effort to attain consistency in their lives must blanket out the challenge to authenticity with a fog of cliches and platitudes.

These different modes or aspects of being-in-the-world collectively form the nature of the temporality, spatiality and causality of this world. The complexities involved in this are most clearly manifest in the studies of psychiatric patients and it has been case studies of these that have been most revealing in this respect. (1) I will only mention

(1) Rollo May et.al eds. EXISTENCE op.cit.

a few aspects of these studies here.

As a process of becoming the temporality of the individual is of the greatest significance. Where individuals successfully achieve authenticity, they experience time as something lived, while failure to effectively engage in the world leads to time being experienced as something to be endured. Where there is a complete inability to constitute the future as a realm of potentialities in which wishes could be fulfilled and projects realized, this can give rise to feelings of impending doom. For instance in a case examined by Eugene Minkowski a patient was characterized by the terrifying delusion that his execution was immanent. (1) Minkowski went on to show how this followed from the patients inability to relate to time so that each day was experienced as an island without past or future.

In accordance with process philosophy, space should not be seen as something existing but as an order of potentialities for interaction. To effectively insert oneself into the world as an authentic agent is to experience oneself as oriented in space. However the nature of this oriented space can vary according to whether one is committed to preserving the status quo, exploring new horizons, driving a car or walking round a garden. There are different spaces associated with the different sensory modalities. There is also an experience of space according to one's mood. Thus the oriented space may appear as full or empty, expanding or constricting according to whether one is elated

(1) Eugene Minkowski "Findings in a Case of Schizophrenic Depression" in Ibid., 127-138.

or depressed. Various psychiatric disorders can only be understood on the basis of distortations of the spatiality of the patients' being-in-the-world.

Finally the experience of causality in the world varies from person to person and within individuals according to their mood. The melancholic feels that everything is determined and weighed down by the causal influences of the past while the manic experiences everything as due to chance without there being any continuity between the past and the future. On the other hand both causality and chance fall into the background in the case of the paranoic who feels that everything is the product of intention.

To understand any person it is necessary to understand their world in all its dimensions with all the relationships between these dimensions. It is also necessary to understand the genesis of this world. But individuals are still unfinished processes of becoming and it must be recognized that they also have a future in which their existing state of being can be transcended. The question then is not simply a matter of describing what is, but of working out what should be, how should people act and live. This is the field of ethics.

ETHICS

Ethics is the subject concerned with how people should live generally and how they should act in specific situations. A successful ethical theory must provide reasons for choosing how to live and how to act. In medieval Europe the conception of the world based on the ontology of formism provided such reasons as people could work out how to live and how to act on the basis of their place within the great chain of being, the series of corresponding planes and the cosmic dance. When the materialist ontology first displaced formism it was thought that the existence of a law governed universe knowable by reason provided the basis for establishing the existence of natural laws to which people should conform. But as the reductionist and positivist interpretations of the new science came to predominate, this ethical theory was undermined. As this world-view came to dominate biology and the social sciences, only two goals came to be seen as of any value: pleasurable experience and survival. On this view there are no grounds for considering the world or other people as having any intrinsic significance and concern for others came to be thought of as only being justifiable in terms of self-interest or irrational sentiment. The only acceptable rationality is the technicist rationality of controlling things to achieve ends which themselves cannot be justified. This has led people to a manipulative attitude towards the world, to other people, and ultimately to themselves.

Originally in opposition to this conception of the world, Romanticism based ultimately on Leibniz's conception of the monad has held that the correct conduct of life involves the actualization of the inner potentialities of oneself, of one's society or of humanity. But this has also led to a degrading of the world and other people to instruments of this self-actualization which is itself seen to be devoid of any higher meaning. As a consequence of this, the ideas of Romanticism have tended to complement positivistic materialism rather than displace it, providing the irrational ends to justify the technical control over nature and man.

I have tried to show that process philosophy enables one to conceive of what humans are and what their place is in the universe in a way that reveals the ends to which people are implicitly committed. Each individual as an embodied subject with all the requirements and capacities for suffering and sensuous enjoyment of other organisms is a partially autonomous process of becoming who transcends these biological imperatives. Through relations to others and through participation in society the individual becomes a reflexive self who strives for both autonomy and recognition from others, an orientation to the world which can be affirmed by others and control over his or her destiny. Through striving to form him or herself each individual contributes to the process of becoming of society which itself is a partially autonomous process of becoming within nature.

Processes can be most fully understood in terms of the analogy of music in that the self-ordering patterns of activity require a duration to manifest themselves as a melody requires a duration to manifest itself. Thus individuals must be seen as in the process of forming themselves with each act of thought, choice, commitment, action and expression. While an organism can be regarded as a melody which sings itself, humans are processes who must also to a large extent compose the music which they sing. But since they only exist as part of the process of becoming of society which in turn only exists as a process of becoming within the ecosystem, each individual must harmonize his or her own process of becoming or self-formation to that of others and to society as a whole which in turn must be harmonized with the rest of nature.

Thus as an unfinished process of becoming situated within a field of potentialities, the individual as a conscious agent who must choose what part to play in the suppression or realization of these potentialities is provided by process philosophy with a general idea of how to act and to live. To begin with by showing what ends people strive for makes it possible for individuals to choose how to go about realizing these ends, to harmonize them and to take responsibility for their own lives. But these ends cannot be reached except by acknowledging the significance of others and taking on responsibility for their welfare as well as one's own. The idea that people are intrinsically selfish and that ethics is only concerned with showing whether and how individuals should limit their selfishness to acknowledge the claims of others is a reflection of the atomistic, mechanistic view of humans. The situation of the individual is far better summed up by the Talmudic saying quoted by Erich Fromm:

> If I am not for myself, who will be for me?
> If I am for myself only, what am I?
> If not now - when? (1)

Ethics must be concerned with how to live the best life and this involves both living for oneself and living for others.

(1) Erich Fromm FEAR OF FREEDOM (1942) Routledge & Kegan Paul, London, 1966, p.v.

Furthermore the ultimate ends which people strive for are not ends which can be reached after a certain amount of time but are ends which must be striven for perpetually in the process of forming oneself over one's lifetime. This does not mean that the ends are never achieved. Rather they should be seen as ends to be realized continuously over the duration of one's life. Consequently it is a mistake to treat either the world or oneself as a mere instrument to achieve these ends. Rather one should see one's involvement in the world and one's life as a whole as a creative contribution to the becoming of the world.

Life understood in this way can best be seen as the search for, amplification of, and creation of meaning in the world. To experience anything as meaningful is to experience it as having some significance, and as such, as having a claim on one. In acting on the basis of this meaningful experience, this meaning is amplified and developed. For instance the look of the other is experienced as meaningful, and this is amplified if one responds to this look. New meanings are created when this leads to the formation of some form of more enduring relationship. And individuals in forming themselves by ordering their interactions with the world create in themselves something of intrinsic significances which is an irreducible part of the becoming of the universe as a whole.

The ways in which meaning can be attained in life have been studied by Victor Frankl who centred his psychiatric theories on the assumption that humans are beings who must search for meaning. He suggested that these can be classified into three chief groups: creative, experiential and attitudinal, writing:

> This sequence reflects the three principal ways in which man can find meaning in life: first by what he gives to the world in terms of his creation; second, by what he takes from the world in terms of encounters and experiences; and third, by the stand he takes when faced with a fate which he cannot change. This is why life never ceases to hold meaning, since even a person who is deprived of both creative and experiental values is still challenged by an opportunity for fulfilment, that is, by the meaning inherent in an upright way of suffering. (1)

To succeed in forming oneself as opposed to simply responding to the world is to achieve a unified style which gives one's life a wholeness or integrity. The nature of this achievement has been described by Erik Erikson:

> Although aware of the relativity of all the various life styles which have given meaning to human striving, the possessor of integrity is ready to defend the dignity of his own style against all physical and economic threats. For he knows that an individual life is the accidental coincidence of but one life cycle with but one segement of history; and that for him all human integrity stands or falls with the one style of integrity of which he partakes. (2)

The rationality involved in such a life cannot be thought of as an instrumental rationality in which there is a sharp division between means and ends, and rationality is thought to pertain to the means only. What is involved is a creative rationality. This rationality must be understood in relation to the different ends for which people strive: objective significance, orientation and control over destiny; though if a person is to achieve integrity these ends must be closely related.

(1) Viktor, E. Frankl "What is Meant by Meaning?" in JOURNAL OF EXISTENTIALISM, Vol.7, 1966-67, pp.21-27, p.23.
(2) Erik H. Erikson CHILDHOOD AND SOCIETY (1965) Triad/Paladin, Frogmore, 1977, p.241f.

