

Somewhere over the... what?

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ABSTRACT

In order to defend his controversial claim that observation is unaided perception, Bas van Fraassen, the originator of constructive empiricism, suggested that, for all we know, the images produced by a microscope could be in a situation analogous to that of the rainbows, which are 'images of nothing'. He added that reflections in the water, rainbows, and the like are 'public hallucinations', but it is not clear whether this constitutes an ontological category apart or an empty set. In this paper an argument will be put forward to the effect that rainbows can be thought of as events, that is, as part of a subcategory of entities that van Fraassen has always considered legitimate phenomena. I argue that rainbows are actually not images in the relevant (representational) sense and that there is no need to ontologically inflate the category of entities in order to account for them, which would run counter to the empiricist principle of parsimony.

Keywords: constructive empiricism, observability, observation, public hallucination, rainbow, van Fraassen.

Since Aristotle, rainbows have been the object of interest of many philosophers and scientists throughout the centuries. Bas van Fraassen, the originator of constructive empiricism, has recently dealt with them too (2001 and 2008). While his focus is on the (alleged) possibility of performing an observation with the aid of a microscope, his account of rainbows ends up raising a new issue, concerning the ontological status of these arcs. In this paper it will be shown that there is a tension in van Fraassen's 2001 account of rainbows, which is not completely solved in his further work (2008). I argue that this tension can be solved by considering rainbows as events and will show that not only does this hypothesis overcome the objections van Fraassen raises against considering a rainbow as a thing, it also complies with the empiricist principle of parsimony.

*No man ever steps in the same river twice, for it's
not the same river and he's not the same man.
Heraclitus*

Heraclitus' famous saying has a clear meaning. Yet, while hardly anybody would deny that the Ephesian philosopher has a point, we still call the Nile the longest river in the world and do not tend to doubt that it's the same river that had a crucial role in the development of Egyptian civilization; nor do we deny it's the same watercourse whose source David Livingstone became obsessed with finding in the second half of the nineteenth century. "Rivers have well established identity conditions", we might reply to any critic of our position, provided there is any. But some neo-Heraclitean might insist that when a slave in Thebes looked at the Nile, the poor man was not seeing the same river that a farmer in Qau was staring at, because the portions of water the

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two were observing were not the same. Then, of course, the watercourse some might observe in the modern Qaw el-Kebir nowadays would also be something different, because the portion of water the farmer in ancient Qau was seeing is very likely no longer part of the Nile.

Roger Bacon's account of rainbows does not seem too far from this neo-Heraclitean perspective. According to the medieval scientist and philosopher, each observer sees his own bow, different from every other observer's, because the sets of raindrops responsible for it are different (they depend on the point of view) (see Kraml, 1994, p. 356). Now, almost eight centuries have passed since Bacon's theory of the rainbow and contemporary accounts of the coloured arc are much more refined. Still, the empiricist van Fraassen seems to take Bacon's point: "I see a rainbow and you say *you see it too*. See what too? You are not seeing the rainbow I see, for yours is located in a different place. (I assume that you are not looking *from inside my head*") (van Fraassen, 2001, p. 156).² The Dutch philosopher made the same point a few years later, adding: "Nor are they simply in a different place in our respective visual fields, in the way the clouds are. For if that were so, we would see the colours 'attached' to the same part of the cloud, modulo parallax" (van Fraassen, 2008, p. 102).

Van Fraassen's interest in the rainbow is part of his strategy to defend the notorious claim that observation is (at least in principle) unaided perception (see van Fraassen, 2001, p. 154, 2008, p. 93). Accordingly, endorsing such a characterization of observation means, among other things, denying that we actually see a paramecium when we detect one by means of a microscope.³ In order to defend such a controversial stance, van Fraassen suggests one should not think of microscopes as 'windows into the invisible or sub-visible level of nature' but rather as devices creating new observable phenomena. In the case of the microscopes, says van Fraassen, the products are images. True, they could be images of something real, as happens with reflections in water, but there is no way of empirically proving this (see Kusch, 2013, p. 13). For all we know, the situation could very well be the same as in the case of a rainbow. A rainbow is obviously not the image of a real arch; in fact it is not the image of anything — but it is an image (see van Fraassen's catalogue of images in his 2008,

p. 104). How can we be sure that, in the case of the images produced by a microscope, the situation is not the same? We cannot. It certainly is not irrational to maintain an agnostic stand towards them, then.

