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on

Bas van Fraassen's *Scientific Representation: Paradoxes of Perspective*²

*The Subject of Scientific Representation*³

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Scientific Representation: Paradoxes of Perspective is an extensive volume made up of four parts as well as four appendices. The first part is dedicated to a general reflection regarding what a representation is; the second offers an epistemological analysis of the problems connected to scientific observation with instruments and to the coordination of mathematical formalisms to experience, paying particular attention to measurement processes; the third part presents an in-depth historical and theoretical discussion on the various forms of structuralism in the philosophy of science; the fourth and final part discusses, instead, different ways of conceiving the relationship between 'appearance' and 'reality', as well as the pretence to obtain a criteria in order to explain how the appearances which we observe are produced starting from the *primitives* introduced by scientific theories.

Many aspects of this work are worthy of discussion: from the proposal for an empiricist structuralism, to the interpretation of experimental observation outlined in Chapter IV: an interpretation which, although it could be questioned, appears to be one of the most profound attempts to account for the possibilities of experience which have been opened up by modern technological instrumentation, in a way which is compatible with scientific antirealism.

As it is impossible to make an overall summary of this rich and composite volume, I would like to limit myself in such circumstances to propose a preliminary reconnaissance and summary of some of the ideas that the volume offers regarding the relationship between scientific representations and the conditions, experiences, knowledge and practices of the subjects that make use of them.

¹ Aldo Giorgio Gargani accepted with enthusiasm to participate in this debate on *Scientific Representation*. Unfortunately when he passed away on the 18th June 2009, he hadn't yet been able to let us have his text. The unbridgeable void that his absence leaves also in this small undertaking may be a tribute to the value of his presence [C.G.].

² B. C. van Fraassen, *Scientific Representation: Paradoxes of Perspective*, Oxford: Oxford University Press, 2008, 408 pp.

³ The cross-references in the body of the text refer to the volume under discussion. I thank Paolo Parrini for his reading over of a previous version of this text, of which I am solely responsible.

As already mentioned, in the first part of the book an ample analysis of the representation is developed. It would seem important to focus, above all, on two aspects (see in particular pp. 22-29).

[1] It is argued that the capacity of our constructs, abstract or concrete, to be valid as a 'representation' can never be understood by limiting ourselves to considering only their internal characteristics, or the mere properties that they would have independently of the context and the role which is assigned to them by someone. As such, an explanation on the matter will not be adequate if it does not take into consideration, for instance, the essential importance that the factors linked to use have, as well as the cognitive or manipulative practices and the aims that, in a given context, lead someone to use a particular artifact with the role of a 'representation' (selective and finalized) of this and that phenomena.

[2] At the same time, the book underlines that the affirmation according to which a given artifact 'represents' something would always be an abbreviated and unsaturated way to say that it 'represents something in that way'. This is because the representative relationship can never be had in an absolute or *simpliciter* way.

As such van Fraassen concludes that "*There is no representation except in the sense that some things are used, made, or taken, to represent some things as thus or so.*" (p. 23). Therefore, there would not be representations if it were not for the fact that intentional subjects assume, in a specific context, that a certain construct of theirs is adequate in order to represent something else in a certain way, for certain purposes, or in the context of certain practices. Not by chance, this work highlights how 'representations' can mean both a *product* as well as an *activity* (see p. 7).

We must then also say that this context of activity in which a representation really becomes what it is, is explicitly understood as having characteristics that are genuinely and irreducibly intentional (see p. 23). We therefore understand how in this light the role of the subjects has a central importance: subjects, who make use of the representations and that, more precisely, exactly in doing so give certain constructs the value as 'representations' of phenomena of their own experience. It is precisely for this reason, van Fraassen argues (see p. 24), that representations "*in nature*", that is to say entities that 'naturally', in themselves constitute representations of something else, will not exist.

