

OBSERVATION IN CONSTRUCTIVE EMPIRICISM: ARBITRARY OR INCOHERENT?

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1. Introduction

We see often enough how by positing unobservable entities scientists are able to explain the behavior and characteristics of phenomena that would otherwise be inexplicable: Why does the Sun shine?; why is the sky on a clear day light-blue rather than any other color?; why does ice float on water?; why do children often resemble their parents? Scientists respond to these questions with "explanations" which, according to the position known as "Realism", aim to give us a true description of what the world is like, with the result that acceptance of an explanation by a realist involves the belief that it is true.

Explanations are about the most intellectually prestigious products of science, and yet the historical record is somewhat ambiguous about their significance. On the other hand, the search for explanations has a long and distinguished tradition in science. Yet, it is the case that many scientific explanations have turned out to be dramatically wrong, no matter how well established people thought they were in the past.

Kepler's explanation of his "Second Law" of planetary motion (that planets in their orbit around the Sun

sweep out equal areas in equal times) is a case in point. Resorting to Aristotelian physics, Kepler reasoned that the speed of a planet should be proportional to the force pushing it in the direction of its motion. He further reasoned that the natural origin of this force had to be the Sun, which in turn led him to propose that planets must be driven around their orbits by a force emanating from that center. And Kepler was confident that the strength of the solar force on a planet had to be inversely proportional to the planet's distance from the Sun, for—he thought—it was bound to be caused by an emanation spreading out uniformly on the plane of the orbits, making this emanation something evenly distributed over every circle around the Sun, with the total emanation per circumference acting as a constant of motion for all the relevant circles. With a stroke of genius, Kepler saw that from these considerations one could indeed derive his second law.

The problem with the above explanation is, of course, that the remarkable views about the world on which it is based are practically all wrong! And the critics of Realism are prone to point out that Kepler's case is not an oddity in the history of science, but pretty much the rule with regard to many past explanations. Because of this circumstance, side by side with Realism an antagonist position, Anti-Realism, has also enjoyed a long tradition in the philosophical commentary of science. Indeed, pessimism about the scope of modern science is not new. Already before the end of the 17th century, Locke expressed famous doubts about what we now call the physical sciences, not so much because he doubted that physical processes did ultimately depend on the motions of some forms of "atoms", but because he severely doubted whether either those atoms or their motions could ever be known by us. At a deeper level still, in

Book IV of the *Essay* we find Locke pondering over how the “piece-meal” approach, which was revealing itself so crucial to the new science, presented a problem in that the scientific description of things had to proceed, from a certain point onwards, “as if” they were isolated from the rest of the universe, even though we do not know how many properties of things may be due to their relations with other things.

Locke’s case is only one early (and modest) example of “anti-realist feeling” with respect to modern science. To the pessimism characteristic of British Empiricism in the 18th century, one could add the anti-realism of 19th century Positivism, 19th century idealism, as well as the different forms of anti-realism or non-realism characteristic of so much in 20th century philosophy.

Today, the problems concerning the interpretation of science are as intense as ever, as the case of our most fundamental theory of matter, quantum mechanics, exemplifies so well, with its bizarre mixture of unprecedented practical success and equally unprecedented conceptual paradox. Admittedly, Realism is still pretty much the staple ideology of most practicing natural scientists (except, perhaps, among some physicists), while Anti-Realism is more common among philosophers and sociologists than among scientists.

2. Constructive Empiricism

In our time Anti-Realism has an unusually blithe spirit on its side, Bas Van Fraassen, whose provocative views on observation are the subject of this paper. These views lie at the heart of a more general philosophy, Constructive Empiricism [CE], which Van Fraassen summarizes thus *The Scientific Image* [SI]:

Science aims to give us theories which are empirically adequate;

and acceptance of a theory involves as belief only that it is empirically adequate [SI, 12].

Van Fraassen's central claim on the question of observation is that whereas appropriate epistemic warrant may exist for what a theory says about observable things, none is available for its claims about what is unobservable.

...the only belief involved in accepting a scientific theory is belief that it is empirically adequate: all that is *both actual and* observable finds a place in some model of the theory. So far as empirical adequacy is concerned, the theory would be just as good if there existed nothing at all that was either unobservable or not actual [SI, 197].

As we see, Van Fraassen's position is close to the old empiricist thesis according to which we have no warrant (or need) to believe what theories tell about the unobservable. Yet his arguments in [SI] make it clear from the start that he is no ordinary empiricist. Of particular interest is Van Fraassen's explicit rejection of the foundation stone of old empiricism, the "doctrine of the given":

To find the limits of what is observable in the world described by theory T we must inquire into T itself, and the theories used as auxiliaries in the testing and application of T [SI, 57].

