Dialogue and Universalism, vol. XI, 3/2001

On the ontology realised in technological world-reconstruction[1].

Karin Verelst
CLEA, Vrije Universiteit Brussel
Krijgskundestraat 33, 1160 Brussel
e-mail: kverelst@vub.ac.be

The purpose for which a study of
the problem of knowledge is undertaken is not
to solve the problem but to go beyond it[2].

1. Introduction

Our concern in the following pages will be the ontology of the relation between living beings (especially, but not exclusively, humans) and the technological artefacts of our late-industrial society. The theme is not new, but important in the context of the emergence and globalisation of so called "post-modern" society[3]. The eventual originality of the present contribution is to be situated in its interpretative framework, i.e., a specific conception of reality's deep ontology, overlooked in general exactly because of the "technological" structure impressed since centuries upon our ways of perceiving of and reasoning about the world. I refer to this neglected but fundamental characteristic of reality as its **ontological paradoxicality.** Before I can embark on my subject proper, it will be necessary to elucidate and elaborate this point a bit further.

---

[1]The core ideas of this article were first presented at the *Third International Conference on Philosophy and Culture* "Cultural Intercourse in the Space of Total Communication", sept. 17-21 1998, St. Petersburg, Russia. A synopsis appeared in: Moreva, L., et al., International Readings on Theory, History and Philosophy of Culture, vol. 6: *Issues of Communication in Contemporary Cultural Contexts*, Eidos/Unesco, St. Petersburg, 1998, pp. 143-150.

[2] S. Satprakashananda, *Methods of Knowledge according to Advaita Vedanta*, with a foreword by dr. Huston Smith (M.I.T.) and an introduction by T.M.P. Mahadevan, Ph.D., The Indian Press Private Ltd., Calcutta, 1974, p. 13.

[3] J.-F. Lyotard, *La condition postmoderne - rapport sur le savoir*, Editions de Minuit, Paris,

2. The ontology of "rational" versus "experienced" reality

The starting point for our analysis will be the riddles that baffled ancient philosophy in its attempts to come to terms with the phaenomena of *existence* and *change* we experience in reality. We all experience ourselves as existing. This experience is absolute: you cannot *deny* you are experiencing yourself as existing right now; *at this very moment*, you *are*[4]. Nevertheless we grow older at every moment: we do not remain exactly the same for longer than an instant, we *are not*. In fact this holds for everything we experience in reality, or should we rather say, for every real experience. Change thus implies the coming together of *Being* and *non-Being* at the same time at a certain place on a certain moment, in a world whose fundamental characteristic it is to exist; therefore it can be stated that reality is ontologically paradoxical. As said before, this implies that reality emerges in a countless number of instantiations of the **coincidence of opposites,**[5] the coming together of Being and non-Being in the change and motion that constitutes at every moment the stream of its events. *Nothing remains identical to itself outside this instant.* But at the same time, *everything* is *in the most absolute sense at this same instant*, for it is impossible to *indicate* anything that does not exist *at this very moment*. This paradox lies at the origin of time. Things only change *over a lapse of time*. Non-Being belongs to the past and the future. But since, for evident reasons, past and future are constructions of the mental in the present, non-Being belongs to the realm of the mental. Furthermore, everything that *is* at this moment appears as totally interconnected with everything else, for the 'unreality' of non-Being *at this moment*, as well as the endless interplay of innumerable interactions in the stream of reality's events both imply the irreducable unicity of the world, and the existence of stable objects existing separated from each other reveals itself as an illusion[6].

---

[4] The intellectual questions of the *meaning* of existence and the *status* of reality are *not* at the issue here. Our subject is not common sense, but common sensitivity.

[5] Nicolaus Cusanus was the first to provide a clear and explicit formulation of this insight in his *De Docta Ignorantia*, viz. capitulum IV: "Maximum absolutum incomprehensibiliter intelligitur; cum quo minimum coincedit." Using the mathematical concept of infinity, Cusanus succeeds in visualising most clearly what he wants to say; cfr. capitula XIII-XV. One will also be inclined to consult his precious little masterpiece *Dialogus de Deo Abscondito*. For Cusanus's works, see the Editio Princeps established by E. Hoffmann and R. Klibansky (eds.), In Aedibus Felicis Meiner, Lipsiae, 1932.