Also the decisive process of *coordination*, that is, the process by which a system of abstract formalism is referred to physical objects and then assumes an empirical content, is considered possible and comprehensible only in relationship to a context characterized by specific conditions, procedures and finality. According to van Fraassen, indeed, this contextual (and indexical) restraint will play a central role:

- both as we tackle the most basic theoretical issues (see chap. XI) linked to the question: "*How can an abstract entity, such as a mathematical structure, represent something that is not abstract, something in nature?*" (p. 240);
- and when considering the problem of coordination more specifically in terms of institution of a particular coordination between certain theoretical structures and certain phenomena (see chap. V).

In the latter case, for example, it is only within a framework in which coordinated links, experimental apparatus and procedures are *already* present, that even choices regarding the correlation and identification (within the theory) between certain properties and certain parameters would become possible and auspicious (see p. 137). It would instead be illusive, according to van Fraassen, to expect to resolve the problem of coordination in absolute terms, by looking for justifications in 'natural' and a-historical correlations between certain physical objects and certain abstract structures (see pp. 121-123).

Therefore, an understanding of the process that we are interested in can only be obtained by moving from the idea of having a 2-place relationship between models and phenomena, to a 3-place relationship that includes also the person who makes use of such formal models (see pp. 253, 258).

"*The crucial role of use and practice*" (p. 189), then, emerges and is explicitly recognized as the *leitmotiv* that brings together the considerations developed on the different aspects of scientific modeling.

It is noteworthy how this '*pragmatic turn*' which van Fraassen articulates in relationship to the scientific representation seems to have at least some affinity with that which, over the past decades, he has defended in the field of the theories of scientific explanation. van Fraassen had indeed proposed to interpret the explanation not as a mere dyadic relationship between a theory and facts, but rather as "*a three-term relation, between theory, fact, and context*",⁴ namely always as something which is linked to the demand, to the finality and to the interests of men.

The first reviewers have, however, also pointed out a possible tension between the classic formulation of the "*constructive empiricism*" of van Fraassen in semantic terms, such as 'truth' and 'empirical adequacy', and this work which emphasizes the dimension of the use of 'models' and 'representations', based on different notions.⁵ At the same time, it is possible that the author doesn't really intend to take leave of the previous formulations (which are still used by him in order to outline his very "*stance*", see pp. 3, 87, 250, 309-311), but rather to enrich, and in a certain sense reinterpret them, with particular attention "*from within*" especially regarding the contextual and pragmatic aspects.⁶ Aspects which are indeed essential in order to apply those models that the theory proposes as accurate representations of certain phenomena to whom accept the theory as "*empirically adequate*" (and therefore as 'true' if it regards only observables). But the effective composition of these two sides is a question worthy of further analysis.

⁴ B. van Fraassen, *The Scientific Image*, Oxford: Oxford University Press, 1980, p. 156; see: Id., "The Pragmatics of Explanation", *American Philosophical Quarterly*, 14 (1977), pp. 143-150.

⁵ See: R. Giere, "Essay Review: Scientific Representation and Empiricist Structuralism", *Philosophy of Science*, 76 (2009), pp. 107-108; G. Contessa, "Review of Bas van Fraassen's *Scientific Representation: Paradoxes of Perspective* (OUP 2008)", *Notre Dame Philosophical Reviews*, 30-3-2009 (on-line).

⁶ On the theme of 'truth' see also: B. van Fraassen, "Replies", in: A. Berg-Hildebrand-Ch. Suhm (eds.), *Bas C. van Fraassen. The Fortunes of Empiricism*, Frankfurt: ontos verlag, 2006, § 5.

In any case, the existence of representations can be linked in another sense to the activities and to the context of the subjects. Indeed, van Fraassen claims, in order for an artifact to be used as a representation of empirical phenomena by a subject, the subject has also to complete the given construct with the knowledge that such a construct cannot on its own already include, yet which is essential to its very functioning. In particular (see chap. III and XI), in order for a scientific model to be used the addition of “*indexical*” knowledge would seem to be necessitated: knowledge that the users of that model cannot find within it.

