The 'Eclipse' of the Object of Research in Late-modern Philosophy of Science: Causes and possible Remedies

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Samevatting

Hierdie artikel verken die geleidelike "verdwyning" van die objek van navorsing in die laat-moderne wetenskapsfilosofie. In die eerste deel van hierdie artikel (afdelings 2 tot 6) word die "verduistering" van die navorsings-objek (wat gepaard gaan met 'n groeiende beklemtoning van die rol van die kennende subjek) aangetoon en bespreek. In die volgende fase (afdeling 7) word gesoek na die oorspronge van die probleem en voorgestel dat dit te doen het met die Cartesiaanse verdeling tussen die subjek en objek van kennis. In hierdie dichotomie gee nominalisme voorkeur aan die kennende subjek, terwyl realisme die objek vooropstel. Een van die konsekwensies van hierdie Cartesiaanse verdeling is die probleem van die inkongruensie tussen wetenskap en die studie-objek. Alhoewel beide nominalisme en realisme hierdie probleem ervaar, is dit veral in die nominalistiese weergawe van hierdie teenspraak wat die verskynsel van die "verdwyning" van die objek meer dramaties ervaar word.

Laastens (afdelings 8 en 9), word aanbeveel dat die strukturele orde van die werklikheid erken word as 'n reaksie op die probleem van die "verduistering" van die navorsings-objek. Hierdie ontologiese voorstel word op die kenteoretiese vlak vergesel van die suggestie dat dit moontlik is om beide die individuele en universele te ken en dat die skeppingsmatige/ strukturele orde wel toeganklik is vir wetenskaplike ondersoek

en daarom nie so ontwykend is as wat dit in die laat-moderne wetenskapsfilosofie voorgestel word nie.

1. Introduction

Why is the object of scientific research undergoing a kind of "eclipse" in contemporary philosophy of science? In the last few decades philosophers of science have increasingly recognised the role played by paradigms, worldviews and frameworks in scientific research. But why is the object of science increasingly regarded as elusive and inaccessible? What are the causes of this phenomenon and what are the possible remedies? To answer these questions we will have to go back to crucial philosophical debates, like the conflict that Bernstein (1985:8) calls "the *agon* between objectivism and relativism".

The objectivist believes that there is a firm grounding for knowledge, something we can appeal to in determining the nature of rationality, reality and truth. The relativist (or subjectivist[1]) claims that what is taken to be foundational, true or right is at best only culturally stable, certainly not eternal, indubitable, ultimate or necessary. According to Strauss, the fundamental disagreement between the objectivist and the subjectivist is due to the fact that the *locus ordinis* is placed in the object by the objectivist and in the human subject of knowledge by the subjectivist (cf. Strauss, 1988:19).

One particular version of the debate between objectivism and relativism is the debate between realism and nominalism.[2] This debate takes place in the ontological arena. The nominalist maintains that the only "things" that exist are individuals and universals are simply *nomina* (i.e. names) which exist only in the language or in the concepts of the subject of knowledge. The subject becomes the *locus ordinis* and the seat of universality. The

1 The author uses "relativist/ism" as a synonym of "subjectivist/ism". In fact, the subjectivist does not necessarily affirm that there is no truth, knowledge or values, but that all this is *relative* to a certain *subject* (culture, community etc.).

2 The conflict between subjectivism and objectivism has several aspects or levels. In this article the author deals mainly with the ontological level. A second level of conflict is epistemological; here the dispute can be labelled as *realism versus idealism.* A third level of the debate can be defined as *realism versus anti-realism*. Here the conflict takes a linguistic turn and is about *what can be said*. For an overview of these different levels of the debate see Delaney (1985:1-10). Mc Mullin (1984:25) mentions a fourth level: *scientific realism versus scientific anti-realism.* In his opinion the basic claim of scientific realism is that the entities and structures postulated by scientific theories actually exist. Scientific anti-realism (in its instrumentalist version or in others) claims that the theoretical entities of science ought to be denied ontological status. Limited (scientific) anti-realism denies ontological status only to certain classes of theoretical entities (Mc Mullin, 1984:25).

realist, on the contrary, acknowledges the existence of universals as ontological components of the world. For the realist there are different irreducible ontological features of the world, corresponding to various kinds of human representations. The object is the source of order and the anchor of sound knowledge.

Historically speaking, nominalism (and conceptualism as a particular version of it) gradually gained predominance in late-modern[3] philosophy of science. The shift from realism to nominalism started within positivism itself, as a reaction against the initial mechanistic-materialistic worldview (Botha, 1988:39). The gradual victory of nominalism however, brought about a few problems. In this article the author is going to explore one in particular, a problem that can be called "the eclipse of the object" of scientific research. As the nominalist places the universal within the knowing subject (or community), the *object* of scientific enquiry, the external world, is increasingly experienced as depending on the theories, the language or the worldviews of the scientific community. The traditional object of science seems to become increasingly elusive and inaccessible to scientific investigation. By "loosing" the object, we loose objectivity as well.

