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OBSERVATION: THEORY-LADEN,
THEORY-NEUTRAL OR THEORY-FREE?

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One major area of discussion in recent philosophy of science has been the distinction between observation and theory. The well entrenched logical positivist/empiricist orthodoxy, what I shall call the Old Empiricism, has maintained that there is some kind of substantive distinction between observation and theory.¹ This position has been widely attacked recently and has been seriously undermined.² A new orthodoxy, what I shall call the New Empiricism, seems to be emerging.³ This position views the distinction between observation and theory as pragmatic and relative. Old Empiricist responses have for the most part conceded major points to their foes.⁴ Thus the view that theories are tested by *theory-free* observations is being replaced by the view that theories are tested by *theory-laden* observations, but observations laden with theories neutral to the theory being tested. The position of the radical critics of the Old Empiricists that each theory has its own set of observation statements and thus cannot be tested by observations has been shown to be incorrect.⁵

Most of these developments, I believe, have been healthy; but they have tended to obscure an important, substantive distinction between observation and theory. Several philosophers of science have more or less implicitly argued for this over-looked distinction.⁶ In this paper I will argue that there is a substantive distinction between observation and theory. Secondly, such a distinction does not involve the problems which the Old Empiricist formulation encountered. Thirdly, it is compatible with the approaches of the New Empiricism, incorporating their criticism of both the Old Empiricists and their radical critics. Finally, this substantive distinction helps to sort out several issues which have often been confused.

There are a number of ways in which attempts have been made to draw the distinction between theory and observation. The important ones, I believe, are the following:

(1) *Meaning Independence*: The meaning of observational terms is drawn from a theory-independent source, empirical observation, and thus is independent of theoretical meaning.

(2) *Truth-value Independence*: The truth value of observational

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statements is ascertained from a theory-independent source, empirical observation, and thus is independent of the truth values of any theory.

(3) *Incorrigibility*: Some empirical statements, those which provide direct contact with what is the case, are distinct from the corrigible statements of theory. They provide the incorrigible foundation for the theoretical superstructure.

(4) *Factualness*: Some statements put us in direct contact with what is the case. Theories do so only indirectly, if they do so at all.

(5) *Use in Perceptual Reports*: Observational statements and predicates are those used in perceptual reports and theoretical statements and predicates are not so used.

(6) *Non-Explanatory Function*: Observational statements are explained by theoretical statements and do not themselves explain.

(7) *Ordinary Language*: The realm of ordinary language is a logically independent realm which is entirely adequate in itself and can in no way be affected by the logically distinct realms of scientific and philosophical discourse.

The radical attack led by Hanson, Kuhn, and Feyerabend on these bases for a distinction between theory and observation is usually developed in the context of giving an account of the growth of scientific knowledge and the replacement of earlier by later scientific theories. The radicals have argued in various ways:

(8) *Radical Meaning Dependence*: The meaning of observational terms is dependent upon the theory which is designed to explain them. Thus competing theories each have their own set of observations. And because of this they become incommensurable. The radical critics have then set themselves the task of giving an alternative account of theoretical change.

(9) *Radical Truth-Value Dependence*: The truth-value of empirical statements is a function of the truth-value of the theories from which they derive and upon which they are dependent.

(10) *In-Principle Corrigibility*: No observational statement is incorrigible, for, indeed, they are all theory-laden and are as liable to be rejected as the theories which sustain them.

(11) *Rejection of Givenness*: There are no statements which put us in direct contact with what is the case.

(12) *Use of Theory in Perceptual Reports*: Theoretical statements and predicates can be and are used in perceptual reports.

(13) *Theory-like Function of Observation*: Just as lower level theories are explained by higher level theories so observational statements are possible interpretations of sensory input. And in this sense they function as theories.