Nor is Van Fraassen a common instrumentalist, for he does not deny that theories may be true. On the contrary,

...on a literal construal [of the language of science], the apparent statements of science really are statements, *capable of* being true or false [SI, 10]

But then, if CE is neither a form of instrumentalism nor involves a theory of the given, why so much fuss about what is or is not perceptually observable? Accord-

ing to CE claims about the unobservable are capable of being true or false, but —adds Van Fraassen— theories need not be true to be good. Furthermore, he suggests, the question of their truth is an irrelevancy, for not only we have no warrant to believe what theories tell us about the unobservable, we simply have no need to do so:

After deciding that the language of science must be literally understood, we can still say that there is no need to believe good theories to be true, nor to believe *ipso facto* that the entities they postulate are real [SI, 11–12].

Van Fraassen's project is as noble as it is heroic. At first sight CE even looks like the fertile and liberal post-positivist empiricism many of us are waiting for, that is, a philosophy powerful enough to deliver the combined "goods" of old realism and old empiricism without any of the philosophical difficulties traditionally associated with either.

Theory and Observation

But, can CE really deliver the goods it promises so eloquently? In the first third of [SI] it becomes apparent that CE depends on a strange restatement of the theory/observation distinction. Van Fraassen is never too clear about the distinction he wants to defend, but his general idea is clearly that a philosophically significant distinction can be articulated in terms of certain *facts*:

... I regard what is observable as a theory-independent question. It is a function of facts about us *qua* organisms in the world, and these facts may include facts about the psychological states that involve contemplation of theories —but there is not the sort of theory-dependence or relativity that could cause a logical catastrophe here [SI, 57–58].

Quite understandably, philosophers have tended to concentrate their critique of CE on the very *possibility*

of producing a convincing observable/unobservable distinction of the kind Van Fraassen needs here (see Gutting 1983, Hacking 1983, Devitt 1984 and Suppe 1986 for important approaches to this line of general criticism). Nevertheless, for the sake of argument, I am willing to grant Van Fraassen the distinction he needs. Suppose, therefore, that the world can indeed be divided into entities observable by us and entities not so observable: can this concession help Van Fraassen?

Scientific inference according to CE

A fundamental application of the distinction is found in the way Van Fraassen conceives of scientific inference. He criticizes realists for giving too much credit to “best explanations”, ultimately for relying on an excessively simplified model of scientific inference. According to Van Fraassen, realists are generally satisfied that the following inferential form is appropriate to science: given a phenomenon P, if the best explanation of P is theory T, then one is entitled to conclude that the world is probably as T says, i.e.,

(1)

INFERENCE TO THE BEST EXPLANATION

Phenomenon P

T is the best explanation of P

Therefore, the world is probably as T says.

Van Fraassen is outspokenly unhappy about this popular inferential form. The above “Inference to the Best Explanation” —he seems to believe— is much too naive and coarse to do justice to scientific inference proper, for at the very least scientific inference comprises a crucial step missed by the realist rule, indeed a step which focusses on whether or not the story told in T is restricted

to the observable. What Van Fraassen appears to have in mind is something like the following:

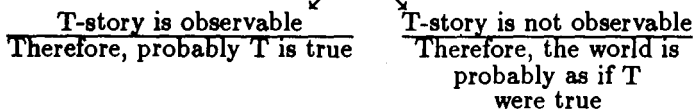
(2)

VAN FRAASSIAN INFERENCE

Phenomenon P

T is accepted as an explanation of P

(Is the story told by T fully observable?)



Both inferential modes within (2) take us beyond the evidence, yet inferences kept within the observable realm allow for stronger conclusions, if—as Van Fraassen maintains—a defensible rival hypothesis to the realist rule is that “we are always willing to believe that the theory which best explains the phenomena is empirically adequate” [SI, 20]:

I hear scratching in the wall, the patter of little feet at midnight, my cheese disappears—and I infer that a mouse has come to live with me. Not merely that these apparent signs of mousely presence will continue, not merely that all the observable phenomena will be *as if* there is a mouse; but that there really is a mouse. [SI, 19–20; my italics.]

An obvious question is, of course, what sort of considerations can possibly provide observability with this much inferential significance.

Observing Something

Van Fraassen’s position is extremely odd. Even if we agree about the observable/unobservable distinction, Van Fraassen’s uncommon empiricism itself appears to undermine from the start the philosophical *relevance* of such

a distinction. For, as we have seen, Van Fraassen rejects the doctrine of the given, with the result that CE incorporates the view that every thing we come to know about an object is ultimately theory-laden. Indeed, he explicitly agrees that observing something does not per-se lead to propositional knowledge: a Stone Age man in front of a tennis ball—he admits— would not see *that* it is a tennis ball. But if so, how can observing something (as opposed to observing that something is or is not a member of a given group) be at all significant? What has observing an entity to do with having warrant to believe anything? This is the first problem I want to consider in relation with Van Fraassen's concept of observation.