The following historical exploration of the eclipse of the object (sections 2 to 6) will focus mainly on five authors.[4] The analysis starts with Karl Popper, a philosopher who is not a nominalist. His position will help us realising the gradual shift towards nominalism that took place in later philosophical developments.

3 The author prefers to use the term "late-modern" (instead of "postmodern") because the former implies a closer connection between modernity and postmodernity. The term late-modern suggests that the advent of postmodernity has not caused the end of modernity. Postmodernity is not situated "after" modernity but in many ways is rather to be considered as part of it (cf. Coletto, 2007:16-17). The analysis of several artistic disciplines, for example, brings Chabot (1991:35-38) to the conclusion that only in some of these disciplines modernity is opposed, while in some others it is continued, re-affirmed and so on.

4 The reasons for choosing these thinkers are for example, that their works focus specifically on philosophy of science, they are (among) the most influential philosophers of science of the period in question and their philosophies are good examples of the theme the author intends to substantiate. By proposing these authors, however, the author is not ignoring the fact that in the same period others have resisted and even opposed the shift towards subjectivism. One can mention for example those who supported realist tendencies (e.g. Boyd, 1983; Mc Mullin, 1991) and rationalist tendencies (Newton-Smith, 1981). Even positivism is not totally absent from the picture. It will be admitted, however, that counter-instances like these constitute a minority and are clearly less influential and authoritative than the mainstream schools in philosophy of science, which have been characterised by a subjectivist approach.

2. Popper's realism

2.1 Laws and universals

Popper's views are posited on the assumption of realism[5] of which he provided a rather extensive defence (e.g. Popper, 1983:80 ff.). In line with the realist position, Popper affirms that universals do exist and it would be impossible to operate within science without recognising their existence and their role (Popper, 1963:119). The existence of universals leads him to the recognition of dispositions and propensities, but Popper (1963:119) is not prepared to conjecture the existence of "ultimate and inexplicable" dispositions: the essences. Therefore Popper accepts the existence of universals but rejects essentialism.

According to Popper (1963:118) "all universals are dispositional". Universal terms indicate that the thing named by the term shows a certain behaviour under certain conditions. Such behaviour is a "law-like behavior" (Popper, 1963:278) and therefore Popper creates a link between universals and laws. The laws of nature exist and are universal in scope. For Popper, however (1961:5), a synonym for "the laws of nature" is "physical laws". As Popper denies that there are historical or social laws but only "trends and patterns" (1961:115) the only laws of nature that he recognises are physical laws. In this sense, Stafleu's (1987:204) observation that Popper absolutises the physical aspect of reality is justified.

Popper restricts genuine universals to the world explored by the natural sciences. It is difficult to see why he does this: if we say that certain objects are breakable under certain conditions why would it be incorrect to say that people have a disposition to behave in a certain way under certain conditions? Popper's reduced version of the universals raises another question. In his system of thought we certainly find the universals. Do we also find a universal *order*? Perhaps the answer can still be "yes", but in the author's view we are confronted with a rather restricted version of the law-order. This is unfortunate, given the positive traits of Popper's ontology. In fact, his recognition of laws, conditions and universals, is more accurate and promising than what we are offered in other philosophies in the nominalist tradition.

2.2 Between subject and object: Popper's attempted synthesis

According to Popper it is futile to anchor scientific certainty and objectivity in the individual scientist, in the community of scientists or in the psychic or social characteristics of the human nature (Popper,

5 Although realism is not discussed as a thesis in his *Logic of scientific discovery*, Popper says that even in that book it "forms a kind of background" (Popper, 1983:81).

1961:155-159). Objectivity cannot depend on the subject of knowledge. In his view this "naive solution" does not offer any guarantee (Popper, 1961:155). Objectivity must rather be anchored in the object of scientific enquiry. In Popper's philosophy, though the universals are mentioned, the anchor of scientific certainty is sought mainly in the facts, in an objective reality independent of the knower. In his philosophy, truth remains "correspondence to the facts" (Popper, 1963:224).

It must, however, be observed that Popper's objectivism is not a crude one that dismisses the role of the knowing subject altogether. On the contrary, the subject becomes more important than in the positivist era. For example, Popper's solution "blends" together elements of essentialism and instrumentalism (Popper, 1963:103) thus making room for selected elements of nominalism. His philosophy remains realist in its main traits, but the object of scientific research is not considered to be accessible in the same manner as naive realists would have it. It is not possible to verify that our theories are true, that they precisely reflect the facts. Compared to the positivist era, the object of science becomes more elusive while the subject acquires a new and relevant role. From a reformational point of view one might say (see Stafleu, 1987:255) that Popper tries to find a synthesis between the subject and the object of knowledge, a synthesis between nature (object) and freedom (of the subject). A synthesis, the author would say, in which the object retains a priority on the subject.

In the next section the author will introduce the philosophy of Michael Polanyi. In his philosophy the role of the subject of knowledge becomes the *locus ordinis* of the scientific enterprise.