The struggle for objective significance which begins with the emergence of the self originally takes the form of attempting to be affirmed in the eyes of significant others such as one's parents or one's peer groups. However as one reaches the capacity to question the ideals of these others, the sense of significance attained by acting in accordance with these is undermined. The strategies designed to overcome this problem vary. In traditional societies these strategies tend to be institutionalised and involve the re-affirmation of the community and the buttressing of traditions with various rites and ceremonies. In modern societies individuals can throw themselves into movements which generate sufficiently intense emotions to dissolve their critical faculties, or they can attempt to live according to abstract criteria which transcends every particular individual or group of people. Both these strategies are likely to prove unsatisfactory in the face of one's involvement in everyday life, and have a tendency to give way to cynicism in which an identity is achieved and a sense of superiority attained by attacking people who in any way manifest one's erstwhile attitudes. More commonly people join reference groups or cliques which define themselves as superior to others who are excluded from membership. This is manifest in occupational groups such as journalists, politicians, academics, intellectuals, doctors, blue collar workers and so on who all see themselves as the axis around which the rest of society revolves. It tends to be the members of these groups who are most insignificant who become most cliquish.

These strategies develop largely as a consequence of people's failure to understand what they are trying to achieve. Where it is understood by people that they are struggling for an identity which will give them a sense of significance, and that this identity can only be achieved through one's relationship to others, then the struggle can be pursued in a rational manner. To begin with it is necessary to acknowledge that having the capacity to question the standards one lives by makes one responsible for these standards whether one acknowledges this to oneself or not. To throw oneself into an intensely emotional state to avoid making choices is itself a choice. But when this is seen to be a choice it must be seen as unacceptable. To be involved in making a choice is to implicitly commit oneself to rationality and it is impossible to deny what one is at the same time affirming as it is impossible to think of a number and then to try to forget it. As one must be aware of the number in order to be trying to forget it, one must be committed to rationality in order to choose to be irrational. Understood from the point of view of process philosophy, this rationality should not be conceived as a formal rationality transcending all subjects but should be seen as the situated, developing rationality associated with an open court of reason. To act rationally is to act in a way that could be justified before such a court of reason and such justification must take as its starting point the achievements of one's cultural heritage.

Since such rationality implies the possibility of acceptance by any rational agent, and since no rational person would accept a moral judgement which reduced him or her to a mere means, such rational judgements must accord with Kant's formulation of the categorical imperative which accords the status of an end in itself to rational nature, i.e. "Act so that you treat humanity, whether in your own person or in that of another, always as an end and never as a means only." (1) This means that

(1) Immanuel Kant FOUNDATIONS OF THE METAPHYSICS OF MORALS (1785 - p.429) tr. Lewis White Beck, Bobbs-Merrill, Indianapolis, 1959, p.47.

justice must have a pre-eminent role in morality and such stratagems as the punishment of an innocent individual in order to give the impression that crime does not pay could never be morally acceptable no matter how much it increased the amount of happiness in the society as a whole.

However apart from the need to treat people as ends in themselves on formal grounds, it is essential if one is to achieve recognition. This is the point made by Hegel in the analysis of the master slave relationship in which the master could not achieve recognition because the people subdued by him were held to be of no significance. Where the striving for a sense of significance is based on reducing other people to objects as is the case for instance with the seducer this striving defeats itself. To attain an identity it is necessary to interact with, form relations with and make commitments to people based on a reciprocity of perspectives in which there is a mutual recognition of the intrinsic significance of each other and of each other's needs, desires, viewpoint and ideals. Such relationships are best formed by participating in the satisfaction or realization of each others needs and desires and by participating in the cultural processes of developing a common understanding of the world and in gaining control over destiny.

That such giving is required to receive full self-hood has been recognized by the Fipa who have developed their society on the basis of a process view of the world. This has led the Fipa to construct their villages to facilitate communication which is seen by the Fipa to be one of the most important ways of attaining self-hood. As Roy Willis wrote of them:

> If the self is a process, as it is for Fipa, then speech is its prototypical expression, though by no means its only expression. In speech the self emerges as originator and constructor - of meaning. Which is to say that in the process of verbal communication the human individual achieves self-definition. In the act of giving which is the speech-performance, the giver also receives - of himself. And since verbal communication is conditioned by the requirement of physical proximity between the participants, we can at last understand why Fipa live in concentrated but formally unstructured settlements: it is a necessity of their psychic economy. (1)

This way of thinking underlying their ethics is manifest in all activities of Fipa society. For instance in the nineteenth century the Fipa lived between two expansionist societies. Their attitudes were such as to enable them to make the sacrifices necessary for them to defend themselves adequately without developing into aggressors in turn. (2) Also the Fipa were characterized by their recognition of the intrinsic significance of outsiders, as Willis noted: "With this special valuation of the Ego the culture of Ufipa instils a complementary valuation of the Other, expressed in a marked reluctance to make blanket judgements of foreign ethnic groups, or to judge individuals by the external marks of ethnic identity." (3)

The second aspect of self-formation which illustrates the need for a creative rationality is the struggle for a common orientation. This can be achieved by denying one's own responsibility for one's beliefs and

(1) Roy Willis MAN AND BEAST op.cit. p.89.
(2) Ibid., p.127.
(3) Roy Willis (1974) op.cit. p.102.

taking over some dogma. One then conceives of oneself as a servant of this dogma. Since dogmatic beliefs are likely to lose their status if there are people who hold and express different views it is necessary to prevent such expression. This can be justified in the name of the dogma of which one is a servant. The dogma can be further strengthened as a source of orientation by the construction of elaborate symbolic forms to affirm its validity. Such an approach must be rejected on the process view of humanity since it involves attempting to deny one's responsibility for one's beliefs and self-formation. In attempting to orient oneself and to arrive at a shared orientation there is an implicit commitment to achieving the best understanding of the world. Since people could not willingly orient themselves on the basis of beliefs which they knew to be less adequate than others, and since any communication involves an implicit commitment to the truth, any attempt to limit communication by preventing other people questioning one's beliefs must be regarded as a form of self-deception and any attempted justification for this a rationalization. If intolerance is faced up to as a self-deception then people must accept that this is an irrational way of retaining one's sense of orientation and that the only acceptable basis for orientation is one which can stand up in a court of reason in which all ideas can be considered. On this basis it must be accepted that it is only possible to make a provisional commitment to any way of viewing the world and there is an implicit commitment to the appropriation of new ideas and continued development of understanding. This development involves an increasing freedom of understanding from individual and group idiosyncracies and limitations and so provides the basis for a common orientation and unity with an increasingly broader group of people. That this is the case has been accepted by the Fipa as pointed out by Roy Willis:

> The Fipa intuition of the world and human nature as essentially a process has...the consequence that the intellectual picture of the universe is always provisional...Instead of the maintenance and extension of social distinctions and cognitive categories, we find Fipa constantly seeking to subsume existing discriminations and categories within more inclusive and fundamental concepts. The constant expansion of intellectual apprehension into the opaque areas without human society and within the human individual tends to unify individual and collective experience and transcend differentiating characteristics of human beings and external nature. (1)

While such understanding has a significance in the self-formation of the individual in its own right, it is also extremely important in that understanding provides the individual with grounds for choosing how to act and how to live. Through understanding individuals are able to transcend their environments and substructures and act according to reason to become immanent causes of their own being, that is, to act authentically. To the extent that individuals do not understand the world or themselves or are deceiving themselves, they are not free agents. By acting on the basis of an understanding of the world which is objectively acceptable it is possible to choose to live in a way which is objectively justifiable and so to attain an objective significance in one's life.

However it has been held in the past that a truly objective knowledge of the world can provide no grounds for action. On this view the real world is painted over with emotions to provide the illusion that it is

(1) Ibid., p.123.

meaningful in itself and a purely objective understanding of the world would reveal it to be devoid of such subjective colouring. The view originally espoused by Hume that an 'ought' cannot be derived from an 'is' has also been widely accepted. These ideas must be rejected on the basis of the way objectivity, understanding, rationality and the nature of the world have been described here.

Firstly objectivity does not imply 'independently of its relation to any subject'. It means a viewpoint which is not contingent upon any particular individual or group, that is, a viewpoint which is defensible before an open court of reason. Therefore it is possible to establish that something has meaning or significance objectively so that any rational subject must acknowledge it.

