

## VAN FRAASSEN'S LONG JOURNEY FROM ISOMORPHISM TO USE

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Bas Van Fraassen, *Scientific Representation*, Oxford: Oxford University Press, 2008. Pp. Xiv + 408.

*Scientific Representation* is the latest stage in Bas Van Fraassen's sustained and profound defence of empiricism against scientific realism over the years. It is a long and demanding book. It aims to give an account of how science represents reality, and is comprised of four parts, discussing the nature of representation, measurement, structure and perspective, and the relation of appearance to reality. The book's key message could be lost in the otherwise engaging and interesting details (many of which relate to quantum mechanics but there is unfortunately not enough space to discuss them here). It may be summarised as follows: 'constructive empiricism' – the antirealist view first defended in the celebrated *The Scientific Image* (1980) – needs to be modified in some substantial ways to make room for an appropriate notion of representation. The modification yields 'empiricist structuralism' or, as I shall call it, 'structural empiricism'.

The shift is meant to preserve the central epistemic commitments of the old view while bringing in some new advantages. Van Fraassen provides reasons for the change; and he offers arguments for the new position. But like any shift this is a gamble. If the reasons for change are convincing but the arguments for the alternative are not, we end up in no man's land. Or in someone else's land. I think we end up in the land of pragmatism.

A good way to express the reasons for change is by reference to an old paper of mine discussed critically in what appear to be two key passages of the book (Van Fraassen 2008: 25-26 and 247-250). Since I don't think my views are described or identified correctly, perhaps some extensive discussion and self-quotation will be forgiven in the first part of the review. The second part critically reviews the arguments for structural empiricism. In the third and final part a more positive assessment is provided which hopefully will make it clear that I think *Scientific Representation* is nonetheless a very good book. Its main merit is to point towards a thoroughly pragmatist conception of science.

### 1. Moving away from 'constructive empiricism'

There is a standard line on constructive empiricism that we all have been taught and go on to teach our students. It takes as central a commitment to the aim of science, encapsulated in the famous slogan: *Science aims to give us theories which are empirically adequate, and acceptance of a theory involves as belief only that it is empirically adequate.* The definition of empirical adequacy then enables us to extract out of the slogan the nuanced and rich position that is constructive empiricism. As is well known Van Fraassen takes the empirical adequacy of a theory to crucially turn on a

distinction between observable and unobservable domains of the world. The theory is true if it literally describes the world accurately; and it is empirically adequate if it describes the observable part of the world accurately. Hence a false theory may be empirically adequate; and the commitments of realism and constructive empiricism come apart.

Of course we must remind ourselves all along that the language of ‘truth’, ‘description’, and ‘says’ is, taken literally, fundamentally inappropriate. It is a *façon de parler*, inherited from a syntactic, or language based, view of theories. On the appropriate semantic conception, a theory is rather a set of mathematical structures: “*To present a theory is to specify a family of structures, its models; and secondly, to specify certain parts of those models (the empirical substructures) as candidates for the direct representation of observable phenomena.*” (Van Fraassen 1980: 64). We may then say that the theory is *true* if it is isomorphic to the world, and *empirically adequate* if some of its substructures are isomorphic to the observable part of the world. *Truth* and *empirical adequacy* are then structural surrogates of the linguistic ‘truth’ and ‘empirical adequacy’.

So, what is the problem then? It turns out that this conception of a theory’s truth and empirical adequacy is in tension with a proper account of scientific representation. The not-so-often-quoted sentence right after the passage above reads as follows: “*The structures which can be described in experimental and measurement reports we call appearances; the theory is empirically adequate if it has some model such that all appearances are isomorphic to empirical substructures of that model*”. This sentence leaves little doubt that the empirical adequacy of a theory is to be understood as the isomorphism of the phenomenological and the empirical substructures of the theory (Suárez 2005). In conjunction with the previous quote it seems to render the view that scientific representation *is* isomorphism; and that constructive empiricism stipulates that the acceptance of a theory implies the belief that the theory structurally embeds, i.e. represents, the observable phenomena.

It is not surprising then to find Van Fraassen’s commentators and critics over the years assuming that his version of the semantic conception requires an isomorphism conception of scientific representation. Among the commentators I include my own (Suárez 1999), which might have unfortunately started the trend. At least it led Steven French (French 2003) to respond by arguing for isomorphism as a necessary and sufficient condition on representation in general. *Scientific Representation* makes it clear however that this is not Van Fraassen’s considered view. Rather he agrees that representation is not definable by means of any necessary or sufficient conditions: it is not the sort of notion that stands in need of any theory. Instead representation is linked to *use*; the *hauptsatz* is: “*there is no representation except in the sense that some things are used, made, or taken, to represent some things as thus or so*” (Van Fraassen 2008: 23).