[6] I refer to the profound analysis, related to our subject, as presented by Gilles Deleuze in his *Logique du sens*. Alice (in Wonderland) grows, and thus *becomes* taller and smaller *at the same time*. "Telle est la simultanéité d'un devenir dont le propre est d'esquiver le présent." But the opposites provoked here are the opposite directions of the *process* that endowes a

Within our tradition, a clear awareness of the paradoxical nature of reality can be found in Greek pre-Socratic philosophy. The purest articulation of both aspects of world-experience is to be found with Heraclitus of Ephesus and Parmenides of Elea. Classical philosophy, however, interpreted both thinkers as presenting contradictory "worldviews", and this contradiction as a threat to the possibility of the acquisition of certain knowledge about our world. Heraclitus of Ephesus is seen by both Plato and Aristotle as the original representative of the doctrine of permanent change in the world, expressed in the so-called *flux-theory*. Parmenides of Elea on the other hand is represented as the opponent of Heraclitus, teaching the non-existence of change and motion in reality[7]. This classical contradiction slipped unimpaired but in different disguises through the Western tradition and is rooted deeply in our present-day epistemological and ontological concepts, both in philosophy and in science[8]. But the question remains whether this presumed contradiction between Heraclitus and Parmenides gives a correct understanding of their thought. I contend, as can be inferred from the foregoing, that it does not[9]. It makes sense to say that Heraclitus and Parmenides do express fundamentally *the same* world-experience: the former the experience of reality over a lapse of time, the latter the experience of the absolute reality of *this moment*[10]. This non-contradiction can be recognised only if we accept both instances of thought as manifestations of a different kind of awareness in which the rational separation

---

with the Being of non-Being that paradoxically instantiates it into reality. G. Deleuze, *Logique du sens*, Les Editions de Minuit, Paris, 1969, p. 9 sq.

[7] Compare, e.g., Heraclitus's fragment 30 or the riverfragment 49a in the Diels-Kranz edition with Parmenides's tÚ §Ún §st‹ (The Being is), as cited and commented by Riezler. See H. Diels, W. Kranz, *Fragmente der Vorsokratiker,* Weidmann, Dublin, Zürich, 1971, erster Band, p. 161, and K. Riezler, *Parmenides, Text, übersetzung, Einführung und Interpretation*, Vittorio Klostermann, Frankfurt a. M., 1970, p. 45.

[8] "Two great warring traditions regarding consistency originated in the days of the Presocratics at the very dawn of philosophy. The one, going back to Heraclitus, insists that the world *is not* a consistent system and that, accordingly, coherent knowledge of it cannot be attained by man. (...) The second tradition, going back to Parmenides, holds that the world *is* a consistent system and that knowledge of it must correspondingly be coherent as well, so that all contradictions must be eschewed." N. Rescher, and R. Brandom *The logic of inconsistency. A study in Non-Standard Possible-World Semantics and Ontology*, Basil Blackwell, Oxford, 1980, introduction.

[9] An elaboration of this argument and its consequences can be found in: K. Verelst and B. Coecke, "Early Greek Thought and new perspectives for the interpretation of Quantum Mechanics: Preliminaries for an Ontological Approach", in: C. Cornelis, S. Smets and J.-P. Van Bendegem, *Metadebates, The Blue Book of Einstein meets Magritte*, Kluwer Academic Publishers, Dordrecht, etc., 1999.

[10] Medieval thought knew this experiencing of experience as the *nunc stans*, the "standing now". See H. Arendt, *The life of the mind*, Harcourt Brace Jovanovich, Publishers. San

between subject and object had not yet appeared[11]. For rational consciousness, however, such "contradiction" is impossible to bear, because it threats the possibility to acquire *certain knowledge* about the external world *in* which we live, - and *of* which certain knowledge constitutes the only justification for our actions *in* it. To escape this frightening uncertainty, rational consciousness had to neutralise the apparently contradicting aspects of stability and instability, knowability and unknowability that appear on the level of experienced reality. Classical philosophy "solved" this "problem"[12] by constructing a *representation* of reality that reshapes human world-experience by separating Being from non-Being, i. e., subject from object, the 'knower' from the 'known', such as to survive the paradoxical present into the past and the future[13]. The two principal variants of the 'world-picture' devised by classical philosophy display a common fundamental characteristic: the division of the world into two separated, though connected layers: one unchangeable 'Parmenidean' or 'Eleatic' layer of stable essences; the other 'Heraclitean' one bestowed with the fluidity of phaenomenal change. In this feature of a two-layered world we recognise the characteristic constitutive of every *metaphysical system*[14]**.** With Plato the ontologically stable, Eleatic Forms precede the concrete, Heraclitean beings in a separate world. It is the participation of the phaenomena in the