Van Fraassen thinks he can include the rainbow among the images because it lacks certain crucial invariances that would allow us to represent it as 'a thing',⁴ as in the previous argument about the rainbow being different depending on the point of view. However, it exhibits other invariances that reflections exhibit too. As with reflections and other images, rainbows are not 'things'; they are something else ('public hallucinations' is the label van Fraassen gives to rainbows and reflections — together with shadows, mirages, and *fata morganas*). But they are all kin.

Considering the rainbow as an image could be questionable, of course, and I will return to this point later on, but it is certainly convenient for his purposes. Van Fraassen did not content himself with this manoeuvre, though. When he first presented his view on rainbows and other images, in 2001, he added: "We never see images, because images do not exist" (p. 158). This obviously created a tension with the claim that microscopes generate "truly humanly observable phenomena" (p. 154) — and was not needed, perhaps, but helped avoiding other problems, such as explaining what images are. About this specific point, however, van Fraassen seems to have retreated a few years later and in his last book (2008), wrote: "When you see the reflection of a tree in water you are not seeing a thing; a reflection is not nothing, it is something, but it is not a *thing*, not a material object" (p. 105). Reflections exist, then, and so do rainbows. And if we see them, then they are observable. Van Fraassen's equivalence between phenomena and observables (see Bourgeois, 1987, p. 305; but also Foss, 1984, 1991) is thus reestablished. But now that rainbows' existence is no longer denied, perhaps van Fraassen should tell us what they are.

He tells us what they are not: "Rainbows are not objects, events or processes" (van Fraassen, 2008, p. 110). Still, they must be some kind of entity, because 'to observe' is a success verb.⁵ In their case, however, says Alsppector-Kelly, it does not seem possible to identify the objects of our experience with material objects. Then perhaps van Fraassen should admit that when we have the experience of seeing a rainbow, what

² Bacon's view seems to be shared by many, in fact. Talking about the rainbow, in the classic *Physics of the Air* (1929), for example, William Jackson Humphreys writes: "as the eyes of two observers must always be separated by a greater or less distance, their bows must also be correspondingly separated and different—different in the sense that they have different positions and are produced by different drops. [...] it follows that two observers do not, and cannot, see the same rainbow" (p. 479). If we were to endorse such a view, however, shouldn't we add that an observer can never see the same rainbow twice, because the drops that produce it change continuously?

³ According to van Fraassen, to *detect* is to be distinguished from to *observe*: "Microscopes, cloud chambers, laser interferometers and other scientific instruments allow us to detect entities, but *detection* has to be carefully distinguished from *observation*. A look through a microscope does not allow us to observe directly a paramecium; only to observe *an image* of a paramecium, or to detect a paramecium" (Contessa, 2006, p. 456). See also van Fraassen (2008, p. 93).

⁴ Tacitly implying that it does not have definite identity conditions?

⁵ According to van Fraassen, "we can't see things that don't exist" (2001, p. 158) and "[t]he term 'observable' classifies putative entities (entities which may or may not exist)" (1980, p. 15). If we do see rainbows, then of course they must be observable. Therefore, a rainbow is an entity (which exists, he now admits). Van Fraassen claimed that rainbows are (observable) phenomena even before admitting their existence, however, and, to him, 'phenomena' and 'observables' amount to the same thing (see Bourgeois, 1987, p. 305)—hence the tension.

we are actually seeing are sense-data (see Alspector-Kelly, 2004, p. 338; see also Foss, 1991, p. 279).

However, it is hard to think that van Fraassen could now be willing to admit that sense data exist, as he has always—and strongly—denied their existence (see 1980, p. 72; 2008, p. 218). On the other hand, if ‘public hallucinations’ are not objects, events, or processes, do we have to conclude that they constitute another ontological category (or subcategory of the entities, as with objects, processes, events)? Well, before jumping to such a conclusion, perhaps we should remember that, like any good empiricist, “van Fraassen appeals to the virtues of ontological parsimony” and tries to avoid ‘inflationary metaphysics’ (Kukla, 2000, p. 64). In this case it is not clear that he is acting according to these principles, though.