What is intended by this is that a necessary “*condition of possibility of use*” (p. 257) for a scientific model is that this model is completed by the subjects who use it with knowledge regarding their own setting, the perspective and ‘the orientation’ that they have. In more general terms it is, therefore, necessary to situate oneself in relationship to a scientific model, so that it may be successfully referred to our world and not remain a sort of mute map: “*For to use a theory or model, to base predictions on it, we have to locate ourselves with respect to it (...) When using a model to find our way around in the world we have to be able to say, for example, that the phenomenon we are presently witnessing is classified in the theory as oxidizing, or as phlogiston escape, or the like. We have to locate our situation in the theory's logical space, in a way that is similar to our 'We are here' with respect to a map.*” (p. 261).

We could certainly, for example, decide to create a meta-model which, in an opportune working context, would also allow us to describe the collocation of the subject in the region modeled by the representation that is used by it. But this will as such make necessary another act of *self-location* by the user in respect to the meta-model so constructed (see p. 79).⁷

The first relevant aspect of these considerations is that the perspective that van Fraassen begins to highlight with such an approach deliberately clashes with the thesis that the scientific representation of the world could constitute a “*view from nowhere*” (Thomas Nagel). In fact it is affirmed that, if also the theoretical models used by scientific theories can be in themselves independent of every observer and of every situated determination, the things will change when we wish to make practical use of them in order to take into account the phenomena of our experience: “*The physical world picture in abstracto is as far removed as possible from this use, it embodies, in Eddington's words, "the view of no one in particular". But to put this picture to use, something must be done by the user, and this is where choice of reference frames comes in. Hence Weyl's words are equally apt when he refers to coordinate systems as 'the unavoidable residuum of the ego's annihilation'.*” (p. 71, see p. 87).

⁷ van Fraassen also links (pp. 78-80) this point to ideas developed by Kant from the essay *Concerning the ultimate ground of the differentiation of directions in space*. It is not possible to discuss these parallels here. I will limit myself to adding that Alfred Schutz referred to the analogy of the map in order to analyze the use of knowledge concerning the social world in: “*The Stranger: An Essay in Social Psychology*”, *American Journal of Sociology*, 49 (1944), pp. 499-507.

These observations can also be directly connected to a second question. Indeed, what would appear to emerge here is how we always need *“something in addition to what science has given us”* (p. 83), namely how, precisely in order to effectively coordinate in practice scientific models to phenomena, we must always add some extra *knowledge* respect to that which they themselves can give us. In this case, it will be real knowledge concerning our positioning. And, van Fraassen adds, whatever interpretation we give of such information we will find ourselves in front of a problem of relevant epistemological interest: *“if we say that the self-ascription is a simple, objective statement of fact, then science is inevitably doomed to be objectively incomplete. If instead we say it is something irreducibly subjective, then we have also admitted a limit to objectivity, we have let subjectivity into science.”* (p. 83).

In other words, the approach of van Fraassen reminds us that our use of any scientific representation of the world (no matter how evolved it is) would appear to have certain insurmountable epistemic preconditions that it could never incorporate, if not by creating the need for other analogous preconditions on which to base itself. Freely paraphrasing the noted and highly discussed political-judicial *Diktum* of Ernst-Wolfgang Böckenförde, it would mean that *mature scientific knowledge is based on epistemic preconditions, which it can't guarantee itself.*

It is worth dwelling a little more upon the questions of the completeness and incompleteness of scientific knowledge and upon the relationship between subjective and objective therein. This theme is indeed proposed on several occasions by van Fraassen with the question: *“Is there something that I could know to be the case, and which is not expressed by a proposition that could be part of some scientific theory?”* (pp. 210 and 261).

As already mentioned, for van Fraassen the answer is that this something does exist, and it is the knowledge concerning our position in respect to the map-model, expressed by *“indexical propositions”*. At the same time, however, plausibly this is not a question of thinking that information like that relative to our position is, as far as its content is concerned, of a special kind, or that it has such a nature so as to exceed by itself the cognitive possibilities of scientific knowledge. van Fraassen himself recognizes how in fact this gap *“implies no relevant incompleteness in the theory or model itself”* (p. 261). That is to say, that this does not imply that scientific theories are, for this reason only, lacking in the representation of some types of phenomenon that it should contain: like a road map is not in itself lacking because it cannot furnish its user with enough information concerning his position. Simply the fact is that it is always necessary to presume an act of extra-scientific self-location in order to avoid an endless regression. But, in itself, the fact of the location of a subject in a certain space is something that a scientific model is able to express, once that it has been coordinated to the phenomena of our experience.