Secondly, together with forming the self as an autonomous rational agent, the growth of understanding of the world and the place of the individual within it must be seen as involving the subject in the meaning of the world, revealing the goals worth pursuing and the best way to act. Understanding is 'indwelling' in the world rather than the accumulation of knowledge about the world and knowledge as such only has significance insofar as it plays a role in the collective process of attaining an objective understanding of the world. While knowledge as the contemplation of some fact about the world detaches the subject from the world, indwelling involves a deeper participation within it. Thus the understanding individual is not a subject who stands over against the world as a contemplative spectator but is basically an engaged subject responding to a world experienced as meaningful.

That an 'ought' cannot be derived from an 'is' is a dogma based on an excessively formalistic understanding of reason. Where reason is thought to pertain only to the relationship between isolated propositions as it is treated in formal logic, there would be some justification to this. On this basis it could be concluded that what is in the conclusion must have been in the premises, and if there was no 'ought' in the premises, there can be no 'ought' in the conclusion. But such a logic necessarily rules out ethical problems because it has no place for becoming in which the subject could play a part. However when reason is understood as it was described in Chapter II in terms of the question and answer logic always understood in relation to the embodied subjects who strive to understand and act in concrete contexts, the role of reason in ethics can be properly grasped. Individuals as embodied in the world are in the process of becoming and must choose to act one way or another. The way they decide follows from their understanding of their situation. To understand a situation is to conceptualize it in a certain way, and the world is conceptualized first and foremost to facilitate action. The concepts used in this way are often implicitly evaluative, and it is through these evaluative concepts that we interact with the world and with each other. Consequently to define what a situation is implies how one ought to act. For instance to define a situation as one in which someone is in danger of drowning while one is in a position to save him or her immediately implies that one should act to save the person. Similarly where people's relationships are conceptually constituted as when one person has made a promise to another the conclusion to be drawn is that the promiser must act according to his or her promise. It is only when there is some doubt about the nature of one's situation that reflection is called for and such reflection in giving rise to a deeper understanding of the situation re-involves one with the world and again mobilizes one for action.

The rationality of ethical judgements and the resolution of ethical disputes tends to be obfuscated by the hypostatization of ethical concepts, in particular the concepts 'good' and 'value'. That 'The Good' is some type of self-subsistent being which can only be understood or perceived by some form of mystical leap or intuition is an idea originally put forward by Plato and recently revived by G.E. Moore and the intuitionists. However this reification was severely criticised by Aristotle who pointed out that even if such a being were perceived it would not be able to provide the criteria for making choices. Dereifying the concept, he began the NICOMACHEAN ETHICS with the statement: "Every act or applied science and every systematic investigation, and similarly every action and choice, seem to aim at some good; the good, therefore, has been well defined as that at which all things aim." (1) Given this definition of good, one is still left with the task of working out what it is best to aim at, and this undertaking can be a rational enterprise.

The reification of value reflects the influence of economic thought. As reified, value is thought of as something quantifiable but purely subjective with such valued phenomena as justice being seen as equivalent to so much sensuous pleasure. These values can be measured by what a person

(1) Aristotle NICOMACHEAN ETHICS tr. Martin Ostwald, Bobbs-Merrill, Indianapolis, 1962, 1094a, p.3.

is willing to pay. But as such value is supposed to be independent of rationality and value conflicts are held to be irresolvable. However a person engaged in the world experiences things as meaningful according to his or her understanding of the situation and what a person is said to value is nothing other than meanings experienced by that person as an engaged subject in a detached way. That things are valued differently is mainly a consequence of the different situations people are in. Conflicts of values on the other hand reflect different ways of understanding the world. This means that disputes about values are basically of the same form as disputes about scientific theories, and while differences may not ever be completely eliminated, they can be brought into the realm of rational disputation.

Ultimately such disputes must come down to the questions about what is the nature of the world and what is the nature of humans. The conception of the world argued for by the materialists by denying free will and meaning in the world is clearly nihilistic, but the conception of the world implied by process philosophy justifies free will and the experience of the world as intrinsically meaningful. Nature is no longer conceived of as 'a dull affair; soundless, scentless, colourless; merely the hurrying of material endlessly, meaninglessly' but as a dynamic process of becoming continually producing new types of processes including living beings which struggle, grow, reproduce and die. They also suffer, experience satisfaction and in many cases aesthetic appreciation. And humans with their own distinctive capacities: for anguish, creation, communion, understanding and elation are an irreducible part of this becoming. Failure to experience such a world as resonant with inward meaning is simply evidence of poor understanding. In such a world it is possible to justify how to live and act. It is evident from what has been written in Chapter V that animals suffer and are generally more intelligent than they have been hitherto regarded, and that life on earth is only possible because of the conditions maintained by the interaction of a vast number of species. It can be concluded from this that animals should be treated with respect, should not be made to suffer unnecessarily and that actions should not be undertaken which radically disturb the ecosystem of the earth as for instance is the case with the destruction of the rain forests. It can also be argued that such animals as otters and whales which are characterized by high levels of intelligence with a corresponding capacity to understand the world and to enjoy life should not be killed for sport or profit. In the case of humans what ends are intrinsically worthwhile can be established through the development of the conception of what humans are, as has been attempted in this thesis.

The difference process philosophy would make to the way people live is to some extent evident from the Fipa who have a process view of the world. Roy Willis showed how in contrast to people in Western civilization in which "a dominant rational materialism encroaches into a diminishing area of human 'spiritual' autonomy." (1)

> ...the monistic Fipa world-view sees the development of the individual and human society as interdependent aspects of a single life-process; there is thus no possibility of a structural transformation of the Fipa world view towards a domination of human beings by reified abstractions, such as Western man has notoriously suffered. Instead we see, in the nineteenth century apogee of Fipa culture, peace and industry in association not with a grim-faced Puritanism but with a vivacious and sociable populace...Our analysis leads us to suppose that these facts reflect basic values projected by the structure of Fipa cosmology,rather than any innate

(1) Roy Willis (1974) op.cit. p.127

ethical superiority in Fipa humanity. (1)

While self-formation requires an understanding of oneself and one's world, understanding itself is not sufficient. It is also necessary to live in accordance with this understanding and to control one's destiny to some degree on the basis of this understanding, even if this control only involves enduring suffering with dignity. This is the third aspect of self formation and this also requires a creative rationality.

The most important aspect of attaining a control over one's destiny is attaining control over oneself. Without such control one's control over anything else must be extremely limited. To have control of oneself is to be able to act rationally or in accordance with what one conceives to be a rational way. The most important feature of such self-control is the ability to act according to one's convictions. Failure in this can be due to two factors: a lack of courage and resolve to act on the one hand, and loss of physical control as occurs for instance when an individual is paralysed by anxiety. These are closely related since the tendency to be paralysed by anxiety can be gradually overcome if a person has sufficient resolve.

More commonly self-control is understood as opposed to impulsiveness or emotionality. Such a way of thinking gives rise to a dualistic conception of consciousness with a harsh moralist accent as either exercising or failing to exercise the will power over an anarchic realm of impulses and

(1) loc.cit.

emotions. However the very existence of such a conflict in the individual suggests a lack of the integration required for self-determination. Integrated people are not those whose impulses must be restrained to accord with certain standards, but those who do not have impulses opposed to their convictions on how they should act, and their convictions are not external standards which they impose on themselves but are fully identified with. Such people simply act spontaneously according to their civilized inclinations.

The attainment of such unity in the individual is largely a matter of coming to terms with one's emotions. I argued in Chapter VI that emotions are essentially associated with threats to or with the augmentation of one's biological or psychological being. For instance fear and anxiety are produced by threats to one's being while the emotion of love is associated with the augmentation of one's being. As such emotions are a response to one's situation in the world as one understands it, and while they may inspire action they do not necessarily do so.

Since one's self-hood is something which emerges through one's relationships with other people and it is only through these others that one's psychological being is maintained, emotional states are largely dependent upon the nature of these relationships. Actions of one's own which undermine the unity of the self as defined from the viewpoint of a significant other, a reference group or the objective standpoint of the generalized other, and which therefore threaten one's psychological being give rise to the emotions of guilt, shame and anxiety. On the other hand living in accordance with the ideals of such reference points provides fulfilment, that is, an enhanced sense of being. Such enhancement of being is associated with the regaining of an awareness of one's dependence on and unity with others, a regaining of the 'we' experience which gives rise to sympathetic emotions and a caring attitude towards others. This emotional state is reflected in the words of John Donne:

> Any man's <u>death</u> dimishes <u>me</u>, because I am involved in <u>Mankind</u>; And therefore never send to know for whom the <u>bell</u> tolls; It tolls for <u>thee</u>.

