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DISCUSSION

About the Reaction to *Styles of Thought on the Continental Drift Debate*

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Abstract
The article appearing previously in this journal entitled "Styles of Thought on the Continental Drift Debate" (Pellegrini 2019) prompted a response from Weber and Šešelja (2020) which they termed as "a defence of rationalist accounts". They argue that their self-designated "sophisticated rationalism" explains the closure of the continental-drift debate without being affected by my critiques to rationalist approaches. While ignoring the empirical evidence that shows the complexity of the debate and the necessity to include broader social elements in the analysis (such as scientists denying continental drift even after the plate tectonics theory, others supporting it without being familiarized with the literature), they proclaim to be unconvinced about the analysis of the styles of thought. In order to clarify differences in the approach to the continental-drift historical controversy, I respond here to the criticism my paper drew while discussing the place of rationalism when explaining the acceptance of a theory. I will argue that their distinction between "crude" and "sophisticated" rationalism does not solve the problem of social aspects being left aside by rationalists in view of the acceptance of a theory. I will also argue that in order to understand what leads people to embrace a belief (namely scientists in accepting a theory), the analysis of mere cognitive or epistemic arguments is not enough and it leads to a reductionist explanation as to social behaviour.

Keywords Styles of thought · Continental drift · Rationalism · Scientific controversy · Social acceptance of a theory · Relativism

1 Introduction

In a previous article appearing in this journal, I analysed the "Styles of Thought on the Continental Drift Debate" (Pellegrini 2019). Recently, Weber and Šešelja (2020) published a response to that article in which they call for a "Defence of Rationalist Accounts of the Continental Drift Debate".

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In my article I speak of different theoretical postulates with different kinds of evidence that were put forth during the long-lasting debate on the continental-drift theory that could be placed under two general styles of thought: one linked to fixism, the other to mobilism. The approach of the styles of thought enables the inclusion of elements foreign to the logical structure of the theoretical postulates in the debate, considering the broader cultural context as well as the dynamics of the social groups involved as conditions that help to explain the final adoption of the theory. My article questioned the traditional readings as to the adoption of this theory, which explained that Alfred Wagener's theory on the continental drift in 1912 had not been universally adopted in his time due to insufficient empirical evidence, which data was supposedly presented by Harry Hess decades later. Weber and Šešelja (2020) (from now on W&S) in their "defence of rationality" argued that this explanation may lie with certain rationalistic perspectives that they referred to as "crude empiricism", but not to others self-designated by them as "sophisticated rationalism".

In this response I will revise the criticism to the rationalist perspectives, acknowledging that there are different kinds of approaches to the continental-drift debate within rationalism, but stating that those variants do not solve the issue under discussion as they necessarily reduce social behaviour (regarding the acceptance of a theory) to a matter of abstract logic. To that end, I will describe the different ways to explain the closure of the continental drift debate, exploring the problems of the rationalist perspectives when deploying logical arguments as an explanation for the social acceptance of a theory. My response will focus on two problems triggered by W&S's reaction: the limits of their social explanation as they only rely on the cognitive aspects of the theory, and their disregard of the empirical evidence that exposes the social complexity of the scientific community´s behaviour in the controversy over the continental-drift theory.

2 Ways to Explain the Closure of the Continental Drift Debate

In my previous publication (Pellegrini 2019), upon describing the styles of thought that surrounded the debate on continental drift, I stressed the necessity to concentrate on the cultural patterns underlying the debate in order to appreciate the changes in the social acceptance of the theory within the scientific community. Nevertheless, W&S reacted (to that article) calling upon the defence of rationalism. Curiously, whenever the analysis of a cognitive phenomenon is undertaken on the basis of the social studies of science that introduce social variables in the comprehension of scientific development, certain voices feel the need to come to the defence of science or rationality, even when those issues are not being attacked.[1] In any case, what was being criticized in my article was rationalism as a