---

[11] "(...) it is still the primary function of the *noos* (mind, K.V.) to be in direct touch with ultimate reality." K. Von Fritz, "Nous, noein and their derivatives in pre-Socratic philosophy". In: A. P. D. Mourelatos, *The pre-Socratics. A collection of critical essays*, Princeton University Press, Princeton etc., 1992, p. 52. It might be relevant in this respect to remind us of Heraclitus's fragment DK 101 §dizhsãmhn §mevutÒn (I searched myself), which is clearly not to be understood in a psychological sense, and which conveys the same insight as the famous Delphic gn«yi seautÒn (Know thyself). I suspect this also to be related to the poetic awareness of Self, e.g. in Pindar's G°noi É oÂÒw §ssi may≈n (Become as you are after having learned); A. Puech, *Pindare. Pythiques*, Les Belles Lettres, Paris, 1966, tome II, Pyth. II (72), p. 45. Taking the difference between ancient reality-awareness and our rationalised self-consciousness seriously has consequences and opens up several tracks of investigation relevant to problems we are facing to-day. Although at variance with him on fundamental philosophical issues, I find support for this approach in principle in Gill's study of "personality" in Greek tradition, viz. pp. 18, 175: C. Gill, *Personality in Greek Epic, Tragedy, and Philosophy*, Clarendon Press, Oxford, 1996-1998. A study of the exact links between some of these non-mythic but still archaic utterances of self- and world-awareness is at the moment in preparation. See also the Acknowledgments at the end of this paper.

[12] No present-day philosophy of knowledge seriously concerned with its subject should be advanced without reckoning Heidegger's penetrating comments on the futile reduction of the basic question of Truth to the level of a mere "logical problem". M. Heidegger, *Basic Questions of Philosophy. Selected "problems" of "Logic"*. Indiana University Press, Bloomington and Indianapolis, 1994, Chapter Two, §§4-5, p. 9 sq.

[13] The necessary condition that made this construction of stabilising world-pictures possible was the earlier coming-to-be of the "inner mind-space", in which the non-present could be re-presented as present. J. Jaynes, *The origin of consciousness in the breakdown of the bicameral mind*, Houghton Mifflin Company, Boston, 1976, p. 54 sq.

Forms and the hierarchy in the order of Being of the latter that saves the possibility for an object to have contrary properties - i.e., to change - while concurrently arresting the ontological contradiction that otherwise would resurge out of the simultaneous presence of Being and non-Being in it[15]. The Form "Being" is at the root of this hierarchy of participation, and thus grants existence to anything before everything else. Its traditional counterpart is the Stagirite's conception of the coincidence of Eleatic Forms and Heraclitean beings in one world. A thing is a Form (οὐσία, substance) with qualities expressed in an undifferentiated material substratum: the ὑποκείμενον[16]. Change and motion are brought about by the four causes: they represent the forces that drive the thing through a process of transformations from *potentiality* to *actuality*, i.e., the *motion* towards its qualitative realisation[17]. The original as well as causal starting point of this chain of transformations is the *First and Unmoved Mover*. In reference to this fully actualised motionless starting point, everything else irrevocably moves[18], whence follow both the separation and the reconciliation of the Eleatic and Heraclitean aspects of reality.

On the level of knowledge, this separation between Being and non-Being is attained at by a concomitant "tool for the generation of certain knowledge" adapted to this divided, stabilised and externalised world-experience: logic. Logic is grounded on an ontological rule, the **principle of contradiction,** that reshapes our experience of reality into a mental representation based on the separation of Being and non-Being sketched above[19]. This remains implicit in

---

[15] A general ontological formulation can be found in Plato's *Sophist*, 251(d); 256(d,e). A more specific elaboration for the Forms Being, Motion & Rest in *Sophist*, 250(b,c). Our edition: H.N. Fowler, *Plato in twelve volumes*, Loeb Classical Library, Harvard University Press, Cambridge, Massachusetts, 1967.

[16] Metaphysics VII (Ζ), 1028b(84)-1029a(34). It should be drawn to the attention of the reader that for this reason, and contrary to a widely held interpretation, no material connotation can be attached to Aristotelian substance. Substance bears properties and thus separates an object out of the plurality of things in the surrounding world open to the senses. Materiality does not bear properties of itself and remains fully embedded within the un-differentiation which is the hypokeimenon. H. Tredennick, *Aristotle. Metaphysics, books I-IX*, Loeb Classical Library, Harvard University Press, Cambridge, Massachusetts, 1996.

[17] Metaphysics I (Α), 983a(24-34). The four causes thus represent the *becauses* that make that something is what it is. αἰτίον, cause, covers a broader scope of meaning than the merely 'causal' one. G. Vlastos, "Reasons and causes in the Phaedo", in: G. Vlastos, (ed.), *Plato: a collection of critical essays*, Vol. I, Doubleday, 1971, p. 134.

[18] Metaphysics IV (Γ), 1009a(24-39).