Actions of others which interfere with one's attainment of self-hood can also generate intense emotions. If one's self-hood is threatened through failure to achieve appropriate acknowledgement from others as when one is treated unjustly this gives rise to anger, bitterness and resentment. Interference with one's attaining of self-hood as when recognition or status symbols are monopolized by others gives rise to jealousy. Where the unity of the 'we' experience is threatened as when the moral order which maintains this is challenged, people become morally outraged.
To live a life of rational self-control the individual is challenged to cultivate those positive emotions which are associated with a deeper understanding of the significance of life and of relationships with others while avoiding negative emotions and the distorting effects that emotions can have on one's perspective. Doing this requires the ability to move between different levels of centredness or decentredness from immediate experience. It is necessary to be centred and emotionally involved in the world and be aware of the significance of things, people, and oneself to be inspired to action. To take a purely abstract attitude is to lose this awareness so that even when a person works out how best to act, he or she is unlikely to develop the resolve to do so effectively.

To move oneself to effective action in the interests of others is also only possible when one emotionally identifies with them. But on the other hand it is necessary to know how to decentre oneself in order to avoid being consumed by resentment or bitterness, to overcome the trauma of failure and to maintain a perspective on what is of major and what is of minor importance. It is also necessary to decentre oneself in order to work out how to live so as to avoid the destructive emotions, to engender the positive emotions and to harmonize these.

The second aspect of attaining control over one's destiny is attaining some control over the world. Control over one's world is generally regarded as synonymous with the ability to dominate one's world. Such domination involves the development of skills, the development and mastery of instruments, the ability to get people to act in the way one wants and the ability to master institutions so as to be able to get what one wants from them. It is here that instrumental rationality appears to have its valid place. But if control is to be authentic it cannot be just a matter of being able to have an effect on the world even if this effect involves achieving ends which one desires. Authentic control of the world is the ability to make the becoming of the world conform to reason. Thus if it is necessary to act in a way which is not defensible to an ideally rational observer in order to be able to have an effect on the world then one does not have control over one's destiny.

This is most clearly evident in the case of those people who achieve success in institutions by acting in ways that are not rationally justifiable. Such people can have major effects on the world by their decisions, while the rewards of office are likely to enable them to satisfy their material wants and to attain social status. However such people are only able to maintain their positions while acting according to the requirements of their positions. People in such situations are not authentic and do not express themselves in their work. They are merely cyphers for processes transcending their intentions. Status achieved in this way is largely spurious because what is recognized is not an authentic expression of the people themselves but merely the trimmings which are part of the roles which such people fill.

People who use other people as instruments are in a similar position. Since their actions are irrational in the sense that they could not be accepted by an open court of reason, they are not acting authentically. Status attained by success becomes meaningless since what is recognized is not authentic. Furthermore since it is difficult to treat some people as instruments without regarding all people as things to be manipulated, recognition achieved loses its significance.

However it is not only in actions involving other people that an instrumental rationality proves to be inadequate. Instrumental rationality defines the ends as external to the means by which they are achieved, and the means come to be regarded as of no significance apart from their part in realizing ends. This not only devalues the world itself but also the work by which any end is achieved. It is no longer regarded as a creative activity through which people develop themselves and express themselves in their creations. This attitude is crystallized into reality as the world is transformed into instruments designed solely in terms of their capacity to achieve ends in the most efficient way. This involves developing instruments which require the least possible skills so that people can be easily replaced. The effect of this crystallization is that people are alienated from the products of their activities and reduced to mere appendages of their instruments. As this instrumental rationality pervades more and more of the lives of people in society, their activities become increasingly devoid of meaning. In the end all that is left for them to do is to compete with each other for status by conspicuous consumption.

By conceiving of interaction in the world linearly as an activity producing an end, instrumental rationality also has the effect of blinding people to the consequences the achievement of ends have on the means by which it is produced. This is illustrated in a minor way by the use of sleeping pills. When a person takes these they are at first effective, but the body then adapts so that an increased dosage is required. Eventually the person taking them must take pills to remain in the position from which he or she started. Similarly in agriculture pesticides increase yields for some time, but where this upsets the eco-system increasing inputs are required to maintain these yields. Eventually large inputs are required just to maintain the original yields.

The collective effect of people's struggle for power through instrumental rationality is worse than the individual problems. Since instrumental rationality does not provide people with real control over their destinies but, if anything, diminishes it, and since it also deprives people of the means of attaining a sense of their own significance, the striving for instrumental control becomes maniacal. The more that appears to be achieved in the way of increased technical control the more power hungry people become. This is most clearly manifest in the development of the military-industrial complex in U.S.A. and the general support this receives from the public as opposed to international aid or welfare provisions.

What is required in place of such an instrumental rationality with its implicit commitment to domination, is a rationality which sees living as a creative participation in the becoming of society, humanity and the world as a whole. Such a rationality must recognize the integrity and intrinsic significance of others and the self-stabilizing dynamism of nature and must acknowledge the effects of one's actions on the becoming of other beings.

However given the complexity of the society and the world generally, making judgements about how to live and to what life projects to commit oneself is extremely difficult. It is necessary to have a broad understanding of the dynamics of the world and a critical understanding of the society within which one lives. Where there are any number of courses open to one and it is impossible to find grounds for choosing between them, then one is not free since freedom implies acting on the basis of one's understanding. Thus understanding is required as the ground for ethics. But understanding is not simply a matter of having the information. Lack of understanding can arise from bombardment with information without having the means to judge its accuracy or relevance as much as from being deprived of it. It is science and philosophy which provides or fails to provide people with the perspectives on the world in terms of which they can understand their situations and potentialities. Consequently such disciplines aimed at increasing our understanding of the world must be regarded as the foundation for an effective ethics and in particular social science and ethics must be regarded as indissociable.

TOWARDS A CRITICAL SOCIAL SCIENCE

In Chapter I it was pointed out that the development of the social sciences has been characterized by two oppositional tendencies. The predominant one derives from the mode of thought of positivistic materialism and the aim of the sciences is seen to be the description and prediction of human behaviour by means of laws. The opposing tendency reflects the influence of the Romantic tradition with its expressivist notion of humanity according to which people live in a world which is largely a human creation. Here the aim of the social sciences is taken to be empathy with the actors involved in this creation and an understanding of the uniqueness of each epoch, society and individual. The Romantic tradition was seen to be marginal and to suffer from its incompatibility with the conception of the world as implied by the physical sciences. However the epistemology developed in Chapter II and the process ontology developed throughout this thesis imply that it is the prevailing reductionist form of social science with its concern with laws and predictions which should be rejected as incompatible with the practice of the physical sciences and the conception of the world implied by them, and that empathy with or understanding of beings conceived of as largely self-creating is the approach the social sciences must adopt if a radical disjunction between the physical and the social sciences is to be avoided.

Attempting to understand the world, which it was argued is the basic aim of all science, involves the attempt to 'indwell' within it. A scientific theory must ultimately be judged according to whether it can facilitate a deeper indwelling than any alternative theory. The notion of 'law' is important in science not as a description of what is discovered but as a metaphor which is useful as a means to understand or indwell in the world.

The process of understanding people is not essentially different from understanding any other phenomena. The nature of indwelling and the importance of grasping the relationship between parts and wholes was described by Herder as '<u>einfuhlen</u>' and elaborated in hermeneutics by such thinkers as Dilthey. But these thinkers stressed the role of imagination without acknowledging the importance of theory, and this has given the impression that there is something irrational about this procedure. However this is an oversight since their studies presupposed and developed the conception of humanity in which humans were seen to be creative and their perception an active constitution of their worlds. This enabled them to focus on such issues as how different people conceive their world differently and what unifying style permeates their creations. This conception of humans has been further developed and elaborated by phenomenologists and existentialists. What enabled Ludwig Binswanger to achieve such a deep understanding of his patient in his famous work: THE CASE OF ELLEN WEST (1) was not simply his imagination but the conceptual framework with which he was working. What prevents behaviourists understanding people is not that they eschew imagination but that their stimulus-response theory of humans is so conceptually obtuse.

With the method by which people attempt to understand other people as creative subjects being essentially the same as the method by which all other phenomena in the world must be understood there is no need for social sciences which acknowledge the subjectivity of people to be bracketed off from the natural sciences. Nor is there any need for such social

(1) Ludwig Binswanger "The Case of Ellen West: An Anthropological-Clinical Study" in EXISTENCE ed. Rollo May et.al. op.cit. pp.237-364.

sciences to deny the reality of the immanent dynamics of processes in society transcending people's intentions. Consequently it is no longer necessary for the social sciences deriving from the Romantic tradition such as symbolic interactionism, phenomenological and existential psychology and sociology, hermeneutics and Hegelian Marxism to be confined as they have traditionally tended to be to the study of micro-sociological processes and culture. It is now possible to understand the phenomena associated with human subjectivity in the broader contexts of society and humanity as a whole in its dynamic relationship to biological and inanimate processes.