[1] In reviewing the relativistic perspectives of knowledge during the decade of the 1970s, Harry Collins noticed that "it has in turn precipitated arguments in 'defence' of science, a defence which seems misguided since the relativist position is not usually intended as an 'attack' on science any more than, say, moral relativism is an attack on moral standards" (Collins 1981, 216).

reductionist argument—namely, the idea that the possibility to demonstrate that one theory is better than another on an abstract plane is what explains the acceptance of the former within the scientific community. Whenever such argument is deployed, whether it is as part of a "crude" or "sophisticated" approach, there is the following problem: a philosopher finds a theory better (or more successful, rational, and so on) arguing that it may solve a problem other theories could not, and concludes a historical controversy was resolved for such reason. That assumption is weak because the abstract comparison requires a series of prior definitions that are allegedly homogeneous, but they are not usually mutually shared, since the social actors may come from different cultures. On an abstract plane, one may attribute greater problem-solving capacity to one theory over another (sophisticated rationalism), or with broader evidentiary support (crude rationalism), but other scientists may still disagree or may even have different reasons to reject that theory. In other words, scientists can have different interests and divergent interpretations, come from opposing traditions, have differing definitions of the problem that is to be solved, and therefore, harbour diverging preferences regarding what they consider to be a better theory. So what scientists discuss in a controversy needs to be empirically analysed, not just presumed.

While defining themselves as sophisticated rationalists, W&S reinforce the reductionist perspective in their response. Indeed, in describing the case, W&S explain:

> Wegener's continental drift theory was first published in 1912 (1912; 1915), but the majority of the scientific community remained unconvinced about its merits. In the 1960s, a new continental drift theory was developed by Harry Hess (1960; 1962). That theory quickly came to be generally accepted (…) The variant of continental drift that—contrary to Wegener's original version—became generally accepted in the 1960s, contains substantial improvements compared to what Wegener proposed. (Weber and Šešelja 2020)

And further on:

> The reason why the scientific community did not accept Wegener's proposal was not mainly due to the absence of convincing empirical evidence. Rather, the theory had unresolved conceptual issues, casting doubt on its plausibility. Scientists had a positive reason to oppose Wegener: generally accepted knowledge in physics made his theory implausible (Weber and Šešelja 2020, 483)

Up to here, the reader receives two "facts": (1) that the scientific community was not convinced of the merits of Wegener's theory when he presented that thesis in 1912 because the latter contained conceptual problems and (2), when Hess presented the new development in the theory in the 1960s, that modified version was rapidly accepted.

But those "facts" are only presumptions: scientists in the controversy are attributed to have reacted in a certain way for those reasons, but no evidence is presented, it is only assumed. It is understandable, though, that through a rationalist perspective, this attribution is the only one conceivable: if one believes that a unique and universal logic exists and that this governs the scientific community, upon confirming that one theory is logically superior to another, the scientific community has to accept the former and there is no need to see how it actually behaves—the behaviour of the scientific community in that regard

would be a by-product uniquely determined by a universal logic. This conclusion implies that scientists are mere reasoning machines.[2]

Laudan does something very similar when he states that: "Plate tectonic theory triumphed in the 1960s over stable continent geologies principally because the former, but not the latter, could explain long-familiar patterns of continental fit and similarities of fauna and flora between the Old World and the new" (Laudan 2004, 17). According to whom did the theory "triumph" for this reason? The explanation of the philosopher here is objectified, placed in what supposedly occurred among the scientists of that period. The reality, however, is that those partisans of the concept of continental geologic stability had their own explanation for the similitude in the continental coasts and in the fauna and flora between the Old and New Worlds. Moreover, they also had diverse critiques of the tectonic-plate theory and, according to them, evidence against that model. For them, said theory would not resolve any problem. At the same time, various scientists had found an explanation they deemed satisfactory for the continental fit and the similarities in fauna and flora between the Old and New Worlds in theories about the continental drift similar to Wegener's some time before the appearance of the tectonic-plate theory.