3. Polanyi: reality and personal commitment

The difference between Popper's and Polanyi's philosophies can be captured in the titles of their most important works. While Popper wanted to achieve *objective knowledge*, Polanyi insisted on the concept of *personal knowledge*. While Popper anchors scientific certitude and knowledge especially in the objects and facts explored by science, Polanyi tries to anchor them in the person, the subject of knowledge. The author will discuss Polanyi's position by taking into account two themes: the formation of universal concepts and the theme of scientific discovery.

In Polanyi's philosophy universal concepts are formed by the committed subject and then held with universal intent (Polanyi, 1974:166-171). The emphasis of his discussion lies on forming concepts, on distinguishing objects that can be placed in the same classes. Polanyi does not dedicate particular attention to the question whether the formation of universals reflects anything structural in reality or is simply a linguistic or logical exercise. He does not refer to anything like a universal order.

It might be argued that he refers to universal standards of truth and rightness (Polanyi, 1974:170-171). But these standards are also grounded in personal commitment. Even in this case, in fact, we are not dealing with universal standards that we submit to, through our commitment. We rather deal with a commitment that grounds universal standards in itself and then adheres to them with universal intent. Commitment is therefore the crucial factor in Polanyi's epistemology, and this emerges also when he considers the issue of scientific discovery.

Scientific discovery looks like an activity of bridging the gap between the knower and a hidden reality (Polanyi, 1958:123), a reality that Polanyi often declares to exist independently of the knower. The bridge between the two, between knower and knowable, is provided by the commitment of the knower, as in all processes of tacit knowing. This commitment, however, lies entirely on the side of the knower. This raises the question: how can this commitment be the condition for the relationship between knower and knowable when it lies completely on the side of the knower? On the one hand this commitment appears as determining the possibility of the relationship between knower and reality. On the other it is a subject within that same relationship. In other words, in Polanyi's epistemology the role of the subject appears to be much more decisive than the role of the object. One should acknowledge however, that Polanyi's intention is not to eliminate or delete completely the object, the external reality. His philosophy tries to account for it and does not propose any wild or crude subjectivism.

With Polanyi, however, the role of the subject of knowledge becomes the anchor of scientific knowledge. Polanyi's approach moves away from realism by teaching us that the object of science cannot provide totally objective, impersonal knowledge. He rejects Popper's idea that there can be knowledge without a knower (Popper, 1983:92, 95). Knowledge is a matter of commitment and is personal. A view of impersonal knowledge leads to a universe without man. However, the opposite danger of subjectivism started to raise its head in Polanyi's philosophy. Very soon the idea that it is the subject that creates his own world (or a plurality of worlds) was to be proposed with confidence.

4. Kuhn: constituting the object

4.1 Kuhn's plurality of worlds

For Kuhn, after a change of paradigm the world changes but does not change![6] To understand this seeming contradiction one must acknowledge

6 See for example the sentence: "though the world does not change with a change of paradigm, the scientist afterward works in a different world" (Kuhn, 1970:121). Other instances of this type can be found in *The structure of scientific revolutions* p. 6, 61, 106, 111, 117, 118, 120, 122, 134, 147-148, 150).

that from *The structure of scientific revolutions* (from now on *The structure*) terms like "world" (or "nature") are not used univocally. Kuhn distinguishes (although not always consistently) between a phenomenal world and a world in itself. The world in itself does not change after a change of paradigm but is merely "seen in a different way" (Kuhn, 1970:53, 118). The world in itself is not accessible to scientific investigation (Kuhn, 1970:111, 114, 118) and in practice, we cannot say much about it (Kuhn, 1970:171).

On the contrary the phenomenal world is accessible to scientific investigation and it is at least in part constituted by the subject himself (Kuhn, 1970:112, 125) who projects a certain paradigm on it (1970:110). This is the world that *changes* with a change of paradigm (Kuhn, 1970:7, 106). This is "the scientist's world" (Kuhn, 1970:7, 111), the world in which scientists "live" (Kuhn, 1970:117, 134) and is accessible to "scientific work" (Kuhn, 1970:6, 121, 147). With Kuhn, the subject of knowledge partly constitutes the object of scientific investigation. These ideas have a definite Kantian flavour, but for Kant only *one* phenomenal world existed and was constituted by the subjects. For Kant, the categories constituting the phenomenal world were the same for each individual. With Kuhn on the other hand, as the paradigms differ, a multiplicity of phenomenal worlds are created.

Two important modifications of this system were introduced at later stages. First, Kuhn (1979:418) "eliminates" the notion of a world-in-itself. He describes his new position as "Kantian but without the 'things in themselves'" (Kuhn, 1979:418-19). Though he claims his position to be "realistic" it is not clear what he means, and he does not clarify the issue further (Kuhn, 1979:415). The second change concerns the phenomenal world. In *The structure* and before 1979 the main metaphor employed to indicate access to the phenomenal world was a visual one (e.g. "they see the world in the same way"). Later the emphasis shifts to language, and Kuhn speaks of "clusters of related terms" and realises that "language structures the world" (Kuhn, 2000:49 – orig. 1982).