But the recognition of the fundamental role of use in scientific representation poses problems for constructive empiricism – which I flagged over a decade ago. Unfortunately Van Fraassen seems to have misunderstood what I wrote then (although he clearly recognises the tension). He writes: “*In a comment on similar “intentional” views of what*

*constitutes representation, Mauricio Suarez suggests that it will hamstring the idea that theories represent*” (Van Fraassen 2008: 26). And he then quotes the following sentence: “*on the intentional conception of representation a theory cannot ‘represent’ a phenomenon that hasn’t yet been observed*” (Suarez 1999: 81). But the extract has been taken out of context. Far from criticizing ‘intended use”, my paper set out explicitly to critique what I took to be the received understanding of Van Fraassen’s conception of representation as isomorphism – and I argued against it precisely by showing it to ignore intended use!

My own view is of course that representation is essentially linked to representational use, and I have always accepted the *hauptsatz* above. (Even though the *hauptsatz* is really very thin and provides little in the way of understanding the relevant practices). This is precisely the sense in which theories do not always represent – their representational uses are not built in. The claim Van Fraassen ascribes to me in no way follows from this. An ‘intended use’ conception does not hamstring the idea that theories represent at all. It rather shows that theories sometimes represent, and sometimes don’t, and whether they do or not depends on *nothing other than use*. In particular it does not depend on isomorphism. (In criticizing isomorphism, partial isomorphism, etc., I took myself to be working in the tradition of Goodman. It is a cruel irony of life that Van Fraassen (2008: 349, n. 1) appears to ascribe the application of Goodman’s exemplification to the assessment of the accuracy of scientific representation to - of all people - Steven French!)

The misunderstanding might have its source in a conflation of ‘intentionality’ and ‘intended use’ conceptions of representation. From the start I set out to defend an intended use conception: Velazquez’s *portrait of Innocent X* and Picasso’s *Guernica* are explicitly advanced to illustrate that *use* is the key to establish representational contents or targets in general. As a reaction to a draft of my paper Bas sent me a draft of the paper that eventually appeared as his (Van Fraassen 2000), which continues his (Van Fraassen 1994) development of an intentional conception. Since this view is also at least *prima facie* incompatible with the reduction to isomorphism, the difference between ‘intended use’ and ‘intentional’ in general did not matter to my purpose then – which was to criticise and reject the reduction to isomorphism. So in the rejoinder I wrote in response ‘intended use’ and ‘intentional’ were run together. Later on I did make clear that the differences do matter for the appropriate conception of representation (Suárez 2003). Chapter 2 of *Scientific Representation* is to my knowledge Van Fraassen’s first attempt to disentangle these two different views. Despite of some residual hesitations on pp. 26-29, he also seems to be ultimately inclined towards an intended use conception.

I realise this is indulging in some self-referential score-keeping, so let us quickly take stock before we move on. I once made the following claim: “*there is tension between an intentional notion of representation and Van Fraassen’s constructive empiricism*” (Suárez 1999: 81). With the appropriate caveat to read ‘intentional’ as ‘intended use’, I continue to endorse it. It actually nicely summarises the main reasons that have moved Van Fraassen towards “structural empiricism”.

## 2. The arguments for 'structural empiricism'

The most original material in *Scientific Representation* is contained in part II, which reveals great attention to the practices of measurement and instrumentation. Many years ago the Stanford school urged philosophers to turn towards an experimental philosophy of science. Some of us embraced the call, while others resisted. The *résistance* often presented Van Fraassen as a leading theory-monger, and employed him as a banner for the entire movement. This no longer seems credible: *Scientific Representation* is a turning point for admirably taking stock of the literature on instrumentation and experimentation of the last two decades. The autonomy of the experimental sciences is fundamentally taken to heart, which is a wonderful development for at least two reasons. First, it is refreshing to find a senior and distinguished figure in the field taking honest stock of a distinct and even contrary tradition. Second, constructive empiricism suffered from lack of detail in the experimental side of the theory-experiment dichotomy that it promoted; and this was undermining it in the contemporary context of new experimentalism.