The reply to the radical critics has been aimed at saving the rational character of scientific endeavour while granting that the sharp distinction between observation and theory cannot be maintained. Thus it has been argued that though all observations are more or less theory-laden and though the distinction between observation and theory is only

a pragmatic one and relative to a particular context, nevertheless theories can be tested by observations and competing theories can be put to observational tests. This is possible because theories are tested not by *theory-free* observations but by *theory-neutral* observations, that is to say, by observations which, though dependent on theories, are not dependent on the theories under question. A new orthodoxy seems to be emerging which grants the radical critics of the Old Empiricism (10) In-Principle Corrigibility, (11) Rejection of Givenness, (12) Use of Theory in Perceptual Reports, (13) Theory-like Function of Observation. But against the Radicals it argues

(14) *Relevant Meaning Independence*: Though the meaning of observational statements is dependent upon theories and/or laws and is not the direct result of sensory input, nevertheless the meaning of the terms in the test statements need not and, indeed, must not be dependent on the meaning of the terms of the theory under scrutiny.

(15) *Relevant Truth-Value Independence*: And though the truth of observational statements is theory-dependent and is not founded on a direct contact with what is the case, nevertheless the truth of the test statement need not and, indeed, must not depend on the truth of the statements of the theory under scrutiny.

I shall now point out some unsatisfactory aspects of the New Empiricist account of the distinction between observation and theory and then sketch an alternative account which shows how it is possible to maintain a substantive distinction between theory and observation while both avoiding the Old Empiricist pitfalls and accepting the valid points of the Radical Critics and the New Empiricists.

Mary Hesse and Peter Achinstein, among others, are prominent critics of both the Old Empiricism and its radical foes. It will be helpful to examine some of their arguments against a substantive distinction between theory and observation.⁷

Achinstein's basic argument against such a substantive distinction is that there is no single unique way to distinguish theory from observation. He concludes that the distinction is a relative, context-dependent one which points up a number of useful contrasts.

For example, he argues against Carnap's account of the distinction on the basis of entities and properties which are observable and those which are not. According to Achinstein there is no unique way of describing what is observed in a given situation. For what is in one context part of the observational description can become in another context part of the theoretical description. Thus the same scientist can talk of seeing the proton following a path diverging from the horizontal or he can argue that the observed rising line of bubbles indicates the path of the unobservable proton.

But this kind of argument is inconclusive. Achinstein is quite right in pointing out that there are multiple situations both in ordinary and scientific discourse in which theoretical descriptions are used in perceptual reports. And he has done a service by his careful

classification of such usages. But careful observation and classification are only the first steps in an adequate account of a phenomenon. I maintain that in philosophical inquiry, as in the natural and social sciences, observation and classification ought to be supplemented by explanatory theories. We may not, indeed, at present have such a theory nor even be able to find one. But to argue that the distinction is not a unique one solely on the basis of a careful examination of ordinary and scientific discourse is to rule out an important avenue for bringing the relative, context dependent usages into a coherent whole. And it implicitly rules out a major source for accomplishing such an objective, namely, empirical psychology.

Achinstein's second argument against Carnap is closely related to the first. He argues that since theoretical entities can be referred to in observational reports, there can be no substantive distinction between observation and theory. But Achinstein's argument is again inconclusive since it is possible to account for such perceptual use of theoretical terms while maintaining a substantive distinction between theory and observation. The root of the inconclusiveness of Achinstein's argument is, I believe, his failure to take into account the possibility of theoretical accounts of the distinction which attempt to explain the observational differences.

Finally, Achinstein argues, concede to Carnap both that perceptual usage is not a sufficient condition for identifying observational descriptions and that even though we speak as if we perceive, for example, electric fields they are not observable in themselves. Nevertheless, Achinstein maintains, the distinction is still context-dependent and not "the general sort required." But Achinstein nowhere specifies what he means by a "general sort of distinction", nor indeed why the Old Empiricists required it. What kind of distinction does Achinstein have in mind? A logical distinction, an absolute distinction? Why would the distinction between observation and theory have to be of this sort? Would the distinction fail, if it were not logical but based on some physical laws of this universe, indeed, some physical laws about human knowers? Does any kind of context-dependence rule out the generality required by the distinction? Would a distinction based on the context of human cognitive capabilities imply that a unique distinction between theory and observation cannot be maintained? Achinstein does not even raise these questions. I shall maintain shortly that these questions can be answered in a way which helps define the kind of distinction which ought to be made and explain the context variations which Achinstein has documented.