3. CE and General Empiricism

Can general empiricism adequately motivate the peculiar inference rule of CE? Why should inference to the observable be stronger than inference to the unobservable? What inferential advantage can possibly result from something being observable? Van Fraassen's judicious rejection of old empiricist foundationism limits the background of acceptable empiricist. Let us therefore begin our search for general ideas in support of CE at the least controversial level of general empiricist advice.

Better General Reliability?

As the quotation from pp. 19–20 shows, Van Fraassen is optimistic about explanations whose ontological commitment is limited to rodents. Here is, therefore, a possible piece of sound empiricist advice in favor of Van Fraassen's rule: "Inferences concerning mice are 'generally' more reliable than *present* inferences about protons or quarks"; or, more liberally: "Inferences limited to the observable are 'generally' more reliable than those

which extend to the unobservable". Can this insight from common-sense help CE to get off the ground?

It clearly cannot, for even if correct the insight here is only about the *statistics* of scientific inference. It is of *no* use in the specific assessment of any given inference; to think otherwise is to indulge in an elementary fallacy, as moderate realists are quick to notice (see, for example, Devitt 1984). Even if it were true that boys are generally better than girls in mathematics, for example, it still would not follow that in any given class the best talent in mathematics is not a girl. The question of statistical reliability is, therefore, of no use to CE. Something stronger is needed.

Skeptical Reading of History?

If the statistics of reliable claims are by themselves insufficient to motivate Van Fraassen's rule of inference, then perhaps the motivation sought resides in the specific track record of theoretical claims. Surely—it might be tempting to think—the vast mistakes we find in the succession of "best explanations" produced in the past should be of some significance, i.e., the case of Kepler's explanation of his Second Law, outlined in section I, is by no means historically unusual. There would seem to be no shortage of equally revealing cases: Cartesian gravitation theories, the caloric theory, Dalton's atoms, and so on and so on. Nothing as wild as that has ever happened at the observable level, claims the Anti-Realist. . . Or has it?

I have suggested elsewhere (1987a, 1987b) that a skeptical reading of the history of science becomes a reasonable option only if one confines the discussion of theories and scientific description in general to the framework of certain *idealizations*, fashionable perhaps in contemporary philosophy of language, but otherwise suspect and

quite alien to working-level science. Nevertheless, it is a fact that Van Fraassen couches his philosophy in terms of quite a few of these idealizations (even though he is explicitly suspicious of philosophico-linguistic approaches in the philosophy of science), especially with respect to language: theories, he insists, must be understood *literally* ([SI], pp. 11–12).

Is Van Fraassen therefore entitled to a skeptical reading of the history of *theories* (as opposed to science in general)? It seems to me that the answer is clearly 'no'. For there is at least one problem with the skepticism invited by Van Fraassen's literalism: if one presses it as hard as it is necessary to get the skeptical reading of theories off the ground, then other skeptical readings raise with it as well. For, if literalism is the word, then, as far as anybody can tell, *no* description ever succeeds in the intended sense, be it about the unobservable or about the observable. Nothing seems to respond to either the literal 16th century description of mice, or the literal description of Rutherford's atom. But the skeptical reading of the history of science is suspect in a more general way. If one approaches the historical record with less philosophical prejudice, for example, there appears to be no shortage of "progressive" theoretical lineages: atomic theories from Dalton to the present, theories of the electron, theories of material interaction and many others. No two theories in any one of these lineages agree entirely either with respect to literal meaning or reference, of course, but it is far from clear why this should constitute a problem at all. And, apart from the fact that the whole framework of meaning and reference is of dubious relevance in philosophy of science, there is the following major difficulty. If meaning or reference constitute a problem at all, it is a problem which engulfs both talk about observables as well as talk about unobservables, especially once the old

doctrine of the given is dismissed. Therefore, whatever skeptical conclusion one may choose to draw from "literalist" empiricism, it is bound to be something still quite insufficient to motivate Van Fraassen's rule: the history of science, even if construed as a succession of literal stories, does not warrant any specific discrimination against "theoretical statements" as such.

Reliable Kinds?

Since the rule under consideration seems to need stronger backing than any of the above openings can offer, perhaps it is time to consider some wilder empiricist options.