Briefly, the intellectual operation taking place in this rationalist explanation is the following: At any specific time after the controversy has occurred, without the need to investigate any social aspect that may give some sense to the position taken by the scientists in the debate, a rationalist philosopher places on the operating table the two theories side by side and determines that the first is better to explain a specific phenomenon. From that point on, he concludes that the second theory was not accepted at the time because it was not as good. As an epistemic exercise, and as a reinforcement of the winning theory, this treatment is quite good. As an explanation for the behaviour of the scientists that led them to adopt one belief and discard other differing positions, that same explanation is highly limited.

W&S's consideration that Hess's theory in the 1960s had a greater problem-solving effectiveness than that of Wegener in 1912 is not the issue; the problem is their assumption that such consideration was shared by the scientific community through the controversy and that it explains the rejection to Wegener's theory and the acceptance of Hess's plate tectonic theory. I have no reason to doubt that the theory as presented by Hess in 1962 is more complete than the one Wegener published in 1912. What I do maintain is that any such difference is irrelevant when it comes to explaining the acceptance of the theory. In fact, I do not doubt that Wegener's theory was even much more complete than that of the Flemish cartographer Abraham Ortelius in 1596. That consideration, however, is irrelevant here: one theory can be more complete in terms of providing more answers to certain questions, but that does not explain its social acceptance because other people may concede importance to another questions, or have different explanations, or find objections to that same theory.

The reason why the continental drift theory finally achieved such acceptance must be sought elsewhere, other than the supposed intrinsic value of its rationality. For greater detail, I will refer the reader to my original publication. The central idea is that, in debating the continental drift theory, geologists were manifesting two opposing styles of thought, mobilism and fixism, which dynamics was part of a wider debate on the modes of understanding reality. The partisans of fixism were linked to creationist ideas, while the mobilists

[2] For the same motives, Bloor asseverated that, in analysing the behaviour of scientists, they could not be conceived of as having detached intelligences moving in an abstract world of thoughts, theorems, and deductions, nor they could be seen as mere carriers of interests or power struggles: "These things were part of their world but not the whole of it" (Bloor 2011, 403).

supported postulates that were more dynamic and evolutionist. At all times, the fixists and mobilists spilled out arguments, theories, and proofs that supported their position and hurled sharp criticism and what they considered proof that discredited their opponents. The fixists continued losing ground in different social spaces, and the mobilists advanced to occupy decisive positions in the universities around the decade of the 1970s. Within the framework of this wider debate of ideas, I explained the acceptance of the continental drift theory, which enabled geologists to vindicate Wegener so many years after the formulation of his theory—just like Gregor Mendel's genetic laws of trait inheritance, acknowledged long after he first proposed them. Each point of view in that confrontation was inherited from a more extensive tradition and which resolution was attributable to changes in the social spaces occupied by the parties in conflict.

3 All the Rationalisms, the Rationalism

W&S criticize the lack of a definition of rationalism in my work. They, in turn, distinguish two types of rationalists—those they call "crude empiricists" and the "sophisticated rationalists"—, and maintain that my criticism is only valid for the former.

Nevertheless, I did define the rationalist perspective as one that "favours internal understandings of what knowledge is" (Hacking 1999, 91–92), and that assumes "universal, context-independent criteria of truth and rationality" (Barnes and Bloor 1982, 35). W&S say that they can be in favour of an internal understanding and also, as with Laudan, accept contextual elements. Notwithstanding, their approach was in fact mainly internalist: they maintain a nucleus of supposedly pure and universal rationality around a scientific theory that serves to explain the social acceptance of said theory, where each and every contextual element becomes either unnecessary or only useful to explain the "deviant" behaviour of those not accepting the *superior* theory. Undoubtedly my original paper highlighted the rationalist viewpoint that explained a scientific development based on the weight of the evidence: my critique was centred on that kind of explanation because that is where the habitual interpretations involving the continental drift theory reside. Nevertheless, other rationalist variants are equally the object of criticism each and every time the same definition of rationalism is used to explain the social acceptance of a scientific fact as being the logical consequence of an intrinsic trait of that scientific fact—whether it is a more thorough theory with greater capability for problem-solving or broader evidentiary support. W&S may differentiate between crude and sophisticated rationalisms, but despite their differences, both forms of rationalism inherit common traits from internalism, which implies a reductionist explanation to the social acceptance of the theory. What I am questioning is the assumption that the logical explanation subsumes the social one because it ignores the fact that any scientific development acquires a given sense provided some prior premises are socially shared. In scientific debates and conflicts, we can delve into the social matrix and cultural conditionings that may prompt members of the scientific community into disagreeing with a given scientific fact. What I am therefore questioning here is how rationalism deals with scientific theories and findings while at the same time denies social and cultural conditioning.