Mary Hesse has criticized the Old Empiricist orthodoxy from another point of view. She has argued that since all predicates, observational as well as theoretical, depend in part on some other general laws and theories, that there is no absolutely independent observation language. This dependence, she argues, establishes the theory-dependent meaning and truth-value of observational predicates and propositions. Because

of this dependence, the application of observational predicates and observational classifications are sometimes changed in order to preserve general laws. And since this is possible in-principle with regard to all observation predicates, there is no irreplaceable set of observation predicates and propositions. However, she maintains against the Radical Critics that theory-neutral observations are available to use in testing and deciding between theories. Hesse concludes that "all descriptive predicates are theory-dependent or theory-laden in the sense that their correct application may become incorrect."

One does not need to dispute Hesse's account of the inter-dependence of observational statements on the one hand and classifications and general laws on the other. This seems to me to be correct. And Hesse's contention that observational predicates are in-principle replaceable also seems to me to be correct, though in need of interpretation which I shall provide. Her argument that there are no theory-free observation predicates and thus no substantial distinction between observation and theory follows only if irreplaceability and/or no dependence on law-like expressions are necessary conditions for being an observation predicate. The Old Empiricists may have put such conditions on observation predicates. I shall argue that they are not necessary.

Irreplaceability does not seem to be a necessary condition for being an observation predicate. Certainly many observation statements are false, incomplete and not invariant. Yet we continue to call them observation statements and their predicates observational. More fundamentally, replaceability or corrigibility is a function of a statement's truth-value and not its conceptual character. And it is the latter which is relevant to the distinction between theoretical and observational concepts. I shall try to clarify what I mean by conceptual character in a few moments. I shall, indeed, claim that there is a sense in which, what I shall call with Sellars the principles of the common sense framework and the concepts which constitute them are irreplaceable. But such an irreplaceability is not a function of the truth and certainty of these principles. For they are not necessarily direct contacts with what is the case. Their irreplaceability is rather a function of the cognitive structure of the perceiving organism and its perceptual environment. Thus their irreplaceability is methodological rather than epistemological.⁸

As regards the dependence of observational concepts and their application on general and law-like expressions, it should be noted that Hesse herself argues that meaning is not only a function of context but also of empirical association. It is this latter function which is important for the distinction I am making. Hesse argues quite rightly, I believe, that it is impossible to specify the necessary and sufficient conditions for the application of any alleged primitive predicates, since such an attempt would lead to the necessity of specifying the necessary and sufficient conditions of the newly introduced predicates and so on *ad infinitum*. Thus she concludes that we must arrive at a process which can not be verbalized and in which a selection is made from the multiplicity

of information available to the perceiver. And, as a result some information is lost. Hesse, of course, is not referring to any kind of mystical cognition. What she seems to be referring to in part, at least, are the causal processes—to a large extent unconscious—which eventuate in the primitive categorizations of perceptual response. An account of these processes, she maintains, is a task for physiologists and psychologists. I agree, though I believe that the kind of account given will have important philosophical implications.

We can conceive of the information-loss, referred to by Hesse, as occurring in at least two ways. First, information can be lost in the sense that a conscious, though non-verbalizable selection process is going on and some information is not included in the categorizing process. This information could possibly be retrieved under new circumstances and used for reclassification and correction or rejection of previous classifications. This is acceptable and the theory I shall propose will make use of this way of understanding corrigibility. But there is another way of conceiving information-loss which must also be included. It is quite clear that part of the process of concept formation is unconscious and non-deliberative. This part is governed by the laws of physics, physiology, and psychology which provide a given viewpoint. These processes, no doubt, do not capture all the information in the situation. But the conceptual results of these causal processes, characteristic of the interaction of physical object, environment, and physiologically and psychologically structured human organism, do possess a degree of stability proportionate to that of the biological species, man. Thus these concepts and the principles associated with them are invariant except under species mutation. But as long as it is not assumed that they capture all information and/or reflect in a direct way the perceived object and its environment, they are open to revision and change, especially by theories, even though they should always remain methodologically necessary. Thus we can argue for an independence of content without claiming finality or incorrigibility.