Perhaps we are not being charitable enough to CE. Perhaps a better way to read Van Fraassen's rule is in terms of entities having or not having been observed in the past, rather than in terms of entities being or not being observable. If so, one might conceivably try to appeal to parsimony and reason as follows: a belief about an entity which has been observed at least once is less risky than a similar claim about an entity which has not, for the simple reason that the latter calls for a riskier existential commitment. Having once observed some mice, one might say, we are satisfied that mice exist, and so an explanation involving mice has a clear advantage over an explanation otherwise similar but involving entities nobody has yet observed, be it mouse-angels, electrons, protons or quarks.

And yet, how do we come to claim that a mouse has been observed? It better not be by someone having observed at least once in the past *that* something in front of him was indeed a mouse. For, if this is what Van Fraassen has in mind, of his own accord it would not work: observing mice in the "observing-that" sense cannot motivate

the inference rule of CE, because propositional observation is altogether a theory-laden entertainment.

Reliable Existence?

So the preferential warrant required cannot come from having or not having observed in the past *that* something was of a certain kind. Perhaps, then, the warrant comes from merely *observing* certain entities.

And yet, how could this be? As Van Fraassen himself appears to agree, a Stone Age man's observations of the modern world would in all probability simply leave him speechless, very much the way one reads about in some medical reports of blind adults who, upon undergoing surgery, gain vision for the first time (an excellent presentation of relevant cases is found in J. Z. Young, *Doubt and certainty in science*, Oxford, 1960). Nevertheless, could one not claim at least that certain entities reveal themselves to *us* more easily than others? Do mice not reveal themselves to us more easily than electrons? Indeed they do, but only in the sense that our theories about the existence of mice, as a matter of contingent fact, generally become robust more easily than our theories about the existence of electrons, and therefore still not in the sense needed by Van Fraassen. "But surely — a Constructive Empiricist might retort — having once observed a mouse does entitle us to claim that at least one entity of its *kind* exists".

And yet, of which kind is anything that we ever see? In what sense are electrons not also of the same kind? The problem here is an old one: everything is of the same kind as everything else in *some* sense, and so until we receive further instruction (meaning a lot of heavy theory) no warrant of the sort needed to save Van Fraassen's rule of inference can follow from this level of empiricist doctrine.

Back to Old Foundationism

Van Fraassen's rule requires, therefore, something stronger still. However, at this point it seems that the only empiricist resource left is old foundationism: "observing a mouse w yields certain knowledge that w is a mouse". But this cannot be, for as we have seen this move appears to be explicitly dismissed by Van Fraassen. And even if it isn't, compelling advances have been made against the foundationist conception of the given (see, in particular, Shapere 1982).

I conclude, therefore, that Van Fraassen's peculiar rule of inference cannot be motivated by the background of empiricist ideas available to him. 'Observing' is simply not made significant enough by any general empiricist consideration open to Van Fraassen, and so his rule of inference turns out to be quite arbitrary from the point of view of general empiricism. Hence, if the rule is to be put forward in a non-arbitrary way at all, the key to it must lie on the epistemic considerations *specific* to [SI].

4. Van Fraassen's Specific Empiricism

The negative conclusion reached in the previous section leads to the second problem I want to consider in this paper. Given that a properly empiricist rationale for CE cannot be found in Van Fraassen's expurgated version of empiricism (i.e., without old foundationism), is there any other way to save CE from the charge of arbitrariness? It will become clear shortly that I deny the popular thesis that Van Fraassen is merely arbitrary; in [SI], at any rate, he advances a number of considerations seemingly relevant to his rule of inference. Only that now we should be under no illusions about having the rule grounded in typical empiricist considerations, for none of these work for Van Fraassen.

Not Theory but Fact

Since Van Fraassen's occasional appeals to general empiricism turn out to be of no use against the critique of the rule of inference of CE, we must take the specific treatment of theory acceptance presented in [SI] as the appropriate background for it. If so, the real starting point of CE is not theory but *fact*, or rather the conjunction of facts mentioned in the passage from pp. 57–58 quoted earlier on: according to Van Fraassen, what is observable is a theory independent question, ultimately a function of facts about us *qua* organisms in the world. It becomes clear from the start in [SI] that what he has in mind is a fairly commonsensical picture of the relation of man and the world:

The human organism is, from the point of view of physics, a certain kind of measuring apparatus. As such it has certain inherent limitations—which will be described in detail in the final physics and biology. It is these limitations to which the 'able' in 'observable' refers—our limitations, *qua* human beings [SI, 17].

The partition of belief along the observable/unobservable line demanded by Van Fraassen's rule of inference relies heavily on this image. Yet, such a partition is by no means a trivial philosophical matter; for even if the partition is granted, the gap between accepting it and Van Fraassen's rule of inference is still considerable.