Let us explore the following rationalist explanation presented in W&S's retort:

"We and other problem-solving rationalists hold that:

- Some of Wegener's assumptions turned out to be correct, while others turned out to be false.
- Wegener's views were rejected mainly due to the severe theoretical objections that his theory faced. The initial lack of consent was not primarily due to the lack of evidence.
- Wegener's theory was never accepted by geologists. In the 1960s they accepted the theory of Harry Hess, which differs in crucial respects from Wegener's." (Weber and Šešelja 2020, 489)

These key arguments are asserted by showing what postulates from Wegener's theory *are correct* (W&S terms) and which ones *are incorrect*. In that sense, they argue that a part of Wegener's theory was and is correct even today (the continents were once united in the super-continent Pangaea, which broke apart in the Cretaceous; continents move apart and they sometimes collide), but another is just incorrect (continents move laterally by ploughing through the ocean floor and lateral movements are caused by two forces: pole-flight and a tidal force). This way of classifying arguments exposes the circle in which rationalist explanations move: a theory is accepted because it is basically correct, consequently, to explain its acceptance, one has to look for what is correct. The problem with such reasoning is that it seems unable to conceptually separate what "is correct" from what "is considered correct". By treating the social sphere as a logical one, the relativeness implied in the cultural and contextual dependence as to what a scientific community considers right at a defined moment is lost behind the enchantment of what is apparently an absolute truth. In other words, what is considered correct or not in a theory may change over time, so to indicate what is now considered correct only speaks about the actual state of consensus about that matter. It does not show what the opinion of it was in the past. Moreover, it does not prove the relative importance that a scientific community gives to every correct/incorrect statement.

In regard to this last issue, it could be argued that, in its fundamentals, Wegener was always considered right by some colleagues. In fact, Hess himself supported Wegener's theory of continental drift as he himself reasserted that the once-joined continents had separated into the seven existing today, and they had done so because they are transported by the shifting tectonic plates on which they rest. This does not explain why Wegener was rejected in his time, but it helps to understand why he was later vindicated as the founding father of continental drift: over the last decades geologists have valued his approach as being fundamentally right. Then if we ask ourselves "why was it not acknowledged back in his time?", a rationalist would continue to call for some internal merits to the theory and therefore classify its rejection as irrational, or the other way round. Our explanation, as already stated, looks for other social factors to understand how scientists deal with a scientific theory.

Although W&S consider it ambiguous to criticize rationalist approaches without differentiating between "crude" and "sophisticated", it is not so, since they are both absolutist perspectives that posit universally valid truths, and as such they refuse to see how knowledge makes sense depending on the culture that produces or adopts such knowledge. The debate about the anti-relativist implications of rationalist perspectives is certainly interesting, but unfortunately it goes beyond the scope of this paper. Nevertheless, it could be said that quoting Laudan is not reason enough to assume rationalism

as culture-dependent, because the cultural values that Laudan finally considers when explaining a theory and its acceptance are just cognitive ones (Barnes 1979).