4.2 Kuhn and the object of scientific enquiry: a few evaluative thoughts

With Kuhn, the object of scientific research becomes more elusive. Before 1979 he creates a double order of reality. There are two "worlds" in his philosophy: the world-in-itself (inaccessible to human knowledge) and the world that we can access, the phenomenal world. There is therefore a "part" of our reality, an aspect or a dimension that cannot be reached, known or described by the knowing subject. In a sense, we may say that in Kuhn's philosophy the object of science has "shrunk". In fact, science does not extend its researches to the whole of reality. Up to 1979 there is

a "part" of reality that simply cannot be known (and later will not be mentioned anymore). The part that can be known is the one that is partially constituted by the subject himself. As a consequence, we do not know an object independent from our awareness of it, but only an object that is (at least in part) constituted by the subject of knowledge.

In addition, in Kuhn's philosophy the object of science is "privatised" (and again made more elusive) by the multiplication of the phenomenal worlds. In this respect we may observe that each phenomenal world becomes a "private property" of the community that has contributed to the constitution of that particular world. Only that community can have a proper access to that world, while the others, to a certain extent, "live in a different world".

Thirdly, the existence of multiple phenomenal worlds implies the existence of multiple objects of scientific research and multiple results of such research. It might be observed that this standpoint implies on the one hand a certain neutrality of the researcher towards the different worlds (because no world can be said to be preferable to the others). But on the other hand this same approach implies that the researcher can approach the standpoint of others only from within his own phenomenal world, so that no neutrality is possible.

While the knowing subject and his paradigms acquires a most fundamental role, the object of science is in part declared inaccessible, in part constituted by the subject and finally "multiplied" (or "divided"?) into many different phenomenal worlds.

This was a consequence of the attempt at anchoring scientific certitude in the knowing subject, i.e. the scientific community. To acknowledge this move it is sufficient, for example, to look at the paradigm concept and to realise how dependent it is on the human subject. According to Kuhn (1970:176), "a paradigm is what the members of a scientific community share, and, conversely, a scientific community consists of men who share a paradigm". Although Kuhn will later specify and modify this basic idea, its fundamental meaning will remain unchanged. However, more radical positions were still to come. Feyerabend for example, openly supported an anarchistic approach to science and methodology.

5. Feyerabend, the real and the preferable

Given his declared anarchistic strategy, one would expect Feyerabend to promote an open nominalist approach to the object of science. As epistemological anarchism is centred on the human subject and rejects external constraints and rules, one would expect nominalism to be Feyerabend's choice. Yet in Volume 1 of his *Philosophical papers* (Feyerabend, 1985) he surprises his readers by saying very little about nominalism and by discussing realism in much more depth and with an openly supportive attitude. Initially, realism was the position that Feyera-

bend (1978:113 ff.) defended. In his *Philosophical papers* (1985:201-202) we learn that realism is always preferable to whatever form of instrumentalism. We learn that there are many types of realism, both scientific and "philosophical", and that he agrees especially with the scientific versions (i.e. scientific realism, see fn. 2).

However, at a later stage the anarchist approach emerged more clearly in his philosophy and Feyerabend tried to combine anarchism and realism. In the long run, his anarchism prevailed. Feyerabend's interest centred especially on the possibility of a proliferation of different theories. The existence of an eventual "independent" reality gradually became much less interesting.

In the same first volume of his *Philosophical papers*, Feyerabend (1985:xiii) claimed that he was moving the "first steps towards undermining this intellectual arrogance [of realism]". Then, introducing Volume 2, Feyerabend complained that realism "only reflects the wish of certain groups to have their ideas accepted as the foundations of an entire civilization and even of life itself" (Feyerabend, 1985:xiii). He was referring to philosophical realism, which he didn't fully appreciate from the beginning. His anarchistic approach required that "we decide to regard those things as real which play an important role in the kind of life we prefer" (Feyerabend, 1985:xiii).

Concerning the object of scientific investigation, we can say that, for Feyerabend, views and theories must have priority above evidence, facts or external states of affairs. In Feyerabend's approach, worldviews are more interesting and more important than reality. The subject of knowledge is more important than the object. Epistemological changes are ontological changes.

> (A) change of universal principles brings about a change of the entire world. (...) we no longer assume the existence of an objective world that remains unaffected by our epistemic activities (...) our epistemic activities may have a decisive influence even upon the most solid piece of cosmological furniture – they may make gods disappear and replace them by heaps of atoms in empty space (Feyerabend, 1978:70).

The *locus* of order is placed in the subject, more precisely in the ever-changing stream of history, where nothing seems to be constant or even stable. This position however, did not convince all. According to Collins, what is really crucial to understanding science is the social aspect of the scientific enterprise.