We can look at the point I am making in another way. If we distinguish with Aristotle that which is primary in the order of knowledge from that which is primary in the order of being, we can then argue for a primacy in the order of knowledge for these primitive concepts and principles, but not claim a primacy in being. Indeed, in the order of knowledge, generalizations and theories depend on observations; but in the order of being the referents of theories explain the observational phenomena as causal effects or as phenomenal manifestations. And if theories do tell us that certain things exist and what kind of things they are, then we can expect that in a completed theory they should explain the content of what we perceive. In this sense the meaning of dependence is from the top of the page down or from *explanans* to *explananda*. But in the order of knowledge the meaning dependence is reversed and is directed from the bottom of the page upward or from *explananda* to *explanans*. Thus there is a two-fold

dependence and independence. And the independence necessary to account for theory-free observations occurs in the order of knowledge.

Therefore I conclude that Hesse's arguments against theory-free concepts, namely, that no concepts are invulnerable to criticism and replacement and that all concepts depend on lawlike generalizations, are inconclusive. I now move to my own positive account.

My contention is that we need an epistemological theory of the ordinary knowledge framework. So far both the Old Empiricists and the New have failed to provide such a theory. The Old Empiricist's acceptance of an independent observation framework has been based on some form of the myth of the given or on a philosophical dogma about the invulnerability of ordinary language. And the New Empiricist's relativization of the distinction between theory and observation has been based on an ordinary knowledge analysis of the distinction as made in scientific and ordinary discourse, as, for instance, Achinstein, or only on an epistemological consideration of truth and meaning as in the case of Hesse. Neither approach is sufficient. My contention is that such a theory can and should be developed, that there are substantial reasons for holding that there are theory-free concepts and that a theory can be constructed which can account for the varying usages we observe, especially the use of theoretical terms in perceptual reports.

The theory I am proposing postulates the existence of some theory-free concepts and some principles formulated in terms of these concepts. What I have in mind is something similar to what Wilfrid Sellars has called the principles of the common sense framework or Manifest Image, though I believe that his implicit Old Empiricist presuppositions finally subvert his attempts to give an account of this framework.⁹ The principles of the common sense framework are a set of propositions concerning perceptible objects, their perceptible qualities, interactions and relations. This is very vague; but I do not believe it is necessary or even possible at present to specify the exact content of these principles or list the theory-free concepts. On this point I agree whole-heartedly with Mary Hesse's remark that such a specification and list would be impossible until we have a completely adequate theory both of theory and of observation. The crux of my contention is that there is such a framework constituted by certain general principles and theory-free concepts. I shall attempt to specify some of the properties of this framework.

On the one hand I want to grant to the Radicals as do the New Empiricists the basic correctness of (10) In-Principle Corrigibility, (11) Rejection of Givenness, (12) Use of Theory in Perceptual Reports. And to the New Empiricists I grant with some modifications the truth of (14) Relevant Meaning Independence and (15) Relevant Truth-Value Independence.

In distinction from the Old Empiricists, Radical Critics and New Empiricists, I contend that there is a set of concepts which is theory-free in the following sense:

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(16) *Epistemic Givenness*. They constitute an epistemic given. That is to say, they are a starting point in the order of knowledge. They are first in the order of knowledge, though not necessarily in the order of being. They are the first cognitive results of the interaction of the human perceiving organism with its environment. But they reflect in no obvious way the cognitive structure of the perceiving organism or the structure of the perceptual object and its environment. Thus I reject as a myth any given which implies (a) an immediate cognitive contact with what is the case and (b) the assertion that the given is an extramental reality known with certainty.

(17) *Biological Stability and Universality*. Granted the biological stability of the human species, we can assume in mature, healthy organisms a similar physiological and psychological structure. We also assume a general similarity in basic needs and tasks and some degree of general environmental similarity. Thus if the conceptual structures with which the human knower gets around in the world are the result of an interaction of knower and known, we can assume some degree of universality in primitive conceptual structure.