Thus, if we do not want to inflate the category of the entities or to deny that images exist—which would force us to deny that they are phenomena too, on pain of contradiction—perhaps we could try to see whether the rainbow allows us to represent it as one of the three subcategories of entities that van Fraassen always (and only) mentions: objects, events, and processes. My opinion is that, contrary to what he maintains, it is possible to describe the rainbow as being an object.⁶ However, an even more convincing argument can be put forward in order to defend that the rainbow is an event—while at the same time saving “van Fraassen’s reasonable belief that talk about ‘objects, events, and quantities’ (1980, p. 58) is intertranslatable” (Foss 1991, p. 279, n. 2).

As a matter of fact, as is well known, a rainbow is created by the interaction of the Sun’s rays and water droplets suspended in the air, and this is how it is usually described in physics books (see, for example, Barnes-Svarney and Svarney, 1999, p. 42). That is to say, the rainbow can be conceived as an event (an interaction), commonly described in terms of the objects involved, in exactly the way van Fraassen would expect.

And what about his objection that what actually happens is that each observer sees ‘something different’? A characterization of the rainbow as an object would be immune from such an argument for it is part of the common use of the verb ‘to observe’ to say that two different agents observe the same object even when each one looks at a different side of it (think of an astronaut being on the other side of the Moon).⁷ Could the menace be brought back by a different characterization of the rainbow? Classifying it as an event, in fact, seems more ‘natural’ than conceiving it as an object—it is actually quite common to find the rainbow described by the

locution *atmospheric event*. Is this a legitimate use, despite van Fraassen’s objection?

Let’s consider an example of an event that he mentions in *The Scientific Image*: a car accident (see 1980, p. 15)—being an event, not only can it be observed, but also, as said above, it can be described/reduced, even if not completely, in terms of the involved objects.⁸ A couple of years ago, a crash involving an ambulance and a truck occurred on a Brazilian interstate highway. According to the police report, when the truck, loaded with sugar cane, joined the highway, coming from a side road, it was hit in the side by the ambulance. The truck driver probably left the side road without checking whether other vehicles were already on the highway and did not see the ambulance approaching. Inside the ambulance, a woman was lying on a stretcher, being taken from one hospital to another. At the moment of the collision, the truck driver only heard the noise of the crash between the vehicles. The woman inside the ambulance only saw the vehicle body deforming all of a sudden, but did not hear anything, because she is deaf. A pump manager, who works in a gas station about four hundred yards from the crash site, saw the two vehicles collide.

Each one of the three saw or heard ‘different things’ Still, we say that they all observed the same car accident. Indeed, when we consider an event, such as a march in protest against the war in Iraq, a tornado in Oklahoma City, an earthquake in Japan, etc., it is more than likely that two different individuals who observed the event at hand actually saw or heard something different from one another. Even so, we say they observed the same event. Why can’t we do the same in the case of the rainbow?

If a car crash is an event, and as such observable, the same goes for a march on Fifth Avenue, for the lightning that stroke St. Peter’s Basilica the day the Pope resigned, and for the rainbow that shone over São Paulo a couple of days ago. The rationale behind these events seems to be the same, *pace* van Fraassen.

The strongest objection against this kind of characterization, however, concerns the subjective side of this phenomenon, which van Fraassen seems to stress. The argument, in brief, is that events such as a car accident, a march on Fifth Avenue, or an earthquake ‘exist out there’ and happen irrespective of the presence of a perceiving subject, while a ‘public hallucination’ such as a rainbow requires that something happens in the agent’s eye or mind in order to ‘exist.’ In other words, according to this view, if there is no observer then there is no rainbow.

But if that is the case, why should we treat a rainbow differently from the pain one feels when hit by a stone, for

⁶ One argument to this effect is that if the point is having well-established identity conditions, then a rainbow does not seem to be in a very different situation from a cloud.

⁷ In philosophical discussion the word ‘observe’ is meant to have a common use (see van Fraassen, 1992, p. 18).