Understanding involves the grasping of the significance of any phenomena within the context of the whole. This means that a scientific theory must enable a person to both grasp each particular in its uniqueness and to relate each particular to other phenomena and ultimately, to the totality. This must be so even if there is no causal relation involved since to understand that there is no such relationship between two phenomena and why there is no such relationship is to relate the phenomena. The uniqueness of each particular can only be understood by relating it to other phenomena in this way. While the physical sciences frequently develop general theories and disregard individual instances for which the theory is relevant, this is because in many cases all instances can be fully grasped by the general theory. For example it is not necessary to detail each instance of the behaviour of the electron because quantum theory in so far as it has been successful can be assumed to offer satisfactory explanations of electrons ever since electrons first came into existence. However science is generally committed to an evolutionary view of the universe and scientific theory attempts to come to terms with every unique feature of this evolution, from the big bang to the formation of elementary particles, the formation of galaxies, stars and planets to the emergence of life and mind and all the particular forms of these, in a way which both reveals their uniqueness and enables them to be understood in relation to everything else. This means that there is nothing unique about human history attempting to understand particular phenomena, and the attempt to divide disciplines up into ideographic or nomothetic according to whether they are concerned with particular phenomena or general laws must be rejected as invalid, and the attempt to divide the social sciences from history must be regarded as a mistake. If this is the case, then each individual should be able to demand from science the means to understand his or her unique situation in the world and the relationship between this and everything else.

For science to be able to fulfil this function it must be based on an adequate metaphysics. Only if this is the case can the various sciences be related to each other so that any particular phenomena can be related to the whole. From the point of view of humanity trying to orient itself in the world and the individual trying to understand his or her unique situation, the most important part of metaphysics is philosophical anthropology. It is necessary to develop a conception of human being in terms of an ontology to show the place of the human order within nature and to provide a basis for the human sciences. Philosophical anthropology is the attempt to grasp the universal features of humanity which distinguishes it from all other forms of being, and it is through the development of an adequate anthropology that all the particular studies of the human order can be understood in relation to each other, just as an adequate conception of being is required to enable the various types of being to be understood in relation to each other. Philosophical anthropology also provides some criteria for determining what is important to study, since such enquiry should not be haphazard but should be aimed at developing to the limits the conception of humanity which has been adopted and to show its superiority over alternatives. Finally the conception of humanity and its place in the cosmos assumed by the social sciences determines the values implicit within these sciences as I attempted to show in Chapter I.

The most important failing of the metaphysics of positivistic materialism was its inability to form the basis of an adequate conception of human beings since it is impossible to understand people as subjects in terms of the concepts of materialism. However in this thesis it has been shown how in terms of the ontology of process philosophy it is possible to conceive of processes characterized by subjectivity and teleological forms of behaviour having emerged in the process of becoming of the world from the inanimate processes studied by the physical sciences. This has then provided the starting point for the development of a conception of the human order in which conscious subjects were seen to be involved in the development of a moral order, a common orientation within the world and control over their destiny. These processes by which people form themselves were seen to engender processes which develop independently of people's intentions thus accounting for the complexity, opacity and inertia of the social order. The creative activity of humans in their process of self-formation can now be understood as an integral part of the world. Assumed by the social sciences this conception of humanity provides a basis for evaluating any social phenomena according to whether it enables people to attain a sense of their own significance, to orient themselves and to communicate with each other, and to attain control over their destiny.

However ascribing this role to philosophical anthropology presents two problems. The first is that it involves the attempt to draw evaluative conclusions on the basis of what man is, thus abrogating the moral division between facts and values and committing what G.E. Moore called the 'naturalistic fallacy'. The second problem is the nature of the relationship between the conception of man assumed by the social sciences and the conception held by the people being studied. It could be argued, particularly in relation to traditional societies that it is ethnocentric to attempt to understand them in any other way than in terms of their own conception of what it is to be human.

That there is an absolute disjunction between facts and values has been implicitly rejected in the last section where it was argued that an 'ought' can be derived from an 'is' and that disputes about values are really disputes about interpretations of the world. However there are some other facets to this problem which have made it appear that science cannot be involved in making value judgements.

According to many positivists a statement is factual if it can be observed directly or indirectly to correspond with the facts. Except for analytical statements which merely state tautologies all knowledge must be based on experience in this way. Science is then seen as concerned with the discovery and representation of the facts. This notion of factuality is frequently accepted even by those who do not profess to be positivists. On this view, since there is nothing a value statement could be observed to correspond to in the world, value judgements cannot be factual. Since therefore such judgements cannot be regarded as capable of attaining the status of knowledge, they must be regarded as ultimately irrational.

But the correspondence theory of truth together with the idea that science is an accumulation of knowledge was rejected in Chapter II. Theories were seen to be formed through the articulation of analogies into conceptual frameworks to be used as instruments for understanding the world. Propositions are tentative answers to questions in terms of these conceptual frameworks and embody the concepts of the theory, and facts are simply true propositions. As such facts are relative to the theory in terms of which they are formulated and also embody the concepts of the theory. There is no reason why the concepts of a theory about the world should not be evaluative as are the concepts 'health' and 'suffering', and facts embodying these concepts such as: "That animal is healthy", or "That animal is suffering", are at the same time evaluative. Therefore if it can be shown that the best theory for understanding humans is one in which humans are conceptualized as forming themselves as beings of intrinsic significance by aspiring to achieve certain goals then statements about people understood in terms of these concepts, that is, statements about the extent to which these aspirations are being or have been achieved, can be both factual and evaluative.

Studying the ideas of people, whether of one's own society or that of another culture should not be undertaken as an attempt to give an account of what these ideas are nor of judging the adequacy of these ideas in terms of one's own ideas. Such a study should take the form of a dialogue in which the ideas are grasped in terms of their difference and similarity to one's own. This not only enables one to grasp the uniqueness of the other ideas but also reveals one's own beliefs. One should then be prepared to accept that one's own beliefs could be inadequate. If this is the case then an understanding of the new culture will require a partial or complete revision of one's own beliefs. But where one's own beliefs are not replaced, then one must acknowledge that to the extent that those ideas or beliefs being understood are different from one's own, they are inferior. This means that one should interpret the society and social situation of these others together with their ideas in terms of one's own conception of the world and since this conception must be evaluative, this means evaluating people and other societies in terms other than those by which they evaluate themselves. With this approach, the understanding of other people or societies is neither a detached observation nor a judgement in terms of one's own culture, but should involve bringing the ideas of the others together with one's own beliefs into the court of reason in which all ideas can attain a hearing. Evaluative judgements are therefore placed on the same rational footing as the judgements about scientific theories. The perspective from which evaluative judgements are made is the universal court of reason, and all societies must be judged according to the image of man that has been defended most satisfactorily in this court. This approach avoids both cultural relativism and ethnocentricism while acknowledging that one's conclusions have only a provisional status and are open to development and improvement.

Having judged beliefs as inferior opens up a number of questions for the investigator. S/he can attempt to explain the inadequate ideas or beliefs in terms of such factors as class interest and then attempt to show how these beliefs are maintained. But perhaps more importantly in that success can provide further justification for a conception of man, it is necessary to show the effects of inferior beliefs. For instance in the nineteenth century where many people failed to acknowledge sexual attraction, this gave rise to various forms of irrational behaviour which could be made intelligible on the basis of the conception of man which argued that there was such an attraction. Similarly in the late twentieth century where people's need for recognition is not acknowledged in many Western societies psychiatrists and sociologists have been able to explain behaviour that appears anomolous as the distorted efforts of people to achieve such recognition without acknowledging what they are striving for. Ideas can also be justified by showing that societies in which such ideas prevail are free of such irrational behaviour.