W&S certainly share an anti-relativist belief, as their answer labels postulates as "correct"/ "incorrect" as if they were absolute truths instead of time and context-dependent consensus. In short, W&S would agree to criticize the use of empirical evidence as an absolute and univocal reason for the adoption of a theory (in a "crude rationalist" way), but they are instead placing some cognitive value of the theory as the reason for its adoption. They shift the place of the absolute reason, but they still behave as absolutists and therefore they have a reductionist explanation for the social adoption of the theory. This is the kind of discussion that enabled Bloor to argue that there is no third way between relativism and absolutism (Bloor 2020).

4 Evidence Is Never Enough, but It Counts

My original paper presented empirical evidence that proved the behaviour of the scientific community had been different, but W&S simply ignored it. In effect, I stated that Hess presented his theory in 1962 but he did not receive the immediate or full acceptance of the scientific community back then, which did not surrender to the strength of the theory or its evidence. In fact, the Royal Society of London held a symposium in 1964 devoted to the continental drift theory where a group of distinguished scientists manifested their frank rejection of Hess's theory. In subsequent years, the objections against the theories of continental drift and tectonic plates multiplied and scientists continued asserting that "the continents have almost certainly not moved with respect to each other" (Wesson 1972, 185). Even more significantly, I managed to recover a survey that Nicketi et al. (1978) conducted on geologists in the 1960s and 1970s where those who had recently accepted the theory and those who remained fiercely against it were equally thoroughly versed in the new literature: that is, they all had manifested a "relative independence of acceptance from degree of familiarity with the literature" (Nicketi et al. 1978, 664). In conclusion, whether Hess provided the scientific community with a superior theory and consequently everyone therein ceded to the superiority of that theory cannot be asserted. Those who were already convinced of the theory of continental drift viewed Hess's findings with favourable eyes (having read his reports or not), while those that opposed the continental drift theory rejected those same findings. In the same way, Wegener's theory was not discarded at the time for conceptual problems, since it enjoyed a certain enthusiastic support, and those who criticised it did so with all manner of diverse arguments.

It is understandable that for (sophisticated) rationalists the cognitive values of a theory are so decisive for its social acceptance that they usually have no interest in how the social actors actually reacted, as they assume which reaction *must* have taken place from the analysis of the problem-solving capacity of the theory or some other cognitive aspect of it. But as mentioned above, I have presented evidence showing the scientific community did not react as expected, many did not surrender to the problem-solving virtues of Hess's postulates, for instance.

At this point, it should be clear that no one in this discussion supposes that any empirical data can close a debate. But that does not mean that empirical evidence is irrelevant or should be disregarded. Many relativists give a lot of importance to empirical evidence, whether you call us constructive empiricists, materialists, or other. We can

encounter the same piece of evidence and still infer different conclusions. For instance, a rationalist could accept the evidence I presented and argue that those scientists rejecting Hess's postulates were behaving irrationally, and I would instead counterargue that they belonged to a different style of thought and they valued Hess's theory differently. It would be honest disagreement so long as we did not ignore the empirical data on the scientific community's reaction, beyond the reaction they were supposed to have.

5 It Is Not About Rationalism "Failing", but Its Limited Resources to Explain Social Behaviour Regarding a Theory

Although the rationalistic explanations of the continental drift controversy are quite frequent, as stated above, W&S insisted on an epistemic explanation ignoring the empirical evidence brought forward in my article regarding the behaviour of the scientists involved. But that absence does not constitute the sole distortion of my original study in their reaction. Indeed, W&S assert that "the author [Pellegrini 2019] argues that rationalist accounts of the continental drift debate fail because…". In fact, in various places, they insist that I state rationalism *failed*. I was deeply drawn by this fact because, when outlining a perspective that seeks to understand knowledge in context, I never resort to general affirmations regarding the success or failure of a theory, nor to its absolute truth or falsehood or its rationality or irrationality; instead of doing so I would ask "*failure for whom and in what sense?*", so I would never be prompted to characterize a perspective just as a failure. Moreover, I do not believe that rationalism has failed in its attempt to explain the continental drift theory by appealing exclusively to internal elements of knowledge. Rather, what I have indicated is that this approach does not allow us to see other things, and accordingly "I have intended to show that continental-drift controversy can also be useful for the study of social and cultural backgrounds which condition the acceptance of a scientific theory" (Pellegrini 2019, 99).