⁸ As a matter of fact, defending the intertranslatability of objects, events, and processes—which is legitimate—does not amount to saying that, for example, an event can be *completely* described/reduced in terms of the objects that took part in it (and vice versa). An event is generated by the objects involved (of course), but there is also ‘something else’ (an action, that is, some kind of occurrence or change in the world), that turns the occurrence in question into a legitimate event; but that, for this very same reason, makes it impossible for the event to be completely reduced to the involved objects only.

example? True, the former can be photographed while the latter cannot; however, in both cases, while it is something external that provokes it, the sensation is completely subjective and cannot be shared with anybody.⁹ If the perceiving subject plays a decisive role in the rainbow's generation, but even so it is observed and is a phenomenon, then Albert's stress, the goalie's anxiety at the penalty kick, and any other sensation one can think of should represent instances of observations and phenomena. But there exist good reasons to resist this conclusion and van Fraassen seems to agree with this.¹⁰

Otherwise, it would be more coherent, in this situation, 'to finish the job' and deny that a rainbow can actually be observed, as the Dutch philosopher did in 2001, when he said that it is a hallucination (it was probably not by accident that he used this term, although he added the adjective 'public'); but then, to avoid contradiction, he should also have denied that it is a phenomenon—unless he used this word 'for the sake of the argument' only, because the rainbow is usually described as an 'optical phenomenon'

Indeed, with regard to the alleged observations of rainbows, in the paper van Fraassen writes: "These observations are like hallucinations, in that they are not of real things, but they are public"¹¹ (van Fraassen, 2001, p. 156, my emphasis). And when, on the same page, he says: "You are not seeing the rainbow I see, for yours is located in a different place", he then clarifies this claim by adding: "I assume that you are not looking from inside my head" (my emphasis). Moreover, he also denies that 'public hallucinations' exist, as mentioned, and this could make one think that he is actually considering the rainbow as a hallucination, that is, something subjective (as with sensations). But then he should have finished the job, as I also said above, and (also) denied both that rainbows are phenomena and that science should account for them, *pace* Foss. He stops halfway, instead, and generates a contradiction (also stressed by Alspecter-Kelly, 2004): according to '2001's van Fraassen', rainbows do not exist and we do not see them. Even so, they

are phenomena and must be accommodated in the conceptual framework that constitutes a scientific theory.

In sum, if it is true that without the observer there is no rainbow, then denying its existence and observability—and the fact that it is a phenomenon, for which science should account—would be the correct thing to do, although contrary to common sense.

Van Fraassen, however, seems to have recently retreated, but it is not clear to what extent. He now claims that we do see rainbows, reflections in the water, etc. (therefore they exist), but continues to deny that they are objects, events, or processes. Nonetheless, if they are phenomena and we observe them, then they must be intersubjective and 'exist out there', and must allow us to describe them in terms of the objects involved (or, in alternative, must allow us to describe them as objects)—unless we are willing to assume that the category of *entities* also accommodates a subcategory called 'public hallucinations', in addition to the subcategories 'objects', 'events', and 'processes'. But this seems to run counter the empiricist principle of ontological parsimony and could perhaps be avoided. In this paper an attempt to achieve this has been made.¹²

Another way of accounting for rainbows and other images, once it is admitted that we can observe them, would in fact be considering that 'public hallucinations' constitute an ontological category apart from objects, events, and processes, but belong, together with them, one level above, to the class of entities. The problem is that if, according to a certain interpretation of van Fraassen's works, one can say that the Dutch philosopher has always admitted that among the entities there is something more than 'just' objects, events, and processes, only recently has he conceded that rainbows and other images exist. Before 2008, 'public hallucinations' did not constitute an ontological category (apart)—or if they did, it was an empty set, since, according to van Fraassen, its 'elements' did not exist.

⁹ Some might argue that a photograph of a rainbow allows us to share it, contrary to what we have just said. However, in this case, what would actually be seen is a photograph, which represents a rainbow, and not the phenomenon itself. If we admit that the rainbow is somehow generated (also) by the observer, then it cannot be shared, although various observers can have an analogous experience under the same conditions.