6. Collins: society as the foundation of order

Collins is part of a larger movement that initiated the "sociological turn" (Botha, 1994:22). His *Empirical programme of relativism* is closely re-

lated to the *Edinburgh School of Sociology of Knowledge*. Among the most representative figures of this "turn" are Brown (1984), Barnes and Bloor (1995).

Collins challenges the commonsense assumption that there is an order of reality that does not change and does shape scientific findings. According to Collins the essence of this order is rather sociological. Because there are communities that explore such order and share a certain language, we experience uniformities and regularities. But the foundation of this order is sociological: "the locus of order is society" (Collins, 1992:148). It is not the order that constitutes the possibility of a common language and of a scientific community. It is just the opposite. The existence of a scientific community is the origin of the perceived order (Collins, 1992:5).

Collins sets out to demonstrate that the origin of replication in science has a sociological foundation. He explores the case of the TEA-laser (for experiments in gravitational radiation) and two studies on paranormal phenomena. Through detailed observations he shows that the object of scientific enquiry has very little relevance in shaping our conclusions. What really matters is our perception. We perceive regularities and order, we expect the future to be like the past. But, asks Collins (1992:6), is there any guarantee that our "inductive inferences – generalisations from past experience – can ever be certain or even probable?" Collins invites the reader to remember Hume's lesson about causality. We see the movement of a billiard ball across the table and we are inclined to say that the ball is propelled by another ball. Its movement is "caused", so our experience tells us. But, asks Collins, supposing that the regularity of the a - b sequence were just an extended coincidence, "how would we see the difference?" (Collins, 1992:7).

> In other words, what is it that we see in the impact of the billiard ball that makes us view it as a casual relationship (...) rather than an extended coincidence, which we could not expect to continue? The answer is: nothing (Collins, 1992:7).

If we want to be able to solve this type of dilemmas, according to Collins we must look carefully into our social life and our language. The two are so intermingled that our habits of speech help determine the way we see the world and thus help form the basis for social interaction (Collins, 1992:11). It is exactly there that our attention should focus. We perceive regularity and order because any perception of irregularity in an institutionalised context is translated by ourselves and by others as a fault in the perceiver or in some other part in the chain of perceptions (Collins, 1992:147). Scientific rules are only rules by virtue of social conventions (1992:145).

But is there no room then, it might be asked, for scientific revolutions created by brilliant individuals who dare to go "the wrong way", against the social network and its settled conventions? Collins (1992:148) admits

that "it is only individuals who can provide the material for conceptual change". But an individual's act of creativity is nothing unless it becomes institutionalised. Even in this case, the wider "network" and the wider society provide the conditions for the success of some new institutions but not others. "Man proposes but society disposes", says Collins (1992:149).

Having sketched a panoramic view of the gradual move towards nominalism and the "eclipse" of the object of science, we must now move toward an evaluation. This will be the goal of the next section. In it we will try to penetrate into the roots of the problem that has been identified and illustrated in the present section.

7. Diagnostic attempts and explorations

7.1 The cartesian divide

The developments described in the previous sections seem to be basically determined by a kind of polarity: the *locus ordinis* is to be searched either in the object (the author's only example in this case has been Popper) or in the subject of knowledge (e.g. Kuhn, Feyerabend). This polarity, in modern philosophy, goes back to the prescriptions of the cartesian either/or. Descartes divided the whole reality in extended matter and mind. Either the subject or the object are supposed to be the *locus ordinis* of reality and of human knowledge. Descartes himself found the *locus ordinis* in the subject after a process of systematic doubting. When everything else is doubted, the subject of knowledge emerges as the anchor of certainty of existence and knowledge. Nominalist philosophy has inherited from the Enlightenment the conviction that rational knowledge is possible, but tries to anchor it to the subject. Realism on the other hand prefers to anchor sound knowledge to the object. It is especially in the nominalist approach, however, that the "eclipse" of the object emerges as a threat.

One of the consequences of the subject-object dilemma is a problem that both realism and nominalism experience, a problem that can be defined as *the incongruence between science and its object of study*. Though it is not the only consequence of the cartesian dilemma, it will be worthwhile to explore a bit further this incongruence and to notice its implications for the main theme of this article: the disappearance of the object. It is therefore advisable to have a look at what we can consider the historical roots of the incongruence problem. It should be noticed, once again, that it is especially in the nominalist version of this problem that the object of science is experienced as elusive.

7.2 Historical roots of an incongruence

In Plato's philosophy, ideas are attributed real existence, independent from the world of concrete realities. Science is thinking of the ideas, and each

idea is the universal model for many concrete realities corresponding to it. In what is referred to as the crisis of Plato's theory of ideas, Plato aims at affirming the logical unity of the ideas while at the same time he tries to approach concrete reality itself via the contemplation of the ideas. This was an attempt at solving the problem of incongruence between science and its object of study. In this phase Plato gradually introduces new members in the world of ideas, in order to account for those phenomena (in concrete reality) that had not yet been accounted for.[7] This attempt to solve the incongruence by adaptation, led Plato to a dead end.