Nevertheless, in this section I want to claim that, if the partition is granted, then motivation for the rule, in the form of a possible way of bridging the gap, is available within Van Fraassen's abstract philosophy. In section 5, however, I shall claim that this way of saving Van Fraassen's rule cannot work for CE.

Fact plus Elementary Decision Theory

I have tried to establish that Van Fraassen cannot turn to

empiricism for further support. He may still turn, however, to very general epistemology and logic, and indeed this is what he does.

What Van Fraassen urges us to consider is that belief that a theory is empirically adequate is a much safer and rational approach to believing than realism.

... it is, on the face of it, not irrational to commit oneself only to a search for theories that are empirically adequate, ones whose models fit the observable phenomena, while recognizing that what counts as an observable phenomena is a function of what the epistemic community is (that *observable is observable to us*) [SI, 19].

This approach to safer belief is further elaborated in [SI] with the help of two additional logico-epistemological observations, one concerning the existence of levels of empirical equivalence within scientific theories (“underdetermination”), the other concerning theory choice on the face of empirical equivalence.

Underdetermination

The question of empirical equivalence springs from a generalization of the old problem of the underdetermination of theories by data. As Van Fraassen understands them, practically all the important theories —classical mechanics, relativity, quantum mechanics, etc.— comprise descriptive substructures in a state of relative epistemic underdetermination, and thus also the existence of various levels of internal epistemic fragmentation. A classical example of this is found in the theory of absolute motion within Newtonian mechanics, in which the substructure that describes relational motions is completely invariant to changes in the absolute uniform velocity of the center of mass of the universe.

Van Fraassen’s thesis is that scientific theories confront

us in general, not with a tight body of entrenched belief, but with what amounts to a family of doxastic options, really a hierarchy of belief alternatives, ranging from minimal belief in what the theory says about the observable world to comprehensive belief in the theory. This hierarchy is never spelled out in detail by Van Fraassen, but his treatment of the problem of empirical underdetermination in [SI] makes it clear that vulgar instrumentalism and vulgar realism are not the only alternatives he has in mind. For present purposes, the important point is that what results from Van Fraassen's discussion is the beginning of a prospective motivation for his rule of inference in terms of a *general* observation about belief structures, a "principle" hinted at in the quotation from p. PP above. Presented in a suitably general form the "principle" in question may be summarized as follows:

VF1) *Epistemic Attitudes and Van Fraassen's Doxastic Hierarchy*: The empirical basis of a theory T gives rise to a family of belief structures, ranging from belief limited to what T says about the observable (represented by O) to thorough realism (R) with respect to T.

$$\text{Belief in T} = \{T_O, \dots, T_R\}$$

Needless to say, this generalization of Van Fraassen's observation on the underdetermination of theories is still not enough to motivate the rule of inference of CE, but it does suggest a next step in the "right direction" to save CE from arbitrariness.

Theory Choice

Given that there is a choice of belief structures, the acceptance of a particular structure must be based on reason. It is here, at the level of theory choice, that I think

Van Fraassen's radicalism reaches its peak. Shall he keep his beliefs closer to Scientific Realism, or shall he satisfy himself with less?

In either case we stick our necks out: empirical adequacy goes far beyond what we can know at any given time. (All the results of measurement are not in; they will never be; and in any case, we won't measure everything that can be measured.) Nevertheless, there is a difference: the assertion of empirical adequacy is a great deal weaker than the assertion of truth [SI, 68-69].

This apparently unassuming passage turns out to be crucial. As we see, it consists of two parts. The first part marks a proviso against skepticism; the second part motivates a differentiation between the realist construal of theories and Van Fraassen's construal in terms of the most abstract principle of parsimony possible.

Why does Van Fraassen derive so much epistemic comfort from the fact that the assertion of empirical adequacy is a great deal weaker? In what sense exactly is it weaker? Early on in the book he presents the import of empirical adequacy in the following way:

[The question of what it is to accept a scientific theory] has an epistemic dimension (how much belief is involved in theory acceptance?) and also a pragmatic one (what else is involved besides belief?) [SI, 4].

Hence, if as I have claimed Van Fraassen cannot resort to general empiricism for further inspiration, he is left only with the prospect of appealing to the type of doxastic strength granted by *logical* weakness: the less you say, the less you are likely to be mistaken. It seems clear, therefore, that if Van Fraassen wants to motivate his principle of inference, lacking more interesting choices, he must take seriously something like the following version of the principle of parsimony:

VF2) *Epistemic Theory-Choice*: Given any two belief structures which are empirically equivalent, if one structure is logically more modest than the other (i.e., logically weaker), the more modest structure must be chosen. Thus, for example:

$$\text{Choice } (T_O, T_R) = T_O$$

Against Skepticism

The two principles so far extracted from Van Fraassen's presentation are extremely non-specific and potentially dangerous, and he knows it, as the disclaimer at the beginning of the quotation from p. 68 above reveals ("we stick our necks out"). Hence Van Fraassen's protection of his position against the temptations of skepticism; indeed, his anti-skeptical disclaimer constitutes a further stricture.