[19] Gotthard Günther's analysis of the relation between logic and ontology starts from a profoundly different point of view, but leads to a similar conlusion: "There is a very simple translation of the term "ontology". It is the theory of What There Is. (Quine) But if this is the case, one rightly expects the discipline to represent a set of statements about "everything". This is just another way of saying that ontology provides us with such general and basic concepts that all aspects of Being or Reality are covered. Consequently all scientific disciplines find their guiding principles and operational maxims grounded in

the case of Plato and becomes explicit with Aristotle. The first formulation of the principle can be found in Plato's *Phaedo*, yet it only serves to undermine the discussion-strategy of the sofists[20]. In the *Theaethetus*[21] its ontological nature is unambiguously exposed: if it be true, as the most prestigious of the ancients hold, that everything constantly moves, and if knowledge of this ever-changing world is only possible via the senses, for the only real thing is appearance according to the Sophists, then it is impossible to say about anything in any meaningful way that it be more this than that. It follows that every answer to whatever question will be equally true: the *ex falso quodlibet* turns out to be the "epistemological" face of the coincidence of opposites! The solution furnished in the *Sophist*[22] is therefore ontological and epistemological at the same time: we should respect in our ways of speaking the ways in which the Forms are interrelated with the phaenomena and amongst themselves, and thus, once their presence recognised in the structure of properties of a concrete being, it will be possible to speak of it in contraries without ending up in contradiction. The principle of contradiction is a necessary consequence of Plato's participation theory, and his ontology clearly encodes a definite epistemology as well[23].

Aristotle's thought-system on the other hand became the commonplace of our intellectual tradition. Whereas with Plato the theory of Being and the theory of knowledge about two separate worlds coincide, Aristotle proceeds the other way around. He *lays down* the separation of Being and non-Being as the basic axiom for correct thinking. This axiom, the principle of contradiction, is unprovable in itself, and is introduced on ontological grounds in the framework of his *metaphysics*[24]. The three possible usages of the verb "to be" thus correspond all to a fundamental aspect of his ontology: existence, predicability and identity. Exactly as with Plato, concepts do mingle the same way as things, when spoken about correctly[25]. Syllogistic reasoning amounts to

---

plays with symbols or formal descriptions of what "really" is. (...) *A system of logic is a formalization of an ontology*!" G. Günther, *Cybernetic Ontology and Transjunctional Operations,* BCL publication 68. Photomechanically reproduced from *Self-organizing Systems*, 1962, Yovits, Jacobi and Goldstein Eds., Washington D.C., Spartan Books, 1962, pp. 313-392.

[20] *Phaedo*, 101(c,e).

[21] *Theaethetus*, 182(e)-183(a).

[22] *Sophist*, 253(b,c).

[23] Plato is the first to discriminate between the existential and predicative use of "to be". For a profound discussion of the relational logic present in Plato's ontology, see H. N. Castaneda, "Plato's theory of relations", in: *Exact Philosophy*, M Bunge (ed.), D. Reidel Publishing Company, Dordrecht, 1973.

[24] Metaphysics IV (Γ), 1005b(8)-1006a(16).

[25] An important study breaking a path for a similar line of argument came under my

nothing else than to the recognition and articulation on the basis of experience of the substance and categories that instantiate themselves in a particular thing[26]. This **categorial discrimination** lifts the thing out of the multiplicity of the phaenomenal world and transforms it into an identifiable object, subject to knowledge. The fact that this can be done without ending up in contradiction is granted for ontologically, as mentioned before.

The principle of contradiction thus reveals itself as the weapon constructed to defeat the uncertainty arising out of reality's underlying paradoxical nature. It is an invention and an intervention; the necessary mental predisposition for it is the separation between subject and object. The representations constructed by means of it then again become logically comprehensible; the "descriptions" of reality emerging out of the application of this logico-ontological procedure onto reality are precisely what we call "worldviews"[27]. An essential problem remains however, often not surmised in modern "empty, formalistic" approaches, but clearly present to the founders of the discipline. Since logic and everything constructed by means of it is intrinsically Eleatic - given its constituting principle, the principle of contradiction, and its unceasing exorcization of non-Being -, it becomes inevitable to provide for a **dynamics,** capable of restoring somehow the aspect of change undeniably present in experienced reality. This dynamics by necessity remains external to the logical system itself. Every description of reality based on logic is explicitly or implicitly in need of a First Mover. This holds true for 'traditional' worldviews *and* for science, which is as metaphysical as whatever traditional doctrine, though its metaphysical nature manifests itself in a different, and in fact obscured, way.