(18) *Evolutionary Products*. This conceptual structure can be considered from the point of view of evolutionary theory as an evolutionary product. Thus it would be a-posteriori from the point of view of the species, though a-priori from the point of view of the individual. Konrad Lorenz among others has interpreted Kant in this fashion.¹⁰

(19) *Methodological Irreplaceability*. This conceptual structure, though neither invulnerable to criticism nor irreplaceable because it is an absolutely accurate account of extramental reality, does possess a stability which belongs to the biological make up of the human species. It will, relative to the stability of the species, always play a role in man's cognitive enterprise.

(20) *A Distinction Based on Physical Necessity*. Thus we can argue that the distinction between observation and theory is a substantial one in the sense that it is based on a physical necessity related to the basic physiological and psychological cognitive structure of the human perceptual apparatus. Consequently though it cannot be maintained that the distinction is a logical one, neither can it be claimed that it is merely conventional or pragmatic. It is context-dependent but the context is that of questions concerning the basic perceptual apparatus and achievements of the human perceiver. Of course, in a Humean perspective, within which ironically many of the New Empiricists still seem to work, where there is no necessity other than logical, the distinction I am making is matter of factual and/or empirical. But within a broader perspective, one with which Aristotle would feel comfortable and which has been recently advocated by Rom Harre, Edward Madden and others, even though the distinction is empirical and matter of factual, it is a necessary one.

There is an increasing amount of evidence pointing to the perceptual

adaptativeness of the human perceptual apparatus. The human perceiver seems to possess a twofold perceptual ability: (1) an ability to perceive wholes formulated in more or less theoretical or interpretative terms and (2) an ability to perceive in a more analytic way and in more fundamental terms.¹¹

It will be helpful to look briefly at an empirical psychological theory which makes use of this evidence. Jerome Bruner has proposed a theory of perception which explains why and in what way concepts are available in our perceptual responses to the environment.¹² He contends that the accessibility of concepts is a function of both the fit between input and category specification and the perceiver's expectations and purposes. Perception, according to Bruner, involves an act of categorization which is accomplished by means of an inference from perceptual clues to categorial identity. The first stage of this process is a primitive categorization in which an object or event with certain qualitative characteristics is isolated in experience. A further examination of clues leads to a more precise categorization in terms of the fit between clues and final categories and the expectancies and purposes of the perceiver. This process is not normally nor necessarily a conscious one, though it can be made so.

It is important to note that according to Bruner even the initial stage of perception is conceptual in character and that this corresponds to the theory-free concepts which I have been discussing. Thus though always present within the structure of perception because they are the initial cognitive results of the interaction between a structured environment and a structured perceiving organism, they are not necessarily present in perceptual reports. For the final perceptual report may be made in theoretical terms. Thus it is possible to explain the perceptual use of theoretical terms while maintaining a basic distinction between theory and observation.

Consider a simple example. The nuclear physicist reports that he sees the path of a proton in a cloud chamber. On the basis of Bruner's theory we can accept that report and yet not claim that the theory-observation distinction needs to be relativized. Moreover, limitations on the size of objects which can be seen by the human eye and the size of the proton make it physically impossible to claim that the proton is seen. The track of the water-droplets formed by the ionized particle is seen, in the sense of the initial stage of categorization within the perceptual process. Yet, because of the expectancies and purposes of the scientist and the fit between initial conceptual clues and theoretical concepts, the scientist's perceptual report includes theoretical terms. On this basis we can accept both Achinstein's and Hesse's evidence concerning the perceptual use of theoretical terms and the possibility of developing various criteria for the distinction between observation and theory without concluding as they do that the distinction is relative and context-dependent.

In closing I would like to point out that my theory clarifies several issues which have been frequently confused to the detriment, I believe,

of philosophical discussion. It distinguishes the conceptual as such from the theoretical. The former is the more inclusive category including both the theoretical and the observational. It makes a distinction between perceptual and theoretical judgments while still being able to account for the use of theoretical terms in perceptual reports. It distinguishes questions of truth-value and corrigibility from questions concerning type of conceptual content and cognitive source. Finally, it distinguishes between an epistemic and ontological given. Thus it can reject the myth of the given and also show that the epistemic given plays a vital methodological role in our cognitive enterprises.