VF3) *Anti-Skepticism*: The total empirical basis must defy skepticism. Accepting a theory must be riskier than skepticism; it must amount to sticking one's neck out.

Van Fraassen's Rule Follows

Now, the good thing about the above three principles of criteria is that —if Van Fraassen chooses to take them seriously, as I think he does— they *do* indeed motivate his rule, not "neutrally" or necessarily to the satisfaction of everybody, but at least relative to Van Fraassen's own simple story about man and the world. Since this is a crucial point, it is appropriate to summarize the story in question: a) something is or is not observable as a result of certain facts about us qua organisms; b) our beliefs may be partitioned according to whether or not they refer to observables by us; c) our scientific theories

are generally underdetermined by their observable basis, which results in our typically having a number of empirically equivalent doxastic alternatives, in particular extreme realism (believing that everything the theory says is true) vs. CE (believing only that the theory is empirically adequate); d) whatever our choice, we must avoid skepticism, with the result that e) the best choice among extreme realism and CE is clearly the latter, i.e. belief in empirical adequacy, for it commits us to less and is thus correspondingly safer, yet without involving skepticism.

Van Fraassen effectively admits that there are plenty of intermediate cases between the clearly observable and the clearly unobservable. His point is simply that it is safer to remain agnostic about everything that does not *clearly* belong to his perceptual empirical basis: to Van Fraassen, CE is above all *safer* than Scientific Realism. And so, according to him, Scientific Realism is simply unnecessary, with the result that his claim that science aims “merely to give us theories which are empirically adequate” becomes then a reasoned claim, in fact a corollary from general considerations such as VF1, VF2 and VF3.

5. But Is Van Fraassen’s Position Really Coherent?

Having attempted to restate CE fairly, I would now like to further examine its account of scientific belief structure in Van Fraassen’s own terms, particularly VF1, VF2 and VF3. My purpose at this stage is simply to consider the following question: Even if, advocating the rationale spelled out in the previous section, CE were able to escape the criticisms against its central rule of inference, would it make much difference? I shall contend that it would not.

It is odd to maintain, as Van Fraassen does, that one should believe all the unobserved observable consequen-

ces of a theory without believing any part of the unobservable-theoretical story. This is especially strange in epistemic situations when the “theoretical story” happens to be the sole basis for expecting some of the observable consequences, as is so often the case in applied natural science. Nevertheless, I have claimed that Van Fraassen’s rule of inference can in fact be derived from his specific “epistemology”. Yet, having claimed this much I must now further claim that Van Fraassen’s proposal is otherwise incoherent in a serious way. What I want to show is that his *reasons* for remaining agnostic about what is unobservable “by us” turn out to be also reasons for remaining agnostic about observables in general.

Others Rules also Follow

Van Fraassen’s deep predicament can be seen in terms of the recursive application of VF1, VF2 and VF3 to CE itself. Consider the following family of alternatives. Partitioning spaces and times into semi-spherical structures allows us to introduce a family of what might be called “spheres of observability by us” (or, just as well, “spheres of empirical adequacy”):

$$S(n,m) = \{(x, t): [R_n = L_0/n] \cdot [T_m = T_0/m] \cdot [x_1^2 + x_2^2 + x_3^2 < R_n^2] \cdot [t < T_m]\}$$

$$n = 0,1,2,\dots; m = 0,1,2,\dots;$$

for arbitrary chosen constants L_0 (say, the distance to the remotest galaxy observed) and T_0 (say, the accepted age of the universe).

I propose that for each of these spheres there is an alternative Constructive Empiricism, $CE_{S(n, m)}$. $CE_{S(0,0)}$ is Van Fraassen’s own Constructive Empiricism. Briefly put, my point is that CE does not admit of equilibrium with respect to its own principles, in the sense that it

cannot be maintained once certain alternatives are envisaged. To see this we may proceed as follows. Assuming that CE is a self-consistent form of empiricism, and using Van Fraassen's own doxastic strictures, in particular VF2, we can recursively force his position into increasingly "safer" alternatives, until a position of thorough agnosticism about the unobserved (be it the unobservable or the unobserved *observable*) is reached. That is, given any $CE_{S(n, m)}$, the application of the very same abstract principles available to Van Fraassen to save his original proposal from the charge of arbitrariness leads smoothly to increasingly "better" proposals with respect to those principles, to some safer $CE_{S(n', m')}$ ($n < n'$, $m < m'$), i.e., to an alternative CE whose empirical basis is just more spatio-temporally restricted than Van Fraassen's original basis. My point is that no sphere short of $S(\infty, \infty)$ corresponds to a point of equilibrium relative to the only rationale available to save CE from the charge of mere arbitrariness.