3. Modernity: the scientific era

Modernity can be described as the human condition resulting out of the claim that the formal and empirical procedures of *science* constitute the

---

Bedeutungsunterscheidungen für das Wort 'Sein' ergibt sich, dab es sich nicht nur um verschiedene *Wort*bedeutungen, sondern zugleich um verschiedene Arten oder Modi des "So-Seins" selber handelt, die unterschieden werden sollen. Da aber in diesen verschiedenen Modi des "So-Seins" auch verschiedene Arten von Gegebenheiten zur Erscheinung kommen, die auf verschiedene Weise gegeben oder da sind, so bekommt die Kategorienlehre, indem sie diese Arten unterscheidet, mit Notwendigkeit in gewissem Sinn eine ontologische Bedeutung (...)" K. Von Fritz, "Der Ursprung der aristotelischen Kategorienlehre", in: Von Fritz, K., *Schriften zur griechischen Logik*, problemata, Friedrich Frommann Verlag-Günther Holzboog GmbH, Stuttgart-Bad Cannstatt, 1978, band 2, p. 17.

[26] K. Von Fritz, "Versuch einer Richtigstellung neuerer Thesen über Ursprung und Entwicklung von Aristoteles' Logik", *o.c.*, p. 63.

foundation for the certainty of our knowledge about the world[28]. As such they constitute the warrant for the validity of our actions in it. Does science represent, as many people think, a *Fremdkörper*, something completely new and alien to the preceding philosophical developments, or could we determine its eventual place in the evolution scetched above? I will now argue why I think it is perfectly possible to situate science in this framework, while at the same time doing justice to its particular originality.

It are not the apparent differences between the alternative conceptions of the 'real world' of modern science and philosphical tradition that are relevant for the further development of our argument. Before we highlighted the ontological link between logic and metaphysics. My approach vis-à-vis science will be to treat it as that particular branch of metaphysics that claims to possess the *sole* method to obtain valid knowledge about reality: mathematical reasoning and experimental observation combined[29]. The core of my argument will be the analysis of the role of 'experimentation' as an observational practice designed to apply the ontological rule present in the logical way of reasoning on our world-experience by changing 'perception' into 'observation'. This further step in the formalisation of the 'objectified' world-experience became the strategy to cope with the uncertainty that followed the abolition of the alliance between Peripatetic metaphysics and ecclesiastical authority as warrants for the selection of the one "good" possibility between the logically equivalent worldviews that could be constructed on the basis of rational thinking alone[30].

---

[28] "The Enlightenment was a daring enterprise. Its goal was to reconstitute political and intellectual life totally under the supervision of philosophy and science." A. Bloom, *The closing of the American mind*, Penguin Books, London, 1987, p. 259.

[29] The well from which this conviction sprang is Galilei's famous dual method, composed of *methodo risolutivo* and *methodo compositivo*, the first one being analytical and based on the acquisition of experimental data, the second one being synthetic and serving the purpose of generalising the principles found by the former by means of prediction and verification. A classic development of its historical beackgrounds: E.J. Dijksterhuis, *De mechanisering van het wereldbeeld*, 7th ed., Meulenhof, Amsterdam, 1950-1996, p. 259 sq.

[30]The debate during Renaissance between the advocates of Peripatetic natural philosophy and the supporters of the re-emerging corpuscular theories can be interpreted in this light as a combat over what explicit ontology should be used to render Aristotelian logic, given its inherent Eleatic nature, into agreement with the changing world of our senses. Preponderant already since the days of the Schoolmen, the Council of Trent had moored Aristotelian physics eventually, but incontrovertibly at the core of Counter-reformation Catholic dogma; the world-historically most important event of change ever to occur, the transsubstantiation of Christ, being explicable only in the context of that framework. Support for this perspective comes from Redondi's astonishing discovery that the actual reason for Galilei's condamnation by the Church was *not* his Copernicanism, but his averted

The new practice that truly originated modern science thus is experimental observation[31]. By means of preliminary experimental preparation, i.e., by the creation of "standard conditions" under which "observables" can be either observed, either ignored, the subject-object separation is enlarged such as to cover the empirical component of rationalised world-experience. It takes the form of the separation between "observer" and "observed". The notion "experimentally controllable observable" is related to the logical concept of "(predicable) property" and permits the observer to treat a real thing as an object, a collection of quantifiable predicates[32]. But the number of properties of a real thing is in principle unlimited. In order to be able to apply the rationalised perceptive procedure of experimental observation upon it, one has to mould it to make it fit the Eleatic ontology present at the core of the logical reasoning apparatus gone before. This exactly is the reason why the introduction of "standard conditions" and "ignorable observables" makes sense. An inevitable prerequisite for application of this logically marked perceptive procedure further reveals its murky metaphysical character: the separation of "system" and "environment"[33]. This again is reflected in the conceptual framework of early modern science. Newton explicitly postulated the existence of "absolute space" and "absolute time" to fullfill his metaphysical needs[34]. They also

---

[31] T. S. Kuhn, *The structure of scientific revolutions*, University of Chicago Press, Chicago, 1962-1970, p. 25 sq.