The most outstanding outcome of this encounter with experimentalism is a new distinction between the observable *phenomena* and the *appearances*, which comes to the fore in Part IV of the book. The introduction of a 3-layer model (theory-phenomena-appearances) is motivated by both the autonomy of experiment and the use-based conception of representation. The observable phenomena underlies (and presumably causes) the appearances (Van Fraassen of course refrains from using any causal language). These are the outcomes of measurement procedures, recorded in various data-models, and routinely employed to represent the phenomena. But the representation at this level can not be isomorphism – since while the data models are mathematical structures, the phenomena are real entities and processes in the physical world. Rather the appearances represent the phenomena in the prescribed use-based sense of representation – in the given context and for the purposes required. No proofs of isomorphism or similarity are needed: it just makes no sense for users of the data model to deny that the model represents the phenomenon – since the claim is built into their very use (Van Fraassen 2008: 250-261). The theory is then empirically adequate if it embeds the *appearances* – and this no longer carries the implication that a substructure of the theory must be shown to be isomorphic to the *phenomena*. 'Saving the phenomena' has turned into 'embedding the appearances that represent the phenomena'. The adoption of the 3-layer model – and consequent rejection of the theory-phenomena dichotomy – turns constructive empiricism into structural empiricism.

The rest of the book is a defence of structural empiricism against i) objections to structuralism in general (part III), and ii) the requirement that the phenomena ought to productively explain the appearances (part IV). While I have some sympathy with the rebuttal of ii), the arguments in part III don't strike me as successful. Van Fraassen points out similarities between Newman's argument against Russell's structuralism, and Putnam's model theoretic argument against metaphysical realism. Roughly, both Newman and Putnam show that the statement of isomorphism between theory and world picks out nothing but the cardinality of the domains. Van Fraassen's resolution to the

problem resembles Goodman's solution of the 'new riddle' of induction in that it appeals to entrenched facts of our linguistic practice – in particular the inevitable use of indexicals within a familiar language in setting up the right coordination or correspondences between theory and world. Goodman's 'entrenchment' move has been considered 'ad hoc' or circular as a *justification* of induction. Similarly critics of structuralism might be inclined to point out that Van Fraassen's move is ad hoc or circular as a justification of structuralism. It can not ground structuralism as the correct account of our theoretical knowledge of the world – whether in its realist or empiricist variety.

One way to defend Goodman's argument is to point to the impossibility of any ultimate justification of induction. Instead 'entrenchment' must be understood as *vindication* of the use of induction in practice. But this is of course a surreptitious rejection of pure induction – for it assumes that all inductive reasoning presupposes some basic non-inductive practical knowledge of the rules that inform inquiry. Similarly Van Fraassen's 'solution' of Newman's objection and Putnam's argument may be seen to surreptitiously abandon structuralism in either the empiricist or realist varieties. Once again the key lies instead in the features of the underlying practice of representation users. But such features, however indispensable in the production and acquisition of knowledge, are not structural but social.

### 3. Towards Pragmatism

There is increasing consensus in the literature that representation may not be naturalised, reduced or defined, as either a property of the objects that stand in the representational relation, or a property of the intentionality of the agents that employ it. Instead representation is grounded upon the representational uses of particular communities, and no further reduction seems available or required.

This is all very welcome (it is music to the ears of an inferentialist like me!), but it might at first seem to contradict the semantic conception of scientific theories. Van Fraassen argues successfully that this is not the case (2008, Appendix to chapter 1: 309-11), and his argument can be strengthened further. The semantic conception is a view about the objects that are scientific theories. By itself it says nothing about the nature of representation, which is instead best thought of as an activity. The object – the theory - is at best the product of the activity – representation. But to characterize the activity by means of its product would commit a category mistake, and fallacies would ensue. More precisely, it would entail the fallacy that every feature of an activity must have a correlate in its product, or vice-versa. And this is fallacious for any activity we know, whether or not productive in the required sense. Some activities simply lack the products to carry out the process-product correlation (e.g. riding a bicycle, playing tennis). And those that are productive in the required sense invariably violate the process-product correlation requirement (e.g. pottery, painting, cooking). The view that the semantic conception of theories entails a particular view of representation commits the same category mistake.

Notice that the argument above turns on accepting a broadly intended use conception that grounds representation in the social world. On this view representation is an *activity* carried out by a community engaged in a collective social practice – and the underlying norms of the practice determine representational sources and targets. An *intentionality* conception, by contrast, takes it that sources and targets are determined by some intentional state of some particular agent or agents, regardless of community, practice, and indeed any intended or unintended uses. On such view, which has its origins in the writings of Brentano and infuses the phenomenological tradition, representation is necessarily the property of individuals: representation is ‘in the head’. The turn from ‘intentionality’ to ‘intended use’ views is thus the first step towards a thoroughly pragmatist and social conception of scientific representation and knowledge that leaves conventional empiricism, structuralism and realism all behind. *Scientific Representation* is useful book that reorients the debate in the right direction, but much work still remains to be done.

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