¹⁰ If, on the one hand, van Fraassen claims that, when two different individuals say they are observing the same rainbow, this is not what actually happens, on the other hand he admits that the rainbow can be photographed, which seems to amount to claiming that this natural phenomenon is both publicly and intersubjectively accessible—it is no coincidence that he calls it a 'public hallucination', of course. It is worth adding that Foss considers 'things' such as the rainbows "objectively accessible phenomena, or at least sufficiently intersubjectively accessible to get full scientific consideration" (Foss, 1991, p. 281). If science investigates the world around us, then the object of an observation has to be external and intersubjectively accessible (so that a mathematical model can be built in order to represent it) (see van Fraassen, 2008, p. 168, 238; Giere, 2009, p. 107-108). This surely is so for van Fraassen: "Locke and Berkeley, of course, were sensationalists. For them appearances were of internal, mental entities. Van Fraassen will have no truck with such things. His appearances are public" (Giere, 2009, p. 107). If microscopes "create phenomena, to be accounted for by our theories" (van Fraassen, 2008, p. 101), then these must be public. Accordingly, the same argument applies to all images, rainbows included—but not to headaches and the like.

¹¹ Van Fraassen does not restrict himself to drawing an analogy between rainbows and hallucinations, but does actually consider the former to be part of a category of phenomena that, as has been said, he names 'public hallucinations': "reflections in the water, mirror images, mirages, rainbows. For those I will use the term 'public hallucinations'" (van Fraassen, 2001, p. 159-160; the very same sentence can also be found in 2008, p. 105).

¹² This is just an attempt. A more accurate study would certainly require proposing identity conditions allowing us to precisely define and identify rainbows and the like.

In conclusion, it seems preferable—and constitutes a proposal for a solution of what could be called ‘the rainbow issue’—to classify, *contra* van Fraassen, this phenomenon as an *event*, which can be described (but not completely reduced) in terms of the objects involved. Moreover, I argue that it should not be considered an image either.¹³ Despite looking like a bow, in fact, as its name obviously suggests, it actually does not replicate (and does not look like) any known *material* arc—as even van Fraassen acknowledges. In other words, including rainbows among images can even be legitimate, but if we want to stick to the representational role of the latter, this choice seems questionable. Images *must* be images of something, otherwise we could include among them dog-shaped clouds or the Italian Peninsula, for it resembles a boot. These are actually more entitled to be considered images of something than a rainbow, which is clearly not an image in this sense, for it does not replicate anything.¹⁴

Including rainbows among *events* seems more natural and, in particular, closer to the empiricist spirit than ‘ontologically inflating’ *entities* and considering, as van Fraassen seems to do, that among them there is also a class of the ‘public hallucinations’—whose nature, indeed, would remain a mystery.