[32] The extend to which this is true can be judged when realising that a school of thought in present-day theoretical physics emerged over the past twenty years - the "Geneva School" in Quantum Mechanics - that tries to solve the formal and interpretative problems related to the inescapable appearance of paradoxes both theoretically and experimentally at the core of that fundamental physical theory, by explicitly coupling the notion individual "property" to the notion "experimental project", in an attempt to provide for an ontologically and operationally sound base to its formalism. A good and accessible review of its theoretical assumptions can be found in D.J. Moore, "On State Spaces and Property Lattices", *Stud. Hist. Phil. Mod. Phys.*, Vol. 30, N°1, pp. 61-83, 1999.

[33] "In Newtonian particle mechanics, their distinction is absolute, once-and-for-all. *System* means some definite family of particles (...); environment is whatever else there may be in the world. (...) system (...) is described by phases or states; (...) environment is the seat of (external) *forces*, manifested in the equations of motion which is imposed on the states or phases that describe system. Environment is, further, the seat of whatever it is that sets initial conditions, initial configurations, and initial velocities. This apparently necessary and innocent partition of the world into system and environment (...) has had the most profound consequences for the notion of causality. For according to it, the realm of causality becomes bound irrevocably to what happens in system alone (...). Environment has become acausal." R. Rosen, "The Roles of Necessity in Biology", in: J. Casti & A. Karlqvist (ed.), *Newton to Aristotle. Toward a Theory of Models for Living Systems*, Birkhäuser, Boston etc., 1989, p. 18-19.

[34] S. Horsley, *Isaaci Newtoni opera quae extant omnia.* Commentariis illustrabat S. Horsley, vol. I, p. 6 (Scholium to the Definitions), Londini, exc. Joannes Nicols. See also the *General Scholium* to book III in that same edition: vol. IV. p. 170-174 sq. For a textual analysis of some philosophical influences working on Newton while formulating his

provided the causal justification for the new experimental method[35]. Within his system, space and time represent the Eleactic and Heraclitean layer in reality, respectively. It can be shown without too much difficulty that, up to the present, the different 'schools' in modern physics all remain underpinned by the same metaphysical set-up, though in different disguises[36].

The "epistemological revolution" brought about by science can therefore be described not as the abondoning of metaphysics, but as the complete *absorption* of the metaphysical structure into the procedures of its formalised "operational" components, cognitive *and* empirical. The obscured relation in science between "act" and "perception" allows for the conception of logical reasoning as a *representation* of the ontological structure of reality *and* for the succesfull application of science to the natural world: reality is adapted to the ontological structure of science, not *vice versa*.

Compared to science, claims grounded on other foundations remain during modernity tolerable as relics of the past and as mere opinions in the realm of private life[37]. Although they may - in democracies - enter the public scene of negotiation and rational consent, they will, if they cannot stand the test on the touchstone of science, loose in the end their credibility or suffer the reproach of sectarianism. A clear example is again that of Catholic Church which seeks, to keep some stronghold in the context of the present society, relatively succesful to permanently reconcile its doctrines with the findings of modern science[38]. It is science that provides both the metaphysical basis and the legitimation for its societal equivalent: capitalism[39]. During early modernity, both science and the new social order still needed the "meta-narrative"[40] of divine creation to justify

---

invloeden op Newtons gravitatieconcept", in: *Denken in openheid. Liber Amicorum Hubert Dethier*, E. Walravens en J. Stuy (red.), VUBPress, Brussel, 1999.

35 "The general validity of the principle that the universe presents the same aspect from every point (...) is accepted in modern physics as a necessary condition for the repeatability of experiments, since space and time are the only parameters which, at least in principle, are beyond the control of the experimenter and can not be reproduced at his will." M. Jammer, *Concepts of Space. The History of Theories of Space in Physics*, third, enlarged edition, New York, Dover Publications, 1993, p. 84.

36 A study of the emergence and transmission of the metaphysical concepts basic to early modern mechanics in this context can be found in: Verelst and Coecke, *o.c.*, p. 170 sq.

37 B. Appleyard, *Understanding the Present. Science and the Soul of Modern Man*, Doubleday, New York etc., 1993.

38 This process took a start with the Contra-reformation as well, which in its turn can be understood - in defence against the attack primarily of protestantism - as the purification of Catholicism of all "irrational" elements, apart from those strictly necessary from the dogmatic point of view. Cfr. the recent recognition by the Church of its mistakes in the cases against Galileo Galilei and Giordano Bruno.

39 The 'archeology' of this relation has been carried out brilliantly by the Dutch philosopher Hans Achterhuis, in: H. Achterhuis, *Het Rijk van de Schaarste*, Ambo, Baarn, 1988.

themselves[41]; the hallmark of Enlightement in the proper sense is that the possibility of consent between human beings considered rational by nature is sufficient legitimation in itself[42].