We could, however, also ask ourselves if there are not more radical and relevant forms of incompleteness of scientific-experimental knowledge. That is to say, if there aren't types of facts that are indeed both knowable, but at the same time cannot and neither could belong to the number of facts described and explained by scientific knowledge: not even when scientific knowledge

has been developed and coordinated with experience. We ask ourselves, that is, if knowledge does not exist that, for the type of content it has, cannot find an equivalent formulation in terms of the type of vocabulary that does belong to the experimental sciences of nature.

As is well known, this regards a question which had a very important role in the epistemology of the XX century and then especially in the recent philosophy of mind. Our intention here is not to enter into questions regarding the philosophy of mind (even if in van Fraassen's book interesting references are made to this, precisely regarding this point: see pp. 210-212 and 292-297). We will limit ourselves to pointing out how the perspective on science that van Fraassen outlines, here and in other works of his, may contribute to a significant transformation in respect to the most common ways for considering this topic nowadays. This is also to say that, if the questions that he tackles rarely necessitate considerations concerning the philosophy of mind, it seems however that, implicitly, they can have an impact upon it (and, in this sense a significant possibility, which still needs to be developed, remains: that of articulating a philosophy of mind in the light of an anti-realist understanding of the scientific undertaking, like that of van Fraassen). We could have an initial confirmation of this, by returning to the question that has been brought up above.

At the basis of the belief by which all of our effective knowledge could be part of a scientific-experimental type of knowledge there are often epistemological presuppositions that are not always discussed in an explicit way. Indeed, the thesis by which all of our knowledge would be or could be reduced to a scientific type of knowledge is not based on the exhibition of an exhaustive and self-sufficient scientific knowledge that has *already* been attained. Or, in an even more limited way, it is not based on the fact that all the non-scientific knowledge concerning a certain field (the conscious mind, for instance) can *already* be expressed in an equivalent scientific version. Rather, as has frequently been pointed out, the sustainers of this generally tend to link such a thesis to programmatic and controversial convictions, according to which the belief that science can, at least "*in principle*",⁸ arrive at providing us with a true and all-inclusive account in all fields would be intrinsic to the very logic of scientific knowledge, or connected to the only vision of reality which is compatible with what science teaches us. It is from this perspective, that it has been possible (let's consider, for example, the so-called 'eliminativism' à la Churchland) even to arrive at assuming that either all of that which we judge to be non-scientific knowledge will end up by being absorbed by science itself, or, far from declaring science to be incomplete, we would rather have to recognize that which we considered as non-scientific knowledge, to be fallacious beliefs: and as such, if irreducible, irreducible because radically unfounded.

Now, concerning this position, van Fraassen consciously develops a perspective somewhat different regarding the aims and the nature of experimental science: a perspective that leads, as such, also to different and more plausible expectations. Indeed, for example:

⁸ The reflection on the problematic questions connected to this clause has been promoted by amongst others: T. Crane-D. H. Mellor, "There is No Question of Physicalism", *Mind*, 99 (1990), § 2.

-the idea is abandoned that the adequate understanding of the process of scientific representation of the world (as well as the *effective* accumulation of empirical success throughout the history of science⁹) makes it necessary (or desirable), *in general terms*, to assume that one among the possible theoretical alternatives in a certain phase constitutes “*the one true story of the world*” (p. 48). We may notice, rather, how every generation ends up effectively evaluating the scientific image that it inherits as “*open, vague, ambiguous*” (p. 47);

-the pretence is abandoned that experimental science must establish its own dominion of primitives entities, that would be the only ‘real’, and then demonstrate how all the inter-subjective ‘appearances’ (the secondary qualities which we experience), are deducible from the knowledge and the principles concerning them (see, above all, chapt. XIII);

-the conviction is abandoned that we can look at scientific models of our world (as much in their origin, as in their use) as if they were non-situated and non-contextualized descriptions and explanations, which refer adequately to the world by virtue of an objective and intrinsic relationship with some of its phenomenon (see especially part I);

-the thesis is abandoned by which certain technological instrumentations belonging to experimental enquiries would *necessarily* need to be understood as opening a “*window*” on the world not directly observable for us, and their outcomes would *necessarily* be understood as mimetic reproductions (see chap. IV).