While philosophical anthropology developed in terms of a metaphysical system provides a general understanding of the place of humanity in the cosmos and is required to attain a unified understanding of all the particular aspects of humanity or society, this still leaves the problem of how to develop social science to grasp all the dimensions of the human order. The existing disciplines have developed haphazardly without any underlying rationale. Economics, sociology, psychology, semiotics, politics, history, geography, literature, anthropology and so on overlap, frequently deal with the same subjects without communicating with each other, and tend to prevent people focussing attention on issues involving a number of disciplines. There is no way of systematically relating these disciplines and specialization leads to distorted or sterile fields of enquiry. For instance economics abstracted from history and politics ignores the changing nature of the economy and the political power relations involved in this, while sociology which attempts to understand society in isolation from the economic order becomes trivial. Even more serious is the tendency of such specializations to present themselves as the total explanation of society as semiotics under the banner of structuralism is attempting to do at present. If there is to be specialization in the social sciences, it must be done in a way in which the specialized study can be understood in relation to all other such studies and to the totality of the becoming of humanity.

Such a way of proceeding is facilitated by the ideas of process philosophy. The basic analogy on which the version of process philosophy developed here is based allows one to think of processes emerging within the process of becoming of the world which are both dependent upon their environment and have some autonomy from it. The various relationships between processes can be understood in terms of the forms of causality: both conditional and immanent, which underlie the process view of the world. To understand the human order it is necessary to identify the processes which have some autonomy from their environment and sub-structure and show how they maintain and develop themselves, resisting their environments and constraining their sub-processes by providing the environment within which they function. It is also important to understand the development of the environment which allows a new process to emerge and take on a dynamics of its own, and to understand the developments which lead to the destruction of processes. Unravelling the relationships between processes can be expected to be very difficult since the processes which make up the human order not only intervene in each other or are in hierarchical relationship, but frequently are mutually dependent, coterminous and yet irreducible to each other, or are in even more complex relationships to each other. Where processes are hierarchically related with higher levels constraining the lower levels, this does not mean that the lower levels are determined by the higher levels. There is no geographical determinism as suggested by Montesquieu or technological determinism as suggested by some Marxists. At various stages, especially when the higher order processes are unstable, the direction of history can be determined by the constituent processes. Ultimately the actions of a few individuals can alter the course of history. For instance the resistance of the ruling class of Poland in the sixteenth century to the development of an adequate political organization eventually resulted in Poland's destruction as an independent entity. There is no reason to believe that the Bolsheviks would have been successful without Lenin or the Nazis without Hitler.

With this conception of the process of becoming of humanity the division of the social sciences into different specialities is justified to the extent that these deal with processes which have some autonomy from other processes. In this way the social sciences should aim to develop an adequate conception of various processes that have emerged throughout history. However, since such autonomy is never more than partial and since all social processes are interrelated in complex ways, the boundaries of these specialities can never be firmly drawn. Science must be developed to enable particular processes, whether the capitalist form of the economy, the absolutist state or a movement in art to be understood in relation to other social processes, and ultimately in relation to the history of humanity. History should assimilate the human sciences in its interpretations of the past, and there can be no human science which is not historical. Consequently the boundaries of the social science disciplines should never be firmly drawn, no social scientist should attempt to work without a wide range of knowledge of various aspects of society other than those encompassed by his or her speciality, and there should be a large proportion of social scientists who do not specialize.

The approach required to understand the social order in all its complexity must involve first grasping those processes which are most enduring. Here again philosophical anthropology as the attempt to understand those characteristics of humans which do not change yet which make human history possible is of central importance. Apart from this geography should be given a central place in the social sciences as the subject dealing with the relationship between humans and their physical and biological environment. Such features as geological formations and climate constrain the human order while providing the conditions of its existence, and through history humans have only slowly changed their relationship to these. The relationship between humans and the biological world has changed somewhat more rapidly as species of animals and plants have been domesticated, altered or destroyed and other organisms have become parasites on humans. Thus the place of humans in the ecosystem and the effect humans have had on evolution should be regarded as the next order of processes to be understood. In these cases what is involved are self-sustaining processes of which humans are a part. After having dealt with these processes it is necessary to focus on those processes which emerge and sustain themselves within the human order. Here the issue becomes more complex as it becomes difficult to distinguish which are the constituent processes, which are the supervening processes, which processes are mutually constitutive of each other and so on. However the same principle must apply: that what should be focussed on first are those processes which are most enduring. A prime candidate for this is the development of technology which is based on man's struggle for control over destiny. The rate of development of this varies from socio-economic formation to socio-economic formation and there have been societies in which technology has declined. However if long time spans and the whole of humanity are considered it can be seen that there has been a continuous development of technology which sustains itself by enabling those societies which have been most technologically advanced to prevail over those which have been less advanced. Other enduring processes are basic modes of perception, socio-economic formations, cities, religious movements, the advance of philosophy and science, nation states, balanced patterns of alliance and conflict between states and so on. Processes of shorter duration should always be understood in relation to these more enduring processes which provide the environment which makes them possible. Also which of the myriad short term processes to focus on must be determined by their significance to the more basic processes. For this reason it is necessary to focus on the processes involved in the destruction or creation of basic processes such as the people, organizations, diseases and so on responsible for the establishment or destruction of civilizations, socio-economic formations, or basic conceptions about the nature of the world and the place of humanity within it. Also of interest are exceptional processes and highly typical processes. These are important for the different ways in which they illuminate more basic processes. For instance it is necessary to look at exceptional instances, whether exceptional communities, mentally deranged people or people of exceptional creativity or intelligence if an adequate conception of humanity is to be developed. And to understand such movements as the rise of the Nazis in Germany it is necessary to look at typical cases in order to understand how such a movement was possible.

Having understood the more enduring features of humanity and society it is then possible to focus on the intentional behaviour of people. While there is no justification for regarding nature itself as directed towards a goal, and while the human order derives largely from processes which are the unintended consequences of people's actions, individuals and groups must be understood as acting purposefully to realize the potentialities of the situation in which they find themselves. They are not simply determined by this situation, they must be understood as transcending the immediacy of their present situation as they live towards the future which they in turn define in relation to the past. As Edward Tiryakian wrote:

> ...human existence stretches out into the future and into the past. The subject, understood phenomenologically, is not an entity contained in an absolute space but rather an existent whose being is a set of possibilities that became actualized in the present. The past and the future are therefore not separate entities: the past is, existentially viewed, a having-been present, while the future is a will-be-present, both being grounded in the phenomenal emergence of the here and now. (1)

(1) Cited by Wendell Bell & James A. Mau in "Images of the Future: Theory and Research Strategies" in THEORETICAL SOCIOLOGY: PERSPECTIVES AND DEVELOPMENTS ed. John C. McKinney & Edward A. Tiryakian, Appleton-Century-Crofts N.Y. 1970 pp.206-234, p. 207.

The ability of people to transcend the present to a far greater extent than any other animals derives from their participation in the transcendent order of the realm of ideas in terms of which they can form an image of the future to be realized. Images of the future can be formed in relation to everyday life, by organizations in relation to their survival over decades, or by societies as a whole. The ability to form such an image of the future has a profound significance for the individual, group or society. As Bell and Mau wrote in relation to cultures:

> The rise and fall of images of the future precede or accompany the rise and fall of culture. History has been made what it is largely as a result of the ideas and ideals of man that have been congealed in the form of images of the future. The time that is yet to come rests importantly on the nature of the present images of the future. Thus, the vigor and potentialities of the society of tomorrow can be detected in the society of today. (1)

To take account of such intentional behaviour it is necessary to adopt the progressive-regressive method of social analysis developed and outlined by Sartre in his SEARCH FOR A METHOD. (2) In this one begins regressively to analyse everything that has gone to make up the situation of the people being studied, from the dynamics of the total society to the particular relationships between individuals. Then one takes the progressive point of view, attempting to comprehend the projects by which people go beyond their historically formed situation, defining its significance or meaning from the point of view of the projected future which is at the same time an attempt by the people to define themselves. To understand history it is necessary to understand a multiplicity of such projects, of particular individuals and groups and of society as a whole and the complex relations between these projects.

(1) Ibid., p.213.
(2) J.P. Sartre SEARCH FOR A METHOD (1960) tr.Hazel E. Barnes, Random House, N.Y. 1968, Ch.III.

However developing an understanding of the human order by focussing first on more enduring processes and last on such short term processes as the spontaneous acts of individuals does not mean that the enduring processes should be regarded as completely comprehensible without any understanding of such short term processes. The comprehension of short term processes deepens the understanding of the supervening processes of which they are constituents. To understand how a businessman acts in a certain situation illuminates the nature of the type of organization to which he belongs, how it maintains itself and how it develops. Understanding business organizations in turn illuminates the nature of capitalism, and understanding the dynamics of capitalism illuminates the nature of socio-economic formations in general. Finally, all such developments of understanding provide a deeper understanding of the nature of humanity as such and of what it is to be human. To advance our understanding of any process in the human order thus helps to deepen our understanding of every other process in this order.