As we know by now, these legitimating meta-narratives crumbled under the very weight of scientific knowledge and the concommitant and unlimited spread of technological practices following the capitalisation first of production processes, afterwards also of interhuman relationships, throughout all aspects of modern society[43]. This loss of legitimating force of meta-narratives is said to be *the* fundamental characteristic of the present "post-modern" condition[44]. But this legitimative collapse *did not* cause the collapse of the system which was supposed to rest upon it[45]. I contend that this implies that in a fundamental sense the modern system of knowledge and society was never *really* dependent upon its supposed legitimations. The true legitimation is the one Lyotard has identified for the *post*-modern condition: performance. The method that allows for this goal to be attained is from the beginning *proceduralisation*, the material face of theoretical formalisation, with its implication of unceasing 'technological innovation'. This can be understood in relation to what has been said before: the ontological intervention effectuated continually in our experience of reality by the cognitive and empirical procedures of science, is matched in society by the ever-increasing demand for productive efficiency. The same circularity as for the legitimation of science evidently holds in this case: its criteria can only be defined inside its own framework. The difference between modernity and post-modernity can now be interpreted as the disappearance of the necessity to furnish other legitimations to sustain this porcess than the purely 'operational' one. Post-modernity reveals itself as *hyper-modernity*[46].

---

[41] "(...) Newton's God-filled space was the penultimate development in the process by which concepts of space were developed by attributing to space properties derived from the Deity; after Newton's time, the properties remained with the space while the Deity disappeared from consideration." B.J.T. Dobbs, "Newton's Alchemy and his 'Active Principle' of Gravitation", in: P.B. Scheurer, and G. Debrock, *Newton's Scientific and Philosophical Legacy*, (Archives internationales d' histoire des idées, nr. 123), Dordrecht etc., Kluwer Academic Publishers, 1988, pp. 55-80.

[42] Bloom, *o.c.*, p. 256 sq.

[43] Illich, I., *Medical nemesis: the expropriation of health*, London, Bantham Books, 1979.

[44] Lyotard, *o.c.*, introduction.

[45] The downfall of societies built on models of "scientifc socialism" only accelarated this process, without fundamentally changing it.

[46] It is clear that the erosion of the power of meta-narratives, as well as the availability of technological infrastructure cleared the road for a number of *other* evolutions which open up cultural possibilities unprecedented in the past. If 'post-modernity' is considered to be the collection of all these, then the present analysis might be judged to limited. My intention however is to shed some light on 'post-modernism' as a consequence of a precise philosophical development yielding definite societal implications. I do not pretend at all

4. The ontology of "machines" versus "tools" and living beings

The obtained adaptation of reality by this ontological intervention establishes the framework for its mathematical description and experimental observation as practised by science, as well as for its 'technological' manipulation. But if logic does not represent the ontological structure of reality as such, only of its divided and stabilised counterpart, then this must leave recognisable traces in its technological artefacts and their interaction with 'real' reality.

This is the case indeed: all machines constructed in this ontological setting can be seen as material instantiations of logic. They manifest the same duality as the logic out of which they arose: a strict separation between an 'internal' causal chain and an 'external' world with which communication is only possible via an 'input' and 'output' of 'information' separated in space and time. This is clear in the case of 'information technologies'. The translation of 'knowledge' into 'information units' moulds transmittable knowledge so as to fit into a system of binary codification[47]. Machines don't live immediate experience; it is replaced by 'causal calculation'. This nevertheless also holds for mere 'mechanical' machines: now it is not knowledge but action that is transformed to fit logical modelisation.

But if this separation of internal and external, of cause and effect, does not exist in reality, then it will be necessary to construct at the same time the 'world' in which these machines can function and communicate: that world should be as predictable as their internal organisation. This becomes inevitable if one wants to take full profit from the predictability - and thus certainty - granted by mechanical operation. A simple example of these logically structured machines is the train running along a network of tracks while linked via a matching cable-network to an electricity power plant, or the robot functioning in a neatly organised factory-hall; a more complex and dramatical one is presented by the "informatisation" of a real workplace. The criterion for this reality-reconstruction is efficiency, i.e. performance[48]. But to be efficient,

---

phaenomena. I do pretend, however, that the latter cannot be fully understood without a clear and profound understanding of the former.

[47] Lyotard, *o.c.*, chapter 1.

[48] That this is the case indeed can be inferred easely from whatever standard economical analysis of the necessity of enhancing "productivity" by means of technological "rationalisation" of production processes. The fundamental notion from which they start inevitably is the "natural scarcity" of goods, but in the end this always comes down to scarcity of energy-resources. The point of course is that this scarcity is not the origin, but a

not only the operations of the machines, but also of the human beings in it have to be organised according to logic. The transformation of European culture into Western civilisation[49] that followed out of the large-scale introduction of machines in socio-economic relationships is commonly called modernity; the present-day 'completion' of this process - in the sense that no 'meta-narratives' are required anymore for its justification - is a possible way of defining 'post-modernity'. The most extreme example of this process is the recently emerging "virtual reality": a digital - i.e., logical - replica of the world that is placed between man and his potential experience of the 'real' one.