Aristotle (1961:Z, 13-15) rightly reproached Plato for trying to create a duplication of reality in his world of ideas. For Aristotle science implies abstraction. The universal exists for Aristotle too, but not in a separate world of ideas. It is rather inherent in the single objects. Aristotle thus identifies reality and essence to a large extent. But what Aristotle's and Plato's solutions have in common is the assumption that the knowable, the universal, must resemble reality. Therefore they assign an entity-like character to the universals. This seems to remain the major difficulty of realism well into the 20th century.

Nominalism avoids assigning an entity-like character to universals and at the same time re-valuates the concrete, individual reality. The best contribution of nominalism and conceptualism probably lies in the importance they attribute to concrete reality, the re-valuation of the role of the individual and the unique, which is indeed neglected by the realist. Yet the problem of incongruence remains. In fact, the reality that we experience is mainly individual, but scientific knowledge does not aim at knowing individualities. It is rather knowledge aiming at the universal. While reality is individual and unique scientific knowledge of reality aims at giving an account of the universal dimensions of reality. Therefore, nominalism has no true solution to bridge the gap between the uniqueness of concrete reality and the universality which is the aim of scientific knowledge.

At this point, a typical nominalist "remedy" consists in introducing a similarity between individual and universal. Most point to similarities in

7 Initially Plato (1925: *Lysis* 219, c) mentions a limited range of ideas like the "good in itself", the "equal in itself" and so on. In *Parmenides* (Plato, 1969:130, c) Socrates is hesitant when Parmenides asks him whether there exist even an idea of a hair, of mud or of dirt. At this stage Plato does not provide an answer but acknowledges the problem. However in the *Republic,* Plato (1966:596, b ff.) distinguishes between a bed painted by an artist, a bed constructed by a carpenter and the bed provided by the creator: the "essential bed". In *Timaeus* (Plato, 1973:29, a-b) we learn that the *Demiourgos* has created the world in which we live as a copy of another world which is "identical and uniform", thus containing the ideas of everything that we know and experience.

reality itself, and they use terms like "kinds", "classes", "sets" and so on.[8] However, as these similarities remain within the individual character of reality, the problem of the incongruence between science and reality remains unsolved. And once such unsolved tension is created, it is not surprising that the object of science may be regarded as elusive.

Our "diagnosis" can be summarised as follows. On the background we have the cartesian duality, according to which either the subject or the object should constitute the *locus ordinis* of reality and knowledge. Though realism has its own problems and does not constitute an adequate solution, the "eclipse" of the object is caused especially by the nominalist strategy of grounding scientific knowledge in the human agent and stripping the object of its universal traits. In addition, the nominalist version of the incongruence between scientific knowledge and concrete reality contributes to the same phenomenon of the "eclipse" of the object. In the following sections a few resources are proposed in order to counteract the problem.

8. Reformational opinions: knowledge and the structural order

8.1 The universal order for reality

Van Riessen (1992:55) rightly suggests that the solution to the problem of incongruence between science and reality can only be found in the recognition of the universal order for creation, the "law", the structural order for reality. It is this order which constitutes the proper object of study of scientific investigation. The recognition of the law, in principle, solves the incongruence between reality and science. Scientific knowledge aims at the universal, at a law which is "valid for", which "obtains for". The universal order for reality is therefore the proper object of study of all scientific disciplines. Accordingly, the *task* of science is "to describe and explain, with the aid of theories, the regularities and scientific laws that typify phenomena in reality" (Botha, 1996:333). Stafleu (1987:152) argues in similar vein when saying: "we consider this aim to be the opening up of the law-side of nature, the discovery and development of law-conformity in reality". By anchoring scientific knowledge in the structural order for creation, theoretical thinking is also allowed to avoid the cartesian subject-object dilemma and is provided with a proper anchor of certainty. But is the structural order knowable?

8 For a detailed historical survey and deep systematic analysis of the discussion concerning natural kinds see Hacking (1991). Hacking presents the discussion for a nominalist point of view. A reply from a realist point of view is offered by Boyd (1991).

8.2 Knowing the universal and the individual

Realism has given priority to the knowledge of universality to the detriment of the knowledge of individuality. Nominalism and conceptualism have stressed the knowledge of individuality to the detriment of the knowledge of universals (which do not exist). Reformational philosophy has promoted the view that both individuality and universality are traits of everything that exists and are both knowable (e.g. Hart, 1984:72-83). Knowledge of the individuality and knowledge of universality are actually linked.

The link between theoretical and naive thinking (on the epistemological level), and the link between universality and individuality (on the ontological level), are to be considered at least as interesting resources that reformational philosophy has to offer as a potential framework to solve certain issues raised in modern philosophy of science. In this philosophical tradition universality and individuality are not regarded as entities but as traits of everything that exists (Hart, 1984:19). Knowledge of the universals is typical of scientific knowledge, while knowledge of individuality is typical of pre-scientific knowledge.