CE Is Absurd

In order to make the above criticism explicit, suppose that, agreeing with Van Fraassen for the sake of argument, we accept his general epistemology as explicated in the previous section. Thus, given a theory T, we interpret it in a Van-Fraassian manner and begin our study of T by limiting belief in T in accordance with $CE_{S(0,0)}$.

Now, it is "compatible with past experience" to consider yet another belief structure, a prospective contendor based on an alternative non-skeptical empirical basis, say O_{01} , more restrictive than Van Fraassen's perceptual basis O, in this case the basis constituted by what is observable within the next fifteen billion years or so:

$$O_{01} = \text{Observables } [S(0, 1)].$$

In contrast, Van Fraassen's original basis (i.e., observation within $S(0, 0)$) ranges over all observables without any spatio-temporal restriction whatever: it commits us to more, not less, its extra burden being constituted by all the observable claims of the theory with respect to the region:

$$S(0, 0) - S(0, 1),$$

which correspond to the presumably dubious story told by the theory about observables from 15 billion years from now onwards.

Notice that O_{01} satisfies all the conditions of Constructive Empiricism, in particular these:

- a) It is clearly motivated by experience. For, to say the least, experience supports just as well —if not better— the hypothesis that short-term predictions are more reliable than long-term ones;
- b) Its demarcation is as non-theory dependent as the demarcation of CE's original basis. And, of course, the new demarcation is clearly based on "Van-Fraassian facts": it refers to observables by us, within the finite region $S(0, 1)$ of space-time;
- c) The observable claims within $S(0, 1)$ are, at least, as unproblematic as those within $S(0, 0)$, for the simple reason that $S(0, 1)$ is a sub-set of $S(0, 0)$;
- d) It is a non-skeptical basis.

Thus, using again the only principles which might allow Van Fraassen to free his position from the charge of arbitrariness, the choice is clear:

$$\text{Choice } (T_{00}, T_{01}) = T_{01}.$$

And so, following the internal logic of CE, we are compelled to *accept* as true only what T says about the world within $S(0, 1)$.

But now Van Fraassen has a problem. What this move toward T_{01} has started is a self-propelled series of increasingly safer (yet non-skeptical) positions with respect to belief in what T says about the world, the point of convergence of which is seemingly none other than doxastic collapse. The problem for CE may be easily seen as follows: a consistent Van-Fraassian cannot stop at something like T_{01} . Because T_{01} does not correspond to a point of doxastic equilibrium relative to CE, it appears that Van Fraassen is bound to take up T into subsequent "safer" versions as soon as these are presented to him, with some freedom of choice everytime, yet forced to go on "adding one" (or more) to either index of his current T_{mn} , consistently in the direction of doxastic collapse:

$$T_{00}, T_{01}, T_{02}, T_{12}, T_{13}, T_{23}, \dots, T_{\infty}$$

or any other such series.

Van Fraassen's problem can be spelled out in full generality by defining a relation of containment for the spheres of observability. For all n, m, n', m' : Let us call $S(n', m')$ a "successor" of $S(n, m)$ if: a) either $m' > m$, or $n' > n$; and b) neither $m > m'$ nor $n > n'$. It is clear that if $S(m', n')$ is a successor of $S(m, n)$, then $S(m', n')$ is strictly contained in $S(m, n)$. Van Fraassen cannot consistently remain faithful to any particular T_{mn} , for no T_{mn} corresponds to a point of doxastic equilibrium within his philosophy, i.e., his epistemic strictures leave any given $S(n, m)$ on a slippery road. The reason is simply that for every $S(m, n)$ there is a successor $S(m', n')$ also compatible with CE, but altogether a "better" option.

$$\text{Choice } (T_{mn}, T_{m'n'}) = T_{m'n'}.$$

And so on, ad-infinitum.

There Are Too Many Facts about Us

Sober epistemic equilibrium is not reached until we actually stop believing the unobserved consequences of any given theory, leaving *all* claims about the unobserved (observable or not) on the same side of Van Fraassen's protective agnosticism.