NOTES

¹ More or less representative of this group are Carnap, Braithwaite, Hempel and Nagel.

² Here I am referring to the writings of Feyerabend, Kuhn, Hanson, Toulmin and Polanyi.

³ Hesse, Achinstein, Suppe and Spector are important contributors to the new orthodoxy.

⁴ Confer, for example, Nagel's essay in E. Nagel, S. Bromberger, and A. Grunbaum, *Observation and Theory in Science* (Baltimore: The Johns Hopkins Press, 1971), pp. 15-43. Also see Carl Kordig, "Observational Invariance," *Philosophy of Science* 40 (1973), 558-569.

⁵ Numerous analyses and criticisms of the radical critics by both the Old Empiricists and the New Orthodoxy have appeared. Some of the most telling criticisms with respect to the relation of theory and observation are: Dudley Shapere "The Structure of Scientific Revolutions," *Philosophical Review* 73 (1964), pp. 383-394, and "Meaning and Scientific Change," *Mind and Cosmos*. Ed. R. Colodny (Pittsburgh: University of Pittsburgh Press, 1966), pp. 41-85. Frederick Suppe presents a comprehensive account of these criticisms and the present *Status questions* in *The Structure of Scientific Theories* (Urbana, Ill.: University of Illinois, 1974), 119-217.

⁶ Confer Abner Shimony "Is Observation Theory-Laden? A Problem in Naturalistic Epistemology" to be published; C.A. Hooker "Empiricism, Perception and Conceptual Change," *Canadian Journal of Philosophy* 3, (1973), pp. 59-74, and "Systematic Realism" *Synthese* 26 (1974), pp. 408-497; Wilfrid Sellars "Scientific Realism or Irenic Instrumentalism," *Boston Studies in the Philosophy of Science*, Vol II, Eds. R.S. Cohen and M.W. Wartofsky, New York: Humanities Press, 1965, pp. 171-204, and passim in his books *Science, Perception and Reality* (New York: Humanities Press, 1963) and *Science and Metaphysics: Variations on Kantian Themes* (New York: Humanities Press, 1968).

⁷ Mary Hesse, "Is There an Independent Observation Language?" R. Colodny *The Nature and Function of Scientific Theories* (Pittsburgh: University of Pittsburgh Press, 1970), pp. 35-77; Peter Achinstein "The Problem of Theoretical Terms," *American Philosophical Quarterly* 2 (1965), pp. 193-203, and *Concepts of Science* (Baltimore: Johns Hopkins Press, 1968).

⁸ Confer William Rottschafer, "Believing is Seeing, Sometimes," *New Scholasticism* L (1976), Winter I, to be published.

⁹ Confer William Rottschafer, "Wilfrid Sellars and the Demise of the Manifest Image," *The Modern Schoolman*, to be published, and *Ordinary Knowledge in the Scientific Realism of Wilfrid Sellars*, Ph.D. dissertation, Boston University, 1973.

¹⁰ Konrad Lorenz, "Kant's Doctrine of the A-Priori in the Light of Contemporary Biology," *General Systems Yearbook of the Society for General Systems Research*. Eds. L. von Bertalanffy and A. Rapoport (Ann Arbor, Michigan: Society for General Systems Research, 1961), pp. 23-35. Cf. Donald T. Campbell, "Evolutionary Epistemology," *The Philosophy of Karl R. Popper*. The Library of Living Philosophers, Ed. Paul A. Schlipp (La Salle, Ill.: The Open Court Publishing Co., 1974) pp. 413-463, and the very important first section on evolutionary epistemology in Milic Capek, *Bergson and Modern Physics: A Reinterpretation and Reevaluation*. *Boston Studies in the Philosophy of Science*, Vol. VII, Eds. R.S. Cohn and M.W. Wartofsky (New York: Humanities Press, 1971).

¹¹ Consult Shimony's paper cited above in note 6.

¹² Jerome Bruner, "Perceptual Readiness." *Readings in Perception* Eds. David C. Beardslee and M. Wertheimer (Princeton, N.J.: Van Nostrand, 1958) pp. 686-729.