According to Dooyeweerd everyday experience is an experience of individualities. In naive thinking there is no abstraction of a particular aspect of our experience in order to make it a "gegenstand" of scientific thought (Dooyeweerd, 1984, I:34). In our naive experience we freely move through the ample variety of modal aspects, without concentrating on a specific one in particular. We rather deal with knowledge of individuality. Knowledge of individualities is therefore considered possible by reformational philosophy (Dooyeweerd, 1984, I:41).

On the other hand, according to Dooyeweerd (1984, I:18), science is characterised by the opposition between the logical aspect of our experience and the other aspects that constitute the field of study of a particular discipline. These aspects are abstracted from the cohesive relationship with the other modal aspects and thus become the object (gegenstand) of scientific enquiry (Dooyeweerd, 1984, I:38-39). Science therefore, according to Dooyeweerd, is characterised as thinking along modal lines, it requires abstraction and it aims at the universal. As the modal aspects correspond to modal laws, science explores the law and is therefore aimed at the universal and structural order for creation.[9]

9 This view of Dooyeweerd has undergone serious discussion by several reformational thinkers. For example, Hart (1985:150 ff.) points to several problems in Dooyeweerd's "gegenstand's" theory. Hart asks whether it is possible to suppose a structural difference between scientific and non-scientific thinking. Along this line of thinking it becomes difficult, according to Hart, to identify the "gegenstand" of philosophy. Philosophy is theoretical thinking, and therefore requires the theoretical dissociation

A similar perspective is developed by Hart. In his opinion "rational knowing" is about "our understanding of structures, our grasp of general patterns, our insight into laws, kinds and properties" (Hart, 1985:155). Stafleu too distinguishes between "artificial" (i.e. theoretical) thought and "natural" thinking (Stafleu, 1981:165). Although he would like to improve on the Dooyeweerdian view of theoretical thinking (1981:167), he acknowledges that "the logical objects of natural thought are concrete things, events and relations" (Stafleu, 1981:166). Theoretical thinking on the contrary is "abstracting thought, by forming concepts it focuses on a limited number of aspects of concrete things" (Stafleu, 1981:167).

Without entering into the complex meanderings of this discussion within reformational circles,[10] the previous few examples aim at demonstrating that knowing the universal side of reality is also considered possible by reformational philosophers. In the following section the author is going to discuss a few concrete factors allowing theoretical access to the structural order.

8.3 Accessing the structural order

Several reformational philosophers have tried to specify more in details the role of theories, abstraction, logical analysis and the metaphorical use of language. These attempts can also be regarded as accounting for the fact that the structural order is accessible to scientific investigation. Certainly they have not understood this accessibility in a positivist way. The knower is not simply placed into a rather direct and unproblematic contact with an object that can always be adequately represented. Reformational philosophy has taken into account the artificial character of theoretical thinking and the role of the knower in the cognitive act. Yet the object of science has not become inaccessible.

Botha (1984:59-64) calls for attention to the role of linguistic metaphors in constituting scientific theories. In her opinion there are several types of metaphors (e.g. literary or poetic metaphors). The ones that are constitutive of scientific theories function as speculative instruments providing a hypothetical focus or perspective illuminating an object that is

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of the modal aspects. Yet philosophy is presented by Dooyeweerd as dealing with the cohesion of the modal aspects, and even with the totality. One additional problem, according to Hart, is that Dooyeweerd gives the "gegenstand" a modal character in the first volume of his *magnum opus* (Dooyeweerd, 1984) but in the following volumes the gegenstand seems to be given a structural character. Similar critical arguments are developed by Geertsema (1995) and Strauss (1984).

10 See for example how Strauss, from an appreciative point of view, has recommended a few alterations for both the ontology of Hart (Strauss, 1989:103-120) and the epistemology of Stafleu. Strauss (1995:127-138) deals in particular with Stafleu's idea of theoretical analysis.

going to be scientifically examined (Botha, 1984:63). Such a metaphor represents a certain expectation concerning the structure of a certain aspect of reality. At the same time it helps shape "a certain frame of vision" (Botha, 1984:63-64). On the basis of this metaphor a theory is elaborated, the aim of which is "cutting the world at its joints"[11] (Botha, 1984:64). The latter is a logical act, but it is supported by a lingual theoretical network. These theory-constitutive metaphors, according to Botha, are based on a "root-metaphor" providing an overall view of reality. In this way she recognises the role of "religious"[12] perspectives in science, while at the same time affirming the role of the language in the accessing of the structural order for reality.

Theories, in her opinion, have the potential of partially disclosing the nature of reality. They do not provide descriptions, but metaphors that are nevertheless truthbearing. It is not possible to approach the structure of reality without linguistic supports like a conceptual frame of reference. Discoveries and new perspectives in science are not possible without metaphors or models. But the structures to which our language is accommodated exist quite independently of our conceptual schemes or theories. We do not construct the world when we adopt linguistic or theoretical frameworks. Botha disagrees on this point with Kuhn who insists that all we can know about the eventual "joints" of the world is our linguistic articulation of those joints (Kuhn, 1979:418).