References

- ALSPECTOR-KELLY, M. 2004. Seeing the unobservable: van Fraassen and the limits of experience. *Synthese*, **140**(3):331-353. <https://doi.org/10.1023/B:SYNT.0000031323.19904.45>
- BARNES-SVARNEY, P.; SVARNEY, T.E. 1999. *Skies of Fury: Weather Weirdness around the World*. New York, Simon & Schuster, 224 p.
- BOURGEOIS, W. 1987. Discussion: on rejecting Foss’s image of Van Fraassen. *Philosophy of Science*, **54**(2):303-308. <https://doi.org/10.1086/289380>
- CONTESSA, G. 2006. Constructive Empiricism, Observability, and Three Kinds of Ontological Commitment. *Studies in History and Philosophy of Science*, **37**(3):454-468. <https://doi.org/10.1016/j.shpsa.2006.06.007>
- FOSS, J. 1984. On Accepting Van Fraassen’s Image of Science. *Philosophy of Science*, **51**(1):79-92. <https://doi.org/10.1086/289165>
- FOSS, J. 1991. Discussion: On Saving the Phenomena and the Mice: A Reply to Bourgeois Concerning Van Fraassen’s Image of Science. *Philosophy of Science*, **58**(2):278-287. <https://doi.org/10.1086/289616>
- GIERE, R.N. 2009. Essay Review: Scientific Representation and Empiricist Structuralism. *Philosophy of Science*, **76**(1):101-111. <https://doi.org/10.1086/599278>
- HUMPHREYS, W. 1929. *Physics of the Air*. New York, McGraw Hill Book Company Inc., 654 p.
- KRAML, H. 1994. Roger Bacon’s Theory of the Rainbow as a Turning Point in the Pregalilean Theory of Science. In: G. MEGGLE; U. WESSELS (eds.), *Analomen 1. Proceedings of the 1st Conference “Perspectives in Analytical Philosophy”*. Berlin/New York, De Gruyter, p. 353-361.
- KUKLA, A. 2000. *Social Constructivism and the Philosophy of Science*. London, Routledge, 192 p.
- KUSCH, M. 2013. Microscopes and the Theory-Ladenness of Experience in Bas van Fraassen’s Recent Work. Available at: http://www.academia.edu/2542922/Microscopes_and_the_Theory-Ladenness_of_Experience_in_Bas_van_Fraassens_Recent_Work. Accessed on January 2nd, 2013.
- VAN FRAASSEN, B.C. 1980. *The Scientific Image*. Oxford, Clarendon Press, 235 p. <https://doi.org/10.1093/0198244274.001.0001>
- VAN FRAASSEN, B.C. 1992. From Vicious Circle to Infinite Regress, and Back Again. *Philosophy of Science Association Proceedings*, **2**:6-29. <https://doi.org/10.1086/psaprocbienmeetp.1992.2.192822>
- VAN FRAASSEN, B.C. 2001. Constructive Empiricism Now. *Philosophical Studies*, **106**(1-2):151-170. <https://doi.org/10.1023/A:1013126824473>
- VAN FRAASSEN, B.C. 2008. *Scientific Representation: Paradoxes of Perspective*. Oxford, Clarendon Press, 422 p. <https://doi.org/10.1093/acprof:oso/9780199278220.001.0001>

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¹³ If ‘images’ were a subcategory of ‘entities’, distinct from ‘events’, then of course including the rainbow in the latter would preclude the possibility of including it in the former.

¹⁴ ‘Public hallucinations’ are divided by van Fraassen into ‘copy-qualified’ and ‘not ‘copy-qualified’ (see van Fraassen, 2008, p. 104). While I disagree with considering the latter as images, his strategy is clear: there exist phenomena that certainly are ‘images of something’, such as reflections in water, and others that certainly are ‘images of nothing’, such as rainbows. In the case of an image produced by a microscope, however, there is no way of (empirically) knowing whether they represent something real or not. This being so, maintaining an agnostic stance towards them cannot be considered irrational (van Fraassen could have called them ‘putative images’ then!). Even so, it is important to note that, according to van Fraassen, microscopes are devices that systematically create new phenomena, “that must also be saved by our theories, suffice to refute theories to be discarded, and serve to gather empirical information” (van Fraassen, 2008, p. 100). An anonymous referee of this journal (whom I thank for giving me the opportunity to clarify my position) suggests that, on the other hand, by considering a rainbow as an event and, consequently, that when someone sees a rainbow what she is observing is an interaction between light rays and water droplets, I am actually making an important concession to the scientific realist. For in the case of microscopic images, says the referee, since they are created by the interaction of microscopic objects, this perspective would imply that, after all, what we observe are the microscopic objects. I disagree with this objection, however, for at least two important reasons: (i) I do not think rainbows should be considered images (I used the locution ‘images of nothing’ for the sake of the argument, but if they are ‘of nothing’, then they are not images to me) and this suffices to ‘break the parallel’ between rainbows and microscopic images—observing a rainbow is on a par with observing a car crash or any other event, instead, even with respect to the empirical information that can be gathered; (ii) by saying that microscopic images are created by the interaction of microscopic objects, not only is the referee making a huge concession to the realist, but begging the question too! For of course, whether there actually are microscopic objects ‘out there’ (or, at least, that we can have any knowledge of them) is what is at stake in the realism/anti-realism debate. For all we know—a van Fraassian could object—the output of a microscope could very well be the result of a mere interaction between light rays and the microscope itself—or ‘noise’, to use a word that is common in microscopy.