Machines thus developed are to be distinguished from 'tools', i.e., instruments grown out of practical experience *in* reality. Tools, like living organisms, operate in reality as it is given, - in a limited and defined part of it, but in a part of it. A tool facilitates a certain type of work qualitatively. The quantity of the work perfomed changes only within definite limits, determined by the 'energy' incorporated in the natural phaenomenon that operates the instrument[50]. The limits by which its functional realm is demarcated are determined in the end by constraints proper to given reality. A machine on the contrary is a construction designed deliberately to perform an amount of work of a certain kind, the amount being in principle independent of "environmental" constraints. It is because of the constant supply of energy stemming from external "resources" that machinal functioning is guaranteed. Moreover, this separation between reality and machines - the "input/output"-

---

production-processes possible. Number of examples and their societal consequences discussed in Illich, Achterhuis. The proces at large has been foreseen already by Marx. A critical but respectful comment on Marx's viewpoint in H. Arendt, *The Human Condition*, University of Chicago Press, Chicago, 1958-1998, pp. 117-118.

[49] "Die Maschine ist also letzte uns endgültige Bestätigung des inneren Antriebes aller Hochkulturen, die Primitivkultur dadurch zu liquidieren, das sie von der Idee der ontologischen Einwertigkeit zum Zweiwertigkeitsprinzip übergehen." G. Günther, "Machine, Seele und Weltgeschichte", in *Beitrage zur Grundlegung einer operationsfähigen Dialektik.*, Felix Meiner Verlag, Hamburg, 1980, dritter Band, p. 211.

[50] In most cases living organisms like human beings, animals, etc. This analysis nevertheless holds true as well for constructions operated by unanimated natural phaenomena like windmills or even hydrological power plants. Although possibly very large-scale in themselves, it remains impossible to boost and exploit the available energy-"resources" that they incoporate at an *unlimited* scale. You cannot enhance at your will and by means of mere 'technological innovation' the 'quantity of wind' that passes at a certain place, nor the energetic power present in a living body. The recent ineluctable growth and industrialisation of Molecular Biology ("bio-technology"), however, clearly represents an attempt to overcome these intrinsical limitations. And although the living body does not remain fully unaffected by its quest for internal manipulation and 'rationalisation', the ecological catastrophe lying before us as its inevitable outcome will outnumber in consequences everything we saw thus far. For material supporting the last contention I refer to, e.g., A. Kimbrell, *The human body shop*, Harper Collins Publishers, San Francisco, 1993, or *Remarques sur l'agriculture génétiquement modifiée et la dégradation des espèces*,

relationship is the productive equivalent to the scientific separation between "observer" and "observed" - allows in principle for the unlimited augmentation of the *quantity* of the work perfomed by unceasingly enhanced technological innovation. Again, this means that **constructing a machine implies constructing at the same time the "world" in which it can function.** This world constitutes both an energetic complement to and a structural replica of the machine's internal organisation. It shall be clear by now that this in my view reflects nothing else then the concrete expression of the ontological reality-reconstruction analysed before[51].

These transformations deeply influence the experience that humans have of themselves and of each other and have a profound impact on the relation between man and the 'real' world[52]. If we want to deal with and handle the consequences of the present accelerated transformations in society without remaining paralysed under their spell, we will have to realise fully the deep ontological roots that are at their origin.

Ackowledgments

I expressely want to thank prof. W. Van Rengen (Department of Ancient Philology, Free University of Brussels-VUB), in discussions with whom I got the first explicit confirmation of my intuitions regarding archaic self-awareness. He did not only provide me with literature for further reading, but was also so kind to compile a *corpus* of the *loci* where fragments of different origins relevant to the subject could be found. If anything, then this will be the solid ground on which my eventual further research concerning this subject will be based upon. I also want to thank Mss. Johanna Brankaer, who helped me checking out some references and clarifying technical issues of philological nature. Last but not least I thank Mrs. Crista Racquet who proof-read the manuscript with respect to the English used.

This contribution was made possible by a travel grant kindly provided for by the Research Council of the VUB and by financial support from its interdisciplinary research centre, the Centrum Leo Apostel (CLEA).

[51] In this context the ecological movement's attempts to promote "natural" production-processes can be judged correct in principle. But a clear theoretical basis stemming from a serious ontological perspective lacks entirely. On the contrary, the theoretical apparatus used remains trapped into the 'discours of scarcity' and often contradicts flagrantly the conclusions reached at on a practical level.