Botha (1984:62) argues, on the contrary, that we accommodate our language to the structures of the world. Semantic changes are conditioned by more than semantic realities (Botha, 1986:85). Recognising these realities is essential and necessary to provide a framework for determining semantic conflation in scientific concept formation. In other words, to be able to recognise when our metaphors become myths (Botha, 1986:86). Botha (e.g. 1994:29) claims that in order to escape the relativistic dead-ends of postmodern philosophy of science, a new ontological model is

11 On this point, Botha's argumentation refers back to a previous dialogue between Boyd (1979) and Kuhn (1979).

12 When speaking about *religious* convictions or beliefs the author do not refer only to christianity or to the classical religions. It is possible to speak of the *religious* convictions of humanists, atheists, positivists, marxists and all those who "interpret" life in some way or the other (i.e. all human beings). Roy Clouser (1991:17) observes that in some religions there are no temples, in others no prayers, or no public gatherings, no "holy books" or even no god(s) (in the traditional meaning of the term). He mentions, as an example, the Pythagoreans and reports the text of an ancient "prayer to number ten" (Clouser 1991:17). On the other hand he observes that "a belief is religious provided that (1) it is a belief in something(s) or other as divine or (2) a belief concerning how humans come to stand in proper relation to the divine". Divine, according to Clouser should be defined as "having the status of not depending on anything else" (Clouser, 1991:22-23).

needed. In this context, she appreciates Hart's ontological proposals, which appropriates Vollenhoven's systematic distinctions in a fruitful way. Vollenhoven (1961:11) has pointed out with particular clarity the distinction between the universality of the law and the universal law-conformity of the entities that are correlated to the law. In order to be the type of individual entities that they are, they must relate to the law in a certain way.

Along this line, Hart points to the existence of structural conditions. In fact he claims that the universals themselves constitute such structural conditions. The universals, in his opinion (Hart, 1984:19; 72-73), shouldn't be interpreted as universal "entities" but as structural conditions that provide the basis for the irreducible primary relations in concrete reality (e.g. similarity and difference). As a consequence, they also provide the basis for linguistic predication and nomination.

Individuals, in order to be what they are, must relate to universals in a certain way. This points toward the existence of certain nomic conditions (Hart, 1984:35). Universals and individuals, says Hart (1984:83), are "both real, mutually irreducible and correlative". They are in fact "traits of the relationship between the nomic conditions (that hold universally for what exists) and the empirical individuals that are subjected to these conditions. Understanding what something is, is grasping in a concept what the (nomic) conditions for its existence are" (Hart, 1984:83). Concepts are therefore linguistic expressions of one's understanding of particular (individual) existents. We recognise them as belonging to a certain class or category on the basis of our own experiential knowledge. These conditions provide the basis for the general modes of experience that grant the possibility of both stability and the possibility of change.

9. Conclusion

This article started from the question: "why is the object of science disappearing"? From historical and systematic analysis we might acknowledge that both realists and nominalists have been searching for the law, the *locus ordinis*, for an anchor of certainty of scientific research. From a reformational point of view this search is legitimate and positive. Both realism and nominalism contain traits that should be accepted and appreciated (Coletto 2007:61, fn. 41). However, in both strategies a kind of displacement or misunderstanding takes place. As they both ignore the existence of a structural order for reality, the law is placed in (or confused with) the object by the realist, and placed in the subject by the nominalist. As a consequence, especially in the nominalist tradition (which dominates late-modern philosophy of science), the idea of an object of scientific research becomes problematic and vague and undergoes a kind of "eclipse".

Given its openness to the biblical background, it is not difficult to see why reformational philosophy would propose the idea of a law-order. But was it not possible for contemporary nominalist philosophers to conceive the hypothesis of a structural law-order for reality? And if so, another question may be: "why not?" These questions point towards the role of our deepest religious commitments. Van Riessen (1992:55), for example, says he is surprised that the nominalists (who were so closely associated with the developments of physics) did not consider exploring the idea of a universal order. After all, the knowledge of physics is expressed in laws. Why was this fact not sufficient to suggest the idea of a law-order?

Van Riessen considers a few possible answers. "But it seems to me", he concludes, "that recognition of a law or structure (...) would run counter to the subjectivist program, for which reality and the scientific, thinking subject were sufficient and heteronomy was rejected" (Van Riessen, 1992:55). According to Van Riessen, therefore, the most profound reason why late-modern nominalism did not consider the idea of a law-order, was linked to the necessity to preserve the idea of human autonomy. This required rejecting a law that is external to the human subject and seeking autonomy in the attempt of constituting the human being as creator and law-giver of his own world. The "eclipse of the object" is one of the problematic consequences of a philosophy of science of which the ultimate commitments and dialectical tensions need to be explored further.

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