Developing social science along these lines provides the means for a better critique of each particular society. The development of the concept of man by social science develops the criteria by which any society must be judged. The concept of humanity developed in this thesis on the basis of process philosophy implies that societies should harmonize with the ecosystem of which they are part and fulfil the physical requirements of its members. It should free them from insecurity and provide them with the opportunities to develop their sensuality to the full. But it should also be a just society in which the intrinsic significance of each individual is recognized and in which social relations are developed so that individuals can attain recognition from others and achieve genuine intimacy. It should enable people to orient themselves in the world and achieve mutual understanding through adequate forms of communication and through the development of symbolic universes. And it should provide people with the means to control their destinies, not simply to free them to act arbitrarily but to take on responsibilities, to make commitments to other people, to work for the realization of socially important goals and to live with integrity and dignity. In other words, society should provide the freedom for people to live according to reason. Developing the social sciences on the basis of the process view of man should focus attention upon these issues and how societies have succeeded or failed to achieve these ends and why they have done so. For instance it should reveal what sort of attitudes to nature and economic organization are required if societies are not to destroy their environment, and what are the characteristics of societies which have been successful or unsuccessful in this respect. It should develop our understanding of what sort of institutions in societies are required to enable people to attain a sense of their own significance and what are the conditions necessary to enable people to orient themselves, to foster understanding and communication. To do this it is not only necessary to focus attention upon the nature of symbolic universes but also the design of cities and buildings and how they define the space within which people live. Cities and buildings which define all space as private space or purely functional space without defining any space as interactional space will be socially dead. (1) Also social science should focus attention upon the types of social processes which lead to a loss of individual freedom and what organizations

(1) Christian Norberg-Schulz has considered the implications of this for architecture in EXISTENCE, SPACE AND ARCHITECTURE, Studio Vista, London, 1971.

could maintain or develop it. In all these cases social science should also develop our understanding of the nature of these ends: the various ways they can be achieved and what effect it has on the lives of individuals to achieve or fail to achieve such ends.

However in attempting to understand humanity or existing society one is not dealing with something which simply 'is' or something which 'has become' but with an unfinished process of becoming consisting of a multiplicity of unfinished processes of becoming. To understand this it is therefore necessary to understand how these various processes are developing, to what extent they are working towards or away from the realization of humanity's ends, how stable or unstable they are and how they support or oppose the development of each other. It is this which Marx attempted to do in the case of capitalism: showing how it leads to a rapid development of technology while at the same time producing an increasingly unjust society racked by depressions in which people are alienated from their own creative activity, the products of this activity and from each other, and how processes engendered by capitalism along with the increasing instability of the capitalist system is paving the way for its dissolution and replacement by a more rational social order. However it is necessary to go beyond Marx who wrote a hundred years ago and consider other major processes which have emerged in late capitalism: neo-colonialism, the development of the arms race and the technocratic domination of people by bureaucracies and multi-national companies. Associated with these processes it is necessary to consider how the technicist mode of thought has so permeated all aspects of society down to the most intimate interpersonal relationships that most people have lost the capacity to conceive of a better society in any other terms than one in which there is greater income to buy more commodities. It is also necessary to face the problem that economic growth, based on capitalism in which all that is recognized as valuable is what can be packaged as a commodity and sold on the present market together with the increasing domination of a purely technicist rationality, is rapidly using up the world's limited supply of natural resources, and through polution and destruction of the environment is beginning to threaten the world's ecosystem as a whole.

In conceiving the world as an unfinished process of becoming social scientists should not think of themselves as external to this process of becoming. People's understanding mediates people's interactions with each other and with the physical world and so is a constituent part of society. Social scientists are situated individuals involved in the development and communication of understanding and so their work must be regarded as part of the creative activity by which society forms and develops itself. However accepting the role of social scientists in the becoming of society means that social science must become reflexive and take into account the effect of the ideas being presented. This means that social science cannot be regarded as simply an effort to make the existing world intelligible. The ideas put forward must interpret the existing situation to people so that they can act to bring about desired results. This was emphasized by Marx in his THESES ON FEUERBACH in which he concluded: "The philosophers have only <u>interpreted</u> the world in various ways; the point is to <u>change</u> it." (1) This is not to downgrade the role of intellect, but to see it as having an effect on the world. Acknowledging this, ideas can only be validated through being accepted then acted

(1) Karl Marx THESES ON FEUERBACH (Original version) in KARL MARX, FREDERICK ENGELS: COLLECTED WORKS, Vol. 5 Marx and Engels: 1845-47, tr. Clemens Dutt et.al. International Publishers, N.Y., 1976, p.5.

upon. As Marx wrote in the second thesis:

> The question whether objective truth can be attributed to human thinking is not a question of theory but is a practical question. Man must prove the truth, i.e., the reality and power, the this-worldliness of his thinking in practice. The dispute over the reality or non-reality of thinking which is isolated from practice is a purely scholastic question. (1)

To facilitate action, social science must not only critically define the problems of society but should indicate how they can be overcome, defining goals for society and showing how these can be realized. Since society must be understood as dynamic on the basis of the process view of humanity, what social science should do is show to what extent these goals are being realized by the existing processes within society, what processes are inimicable to such realization, and what different actions people should take to alter the way society is at present developing. To do this it is necessary to understand the nature of the stability of the various self-stabilizing processes in society, showing how those which already embody the ideals being defended can be strengthened and developed further and how those embodying alternative modes of thought which are preventing the realizing of these ideals can be weakened and undermined. However it is not enough to be destructive since such destruction is likely to pave the way for other processes which are even more inimical to humanity's goals than the processes which have been destroyed. What is required is the development of new processes from the existing situation embodying the ideals and modes of thought that social science is defending which are able to maintain themselves and develop to displace the other processes.

(1) Ibid., p.3.

For example as the market system with its implicit commitment to recognizing each individual as a responsible agent developed within the feudal order and then grew to displace it, it is necessary to set up forms of organization within the economy in which the process view of nature and humanity is assumed which can develop as self-maintaining processes to displace the commodity fetishism and technicist rationality of late capitalist organizations. Examples of such forms of organization are those government instrumentalities which strive to regulate the economy to function in the interests of society's members and worker participation in the management of industry.

In defining society's goals, social science must create an image of the future to be realized. For such an image of the future to be actualizable it must not be a utopia. What is required is not an end state to be reached but a general direction, that is,a clear understanding of what is of ultimate intrinsic significance; the harmony of society with the eco-system, shared understanding, mutual recognition, power over destiny,and so on, and some idea of what sort of order could be developed from the existing state of affairs which would facilitate the pursuit by people and society of these ultimate goals. More consideration needs to be given to what sort of future should be aimed at than was given by Marx who assumed that once the capitalist system had been overcome people would have no problems in developing a rational order. It is necessary to consider not only what sort of order would enable ultimate goals to be realized, but what sort of order would be sustainable. For instance it was noted by Makhaisky in 1901 that replacing capitalism by central planning would lead to the development of a new repressive class. (1) Thus it is

(1) Bertram D. Wolfe THREE WHO MADE A REVOLUTION (1948) Penguin Books, Harmondsworth, 1966, p. 243.

necessary to consider the nature of power relations in society and to work out what sort of social order would prevent such a concentration of power if a sustainable democratic society is to be achieved. Similarly it is necessary to pay attention to what effects the proposed society will have on its members. If a social order is to allow the greatest possible freedom to individuals to control their destinies, then it must incline people to be self-disciplined and to take their responsibilities seriously.

Such a reflective social science avoids the tendency of the positivistic and reductionist approaches to the study of humanity to set themselves above society so that society and people are seen as things to be manipulated and controlled. Instead, social scientists must see themselves as participants along with everyone else in the collective struggle for orientation and communication, and other people must be assumed to be rational agents who can be persuaded to reinterpret their place in the world and to strive for new goals. This is not to suppose that the dynamism of society can be understood entirely in terms of arriving at a consensus as to the nature of society, what goals should be pursued and how things ought to be done. Autonomous social processes which presuppose people's intentions but which develop independently of them together with the limitations in the channels of communication, the limitations of people's intellects and their vast capacity for self-deception where self-interest is concerned all severely limit the scope for collective appraisal of any social situation and inevitably lead to people being thought of as others to be overcome rather than as fellow subjects jointly participating in collective projects. But even as obstacles to rationality these others must be thought of as people needing to be outwitted, deceived, defeated or converted, not as things to be controlled.