My contention is that Van Fraassen's predicament is brought about by his lack of the *theoretical* support required to stop the contraction of the empirical basis in a non-arbitrary way. Lacking this, however, his severely abstract principles, coupled with his peculiar appeal to "facts" concerning what is observable "by us", are a recipe for disaster: that something is observable within any given $S(m, n)$ is as much a *fact* about us qua organisms disclosed by theory as Van Fraassen's original choice of fact concerning $S(0, 0)$. There are simply too many facts of *that kind* in the world (their number is actually infinite).

Facts without Theory Are no Good

What Van Fraassen needs to do, of course, is to provide a *theory* of $S(0, 0)$ that shows why his empirical basis is to be philosophically preferred to any other, but—if the conclusions reached in section 3 are correct—this he utterly fails to do, grounding his choice instead merely on "facts about us qua organisms". Thus, having failed to make 'observation' philosophically relevant to the *propositional observation* characteristic of science, Van Fraassen proceeds to demarcate 'observation' in terms of his original selection of "facts". As we have seen, however, this selection being supported by *nothing* commits CE to an absurd position.

CE Is Ultimately Incoherent

But, if so, CE is more than merely absurd. For it incorporates a proviso against skepticism, VF3; yet, as we have seen, Van Fraassen's position is removed from ordinary skepticism about the future by an infinitesimal at best, since for every non-skeptical basis proposed within his framework, there is always another, more restrictive (yet, still non-skeptical) basis. The point of equilibrium for Van Fraassen's proposal, as it stands in [SI], is really nothing less than $S(\infty, \infty)$.

CE and the Past

And CE is equally disturbing with respect to the past. Consider the empirical basis associated with " $S(0, -1)$ ". Following the definition of $S(m, n)$, given before, $S(0, -1)$ is the basis sphere of observability which goes back in time to the "big-bang". It seems clear that, relative to Van Fraassen's epistemology, $CE_{S(0,0)}$ is not preferable to $CE_{S(0,-1)}$. And again, using his own strictures, we can recursively force his position into increasingly "safer" alternatives, until a position of thorough agnosticism about the past (be it the unobserved unobservable past or the unobserved observable past) is reached.

Moreover, one could further point out against CE that past events are never "observed" in any perceptual sense, but, if at all, merely *detected*. In Van Fraassen's jargon, we detect the big-bang, the presence of dinosaurs in North America millions of years ago, the arrival of man in the continent, the life and times of the Aztecs, the American Revolution and the birth of our parents. Whether or not it is good philosophy to limit ourselves to mere "detection" when it comes to past events within our own lives seems to depend on whether or not we advocate realism with respect to the contents of memory

and other “traces”. Therefore, no matter how we choose to articulate our stories about what has been going on before the present time, it seems clear that concerning the past there is again only one $CE_{S(n,m)}$ in state of equilibrium with respect to Van Fraassen’s epistemic strictures, $CE_{S(\infty,-\infty)}$, i.e., a position of thorough agnosticism about the past.

6. Conclusions

And so, it appears that Van Fraassen’s failure to spell out the philosophical relationship between the *perceptually* relevant ‘observing’ and the *scientifically* relevant ‘observing-that’ cannot be compensated for merely by appealing to a blend of abstract general decision theory plus facts about us qua organisms.

On the basis of the analysis presented in this paper, my conclusion is, I hope, straightforward: Van Fraassen’s philosophy of observation is internally flawed in a non-trivial way. Relative to his epistemology, it is simply not reasonable to believe, as he claims we must, all the observable consequences of an accepted theory without ever coming to believe *any* of its claims about the unobservable.

CE: Arbitrary or Incoherent?

As I see it, therefore, CE presents us with the following dilemma: either the philosophy of observation which it embodies lacks philosophical motivation and is ultimately arbitrary, or it is based on the peculiar blend of general decision theory plus bare facts about the human species. The latter alternative, however, although initially promising, turns out to be no good: the rationale it embodies does far more than merely save CE from the

charge of arbitrariness; it can be appealed to just as well to save an infinite family of daunting alternatives to CE. Once this is realized, the difficulties with Van Fraassen's philosophy reappear with even more force than before.

The moral, of course, is not that scientific observation lacks philosophical significance, but simply that in no clear sense is observation in contemporary science fundamentally perceptual or theory neutral.

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RESUMEN

El empirismo constructivo se halla inapropiadamente motivado por la doctrina empirista general. Sin embargo, sostenemos que es posible encontrar una motivación para dicho empirismo en la peculiar mezcla entre la teoría de la decisión y algunos hechos específicos acerca de la especie humana anticipados por Van Fraassen en *The Scientific Image*. Lamentablemente, una filosofía de la ciencia motivada de esa manera es incapaz de evitar su propio hundimiento bajo el peso de otros múltiples "hechos" relativos a la especie humana.