For the sake of clarity: I criticize rationalism as a reductionist argument in explaining social acceptance, not the rationalist analysis of the cognitive aspects of theories. In other words, I criticize the poor range of epistemic analysis when they pretend to explain social phenomena, not when they explore logical meanings of theories.

Thus, if I had, in fact, maintained that rationalism had failed, such a statement would have been a problem in my own perspective. The possibility prompted me to reread my paper meticulously, fortunately, no contention of that sort was present anywhere. This incident, nevertheless, can serve to illustrate something interesting about my argument in connection with the styles of thought: the difficulty to decode the thinking of another when one is deeply rooted in a different point of view. Kuhn expressed the same notion when he indicated that, when one identified with a paradigm, to see something that did not fit into that same paradigm was very difficult. It is even difficult to perceive an anomaly because one is prepared to see only what that paradigm conditions one to see. In a similar sense, those in the debates over the continental drift theory that were firmly attached to a fixist style of thought tended to ignore or belittle the mobilist arguments; and furthermore, when confronted with opposing evidence or theories, either found ways of reinterpreting those in their favour or finding problems to invalidate them—with the same dynamic occurring in reverse for the mobilists with respect to the fixist postulates. Likewise, in an analogous sense, if someone is too convinced that the acceptance of a theory depends on its intrinsic superiority—with that attribute being its greater capability

of resolving a problem or the stronger evidence supporting the theory—they will tend to see theories in terms of successes or failures and to distain the importance of social behaviour: because the acceptance of a theory is presumed to be a logical consequence of its "success".

6 Conclusion

In this article I have analysed W&S's reaction to the 'Styles of Thought on the Continental Drift Debate' pointing out that:

- Different forms of rationalism may indeed be deployed, some emphasizing the role of evidence while others analysing theories on behalf of their capacity to solve problems, for instance. But what I criticised is their use as an explanation for a social behaviour before a scientific controversy. No matter what variant of rationalism it is, if it explains the adoption of a theory by a community as a matter of exclusively internal epistemic issues, it becomes a reductionist explanation and it misses the possibility to see the influence of broader social aspects. If a rationalist perspective attempts to show on an abstract plane that one theory is better than another and from thereon it presents it as what explains the acceptance of a theory within the scientific community, that argument is fiercely reductionist, and it is what I am criticizing in the usual interpretations of the continental drift debate.
- W&S reinforce the reductionist interpretation of the continental drift debate by simply ignoring the empirical data that showed the heterogeneity of arguments, positions, proofs, and critiques deployed during the long debate about the continental drift theory. In that way, they can presume that it was only a matter of who proposed a theory that solved a problem, and when Hess finally provided such theory, everybody accepted it. I have shown that this was not just the case, since those who supported Hess's findings were already in favour of the continental drift theory while those who rejected them opposed the theory. Different interpretations, criticism, proofs were mobilized during the whole controversy, even when Hess deployed the plate tectonic theory, which was not accepted at once. At the same time, W&S tendency to analyse every argument in terms of "success" or "failure" (concepts that were not introduced in my work) reinforces the reductionist approach that shuns more complex social explanations.

Therefore, W&S's attempt to distinguish between crude and sophisticated rationalism may be interesting in epistemic terms, but it does not solve—rather it tends to reinforce—the problem to explain a complex phenomenon like the social acceptance of a theory only with epistemic notions. Finally, this attempt perseveres to the detriment of ignoring the concrete elements mobilized during the controversy (such as the diversity of arguments and the persistence of the confronting positions in spite of new evidence and theories), elements that become understandable within social factors, as can be found through the styles of thought.

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