Consequently it is necessary for the social scientists to convince people of the correctness of the ideas being offered. To do this they must provide people with the means to orient themselves in the world so that they can understand the significance of their lives and actions in relation to the dynamics of society as a whole. This should enable people to define their own problems and goals in relation to those of society, so that social science's projected image of the future can take on a concrete meaning in people's everyday lives. At the same time it should reveal to people the potentialities of their situations so that they can play the fullest possible part in the formation of their society and of humanity as a whole. In orienting people in this way, social science would provide people with the means to choose how to act and what sort of lives to lead, thus serving the function required of it by ethics.

CONCLUSION

I began this thesis by assuming that humans are beings who struggle to orient themselves in the world, and whose societies and lives are largely formed by the ideas they hold about themselves and their place in the world. Through an historical account of the development of ideas in Western society I tried to show how our culture is dominated by positivistic materialism and how this is totally unsatisfactory as a world view to orient oneself in the world and to provide grounds for choosing courses of action and how to live. Quite apart from its nihilistic implications, it was shown to be a mass of contradictions and totally unable to deal with such problems as how it is possible for us to be conscious, or how it is possible for us to hold any beliefs as superior to any other. The general effect of the domination of society by positivistic materialism was seen to be a fragmentation of culture with a consequent fragmentation of the self and a general feeling that life is meaningless. Furthermore it was argued that the long term tendency in any society dominated by positivistic materialism in which everything and everyone is thought to be something to be predicted, manipulated and controlled is to become more totalitarian.

In this conclusion I have returned to the starting point. The epistemology and ontology of positivistic materialism have been criticised, found wanting and replaced. The assumptions with which the thesis began: that it is an essential part of being human to struggle for orientation in the world, that one's very being as a self is dependent on the ability to define oneself in terms of the ideas of one's culture, and that people are capable of rationality and of communication, all of which are unacceptable in terms of positivistic materialism, have been justified in terms of the new epistemology and ontology. It was also shown how it is necessary to adopt one's cultural heritage as the starting point for any enquiry. This justified taking positivistic materialism and its implications and problems as the point of departure for the development of the ideas of this thesis, and for taking science as the main reference point for their justification. Then the problems which had been shown to be insoluble in terms of positivistic materialism such as the relationship between mind and body and between free will and determinism were solved at least in outline form within the framework of the new metaphysics. Finally the new epistemology and the ontology of process philosophy were shown to be consistent, thus explaining both how it is that we can claim to have some comprehension of the world, and the nature of the world such that there are beings which have developed within it capable of comprehending it.

This metaphysical system then provides a basic orientation within the world. Whereas the positivistic conception of knowledge implies a detached accumulation of knowledge and divides the subject of knowledge from its object, my conception of understanding implies an indwelling the world so that each object is understood by being experienced against a background which ultimately includes the world as a whole including the subject attempting to understand the object. Furthermore where the universe is understood as a polyphonic process of becoming in which there have evolved a multiplicity of semi-autonomous processes: galaxies, stars, planets, forms of life and ultimately the subjects who are able to understand all this, the individuals can see themselves with their day to day problems, their struggles and their achievements in cosmic perspective. Their own creative self-formation can be seen as part of the process of becoming of their community, of humanity and of the universe.

Such a universe is not a meaningless configuration of blind matter governed by immutable laws but consists of a multiplicity of processes many of which are living beings, that is, subjects which constitute their environments as worlds within which they strive to realize goals. To understand such beings is to understand them as having an intrinsic significance and a derivative significance as part of the ecosystems they participate in and help to sustain. And the most intrinsically significant beings, those which have the greatest capacity for awareness, for suffering and elation and for self determination are humans.

Humans have the capacity to question the ends for which they are striving, but the conception of humans developed on the basis of process philosophy implies that there are ends which are intrinsically valuable and worth striving for. Apart from those ends shared with animals such as sensuous pleasure, the exercise of skills and aesthetic contemplation, there are such intrinsically valuable ends which are only fully developed in humans. These are: the state of mutual recognition through which individuals attain self-hood and an identity, a state which is most fully attained in relationships of genuine intimacy and in just social orders in which the significance of each individual is recognized; a shared understanding of the world so that individuals can orient themselves in relation to the world and to each other; and control over destiny which is achieved by individuals through self-mastery and through living in an open society in which they can creatively participate in the development and use of the means, including instruments, techniques and organizations for achieving social and individual ends. The way the human order is understood in for instance, the vicissitudes of nature. Apart from natural catastrophes, diseases, death and the like, as Aristotle noted it is impossible for a person who is very ugly to be really happy. It is often impossible for people to achieve anything worthwhile in life because of the situation they are born into, and there is no reason to believe that there will be a final reckoning whereby everybody will get their just desserts.

Each individual must make the best of the situation in which s/he finds him or herself, but even this is limited by the inevitably less than full understanding of the situation and the lack of full knowledge of all the consequences of decisions made on the basis of this understanding. There is no quantifiable value in terms of which ends can be judged and it is therefore necessary for individuals to make choices between incommensurable ends. For instance if an individual chooses to devote him or herself to understanding the world, s/he is likely to have to be reconciled to an ascetic and insecure existence, to social isolation and to the disorientation which follows from holding ideas and experiencing the world in a way that is continuously disaffirmed by adherents to established ideas. More commonly, individuals are often confronted with situations in which they have to choose between acting on the basis of their own understanding of the rights and wrongs of the case and in this way maintaining their integrity on the one hand and the maintenance of social esteem, physical comforts, or even physical existence on the other. It is the situations where an individual defies the established order of things in the name of his or her own moral and emotional integrity and ends up destroying both him or herself and many innocent bystanders from which dramatic tragedies are made. Part of the genius of Euripides for which he himself was persecuted was to emphasize that such tragedies cannot relation to the rest of nature in process philosophy implies that these ends must be pursued so as to harmonize with the dynamics of nature. Given the status of these ends as both rationally based and intrinsically valuable, individuals are provided with ultimate grounds for choosing how to live and thus attaining meaning in their lives. Having developed these ideas in accordance with science justifies a belief in the dignity of man in opposition to those who would reduce the stature of man in the name of science and objectivity. The supposed foundation of nihilism in science has been undermined.

Social science has a crucial role to play within society as understood by process philosophy. It not only plays an essential role in orienting individuals and groups within the process of becoming of their society and of humanity, but it is also part of the creative process by which people form themselves. By defining the nature of social reality it comes to be part of this reality as people come to understand themselves through social science. In assuming and then developing the process conception of humanity, social science would evaluate the existing state of affairs, define its problems in terms of the ideals implied by this conception of humanity and indicate how these problems can be overcome. As such the human sciences would provide the grounds for making decisions about and justifying courses of action and styles of life.

However process philosophy does not justify any complacent optimism about the world. While life and the world are shown to be meaningful and while it is possible to affirm the value of some goals over others, the philosophy I have developed does not justify an identification of thought and being or demonstrate that the universe is completely rational. Life always involves an irreducible element of contingency and tragedy. There are, be assumed to be intelligible in terms of some deeper order of meaning.

On a societal level, conflicts arise over which goals will be pursued, and it is the tragedy of capitalism that while it has provided the conditions for the greatest development of the instruments for controlling the world, and consequently vastly increased the consumption goods available to a large part of the world's population, it has done so not only at the expense of alienating people from the physical world and each other, leaving them disoriented and isolated, and reducing people's lives to insignificance but has created a situation where increasing manipulation of the physical world is likely to destroy the whole of humanity either through high technology warfare or through the destruction of the processes by which the conditions of life are maintained. Contrary to the beliefs of many Marxists, there is no inherent necessity in the dynamics of modern capitalism to ensure that the productive powers developed by it will be reappropriated by people for the long term interests of humanity. There is no guarantee that humanity will not end disastrously and take the rest of the biological world with it.

But even without such conflicts between goals and in the best of circumstances, the ends for which humans strive are incapable of ever being fully achieved. In the best social order there will always be some injustice and in a relationship of fully requited love it is impossible to attain complete intimacy. No individual lives his or her life with complete integrity and the greatest artist is never able to fully communicate his or her vision and experience of the world. Finally, complete understanding of the world is unlikely ever to be achieved, nor is there any reason to believe that the world could be fully understood.

There are no grounds for assuming that a metaphysics could be developed free of all internal inconsistencies through which the world in all its diversity could be grasped completely as a whole. All that can ever be done is to show the superiority by virtue of its consistency, simplicity, comprehensiveness and potential fruitfulness of one world-view over the alternatives which have been developed, and in this way to justify making a provisional commitment to this way of viewing the world. It is this which I have attempted to do in this thesis.

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