The perspective that in such a way begins to be sketched out can as such usefully contribute to defusing the risk of a generalized “*clash*” between “*the manifest image*” and “*the scientific image of man in the world*”.¹⁰ This is a risk, which after all, is linked to the inappropriate pretence to be able to achieve, and to achieve in all fields, a *scientific-experimental* description and explanation that is true, objective, self-sufficient and exhaustive of our knowledge. On the contrary, on the horizon that the reflections of van Fraassen outline, we can indeed understand more easily also how there can be effective knowledge, which, due to its content, cannot, however, be expressed by a scientific theory (or meta-theory), and as such leads to the emergence of a truly “*relevant incompleteness*” of scientific theories.

Naturally van Fraassen’s approach, like also the more general philosophical framework in the context of which it is inserted (even though it does not depend on this in all of its parts), brings several questions to the surface, as well as the need to examine this more closely. I mention, amongst other things, the conspicuous “*common sense realism*” (p. 3) that van Fraassen adopts regarding the *observables*.¹¹ That is that a non-corrective attitude is

⁹ See on this point: B. van Fraassen, “Structure its Shadow and Substance”, *The British Journal for the Philosophy of Science*, 57 (2006), § 4.

¹⁰ See: W. Sellars, “Philosophy and the Scientific Image of Man”, in: Id, *Science, Perception and Reality*, London: Routledge, 1963, pp. 1-40.

¹¹ On this topic see also: E. McMullin, “van Fraassen's Unappreciated Realism”, with the rejoinder: B. van Fraassen, “On McMullin’s Appreciation of Realism Concerning the Sciences”, *Philosophy of Science*, 70 (2003), pp. 455-478, and 479-492.

assumed regarding our way of categorizing and referring to what is perceivable for us, an attitude according to which: “*reference to observable phenomena is unproblematic: rocks, seas, stars, persons, bicycles...*” (p. 3). We can ask ourselves, however, if we could not express with a less onerous and anti-revisionist formulation all of such an epistemic option (epistemic and *not* ontological) that is of importance for van Fraassen's discourse on science. In any case, also this aspect, however it is evaluated, contributes to the bringing about of one of the main characteristics of the entire proposal of van Fraassen: the idea according to which our scientific models and our *scientific-experimental* theories do not really have as their aim to go beyond the phenomena and they cannot be made completely independent of the constitutive capacities, effective practices, contexts and the finalities of the subjects who create them. In other words, we could say that we are reminded here that the experimental science of nature reveals itself as knowledge “*with a human face*”.

As is well known, Hilary Putnam has characterized his own position, referring to precisely this metaphor, as a “*Realism with a Human Face*”.¹² For van Fraassen we could, therefore, perhaps speak of a (scientific) *antirealism* “*with a Human Face*”. And not only in order to design an epistemic perspective that is faithful to the original human aspirations which it intended to achieve (instead of changing completely into its opposite), but rather in order to underline how, from this perspective, scientific-experimental knowledge cannot ever presume neither to completely encompass the human point-of-view which creates it, nor to free itself completely from it. And indeed, precisely this, far from making science arbitrary, guarantees it the possible objectivity (intended as “*maximal intersubjectivity*” p. 266).

Perhaps, therefore, the words of Wittgenstein are apt here when he notes: “*A curious analogy could be based on the fact that even the hugest telescope has to have an eye-piece no larger than the human eye*”.¹³

(Translated from the Italian by Emily C. Fullwood)

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¹² H. Putnam, “Realism with a Human Face”, in Id., *Realism with a Human Face*, edited and introduced by J. Conant, Cambridge-London: Harvard University Press, 1990, pp. 3-29, see: p. XV.

¹³ L. Wittgenstein, *Vermischte Bemerkungen – Culture and Value*, ed. by G. H. von Wright, Oxford: Blackwell, 1980², p. 17.