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UNDERSTANDING WITHOUT EXPLANATION: A STILL OPEN ISSUE

Abstract

This paper takes a stance in the debate concerning scientific understanding. It claims that the case for a specific type of understanding, understanding without explanation (UwE), is still open, despite the tendency in the current literature that might suggest otherwise. The paper begins by situating the distinction between an explanatory and non-explanatory understanding in the debate on understanding by introducing Lipton's account of UwE. The paper then discusses the significance of Lipton's proposals for the debate and argues that Kelp's interpretation does not exhaust the challenge they pose to any theory of understanding. The paper then examines the best articulated critique of Lipton's account provided by Khalifa and rejects it as inadequate. It ends by sketching out a list of positive reasons that support the continued examination of UwE.

Keywords: scientific understanding, understanding without explanation

1. A BRIEF RETROSPECTIVE LOOK

Scientific understanding has not been a mainstream topic in the philosophy of science in the analytic tradition. However, its profile was raised recently, in the aftermath of the climax of the great debates on scientific explanation, at the end of the last century.[1] But it also emerged in the frame of these debates. It should come as no surprise, therefore, that the topic of scientific understanding

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[1] A good review of the debate with presentations of the major moments and directions till the end of the 1980s can be found in Salmon 2006.

retained a direct reference to the notion of explanation. My argument touches on this point and exposes the assumptions that are determining the directions of the inquiry on understanding.

The subject of scientific explanation had a respectable position in the philosophy of science for most of the second half of the last century. After its inception by Carl Hempel (1948, 1965) in the context of neopositivism, it attracted the attention of philosophers of science and triggered serious debates. With the declining influence of the Hempelian model during the 1980s, more varied approaches, such as the influential unificationist approach (Friedman 1974, Kitcher 1981) or the causal one (Salmon 1984), polarized the discussion. Understanding was initially rejected by Hempel as an unsuitable object of inquiry through logical and philosophical means, due to its pragmatic nature (Hempel 1965). Yet the next generation of philosophers — albeit informed by the spirit of neopositivism — did not ignore the importance of scientific understanding. They acknowledged that understanding is a major goal of scientific inquiry and therefore did not dismiss it but placed it among the topics of philosophical analysis.[2]

The unificationist approach was a mainstream approach to explanation which reevaluated understanding, especially through Michael Friedman's account. According to his view, any theory of explanation should also show what understanding the scientific explanation produces and how this is accomplished. In order to make understanding respectable — that is, eliminate its subjective and pragmatic dimension — an account has to isolate a property that embodies the objective sense of scientific understanding (Friedman 1974). In Friedman's view, this can be done only by simultaneously offering an explication of explanation and understanding. He criticizes any approach that will first define explanation and proceed afterwards to clarify understanding. This makes any approach to understanding totally dependent on the approach taken on scientific explanation. Furthermore, this position was taken by those who were researching explanation at that time.

It took some time until radical new views surfaced in explanation research. Early harbingers were Gerhard Schurz and Karel Lambert (1994), who advanced an account of scientific understanding totally independent of explanation, but not without subscribing to the idea of understanding as unification, central to the unificationist approach. Just after the turn of the century one could see emerging a real debate around the subject. The philosopher Henk de Regt (de Regt, Dieks 2005) can be regarded as a pioneer in this sense, with his contextual theory of scientific understanding. J. D. Trout

[2] As does Friedman (1974) in his seminal paper.

(2002) was one of the first fervent opponents of this new research, when he dismissed the value of applying a philosophical approach to the topic of understanding.

A parallel tendency of reevaluating understanding has flourished during the last two decades and has found its expression in virtue epistemology. Thus, understanding has attracted the attention of some epistemologists such as Linda Zagzebski (2001), Wayne Riggs (2003), Jonathan Kvavig (2003) with the promise of reconfiguring the epistemological agenda by rediscovering the value of understanding. As the voices in the two philosophical fields, epistemology and philosophy of science, multiplied, the subject gained momentum, and cross-fertilizations appeared in this landscape. The recent volume edited by Stephen Grimm and collaborators (2017) presents a good sample of these tendencies in both philosophical fields. However, as a recent review suggests (Dellsen 2018), not everybody is happy with the intersection of these research interests. I will return to this point below.

2. THE EXPLANATORY AND NON-EXPLANATORY UNDERSTANDING

In this section I will track the distinction between explanatory and non-explanatory understanding as it has been suggested, but rarely made explicit, in the mainstream debate. Indeed, it could be argued that the distinction has been rather overlooked and suppressed. Even today it has a precarious status, which might give the impression that we have almost solved the case, or at least it is not a real issue to be addressed in a proper way. As will be discussed further below, this is mainly due to the debate on understanding being dominated by a reductionist view on the subject. On the other side, the more applied investigations of scientific practices could not ignore such a distinction, but in most cases, it did not reflect on it in an explicit way. The exception to this was the proposal advanced by Peter Lipton (2009), which I will discuss at the end of this section, and then defend in the next section.

At first sight, the distinction between explanatory and non-explanatory understanding might be a bit confusing. This may arise from a strong underlying natural trend to consider explanation and understanding together, and this has been reflected in the historical evolution of the debate on explanation. As was already discussed above in the first section, Friedman sees any decoupling or prioritization of the inquiry on understanding and explanation as unreasonable. According to Friedman (1974), we can find out what understanding is just by simultaneously inquiring what explanation is. The close

connection might also have a good methodological reason linked to the need to secure the objective dimension of understanding. Explanation approaches already did or tried to secure such an objectivity previously; by coupling understanding to explanation together, we might have a stronger warranty for securing the objectivity of understanding too. In this circumstance there is no place for a non-explanatory form of understanding, which seems to be unconceivable.

The situation has changed in recent discussions. The reductive approach to understanding[3] in the recent debates on understanding could be seen to broadly follow a more general original attitude.[4] Kareem Khalifa (2017) provides a more elaborated view that might be called the "redundant view," since "understanding is redundant given a theory of explanation" (Khalifa 2012: 17) and is made explicit by the EMU (Explanatory Model of Understanding) thesis that states that "any philosophically relevant ideas about scientific understanding can be captured by philosophical ideas about the epistemology of scientific explanation without loss" (Khalifa 2012: 17). This echoes the classical attitude but does not simply restate Friedman's view. Like Friedman and the classics, Khalifa is coupling understanding to explanation, but for him the possibility of non-explanatory forms of understanding is no longer unconceivable. In fact, Khalifa puts a lot of effort into rejecting this possibility. I will discuss his argument, and then I will reject his critique, in a later section. Unlike Friedman, Khalifa is not concerned with recovering understanding in the frame of a theory of explanation, nor is he interested in providing an articulated theory of explanation. Nevertheless, he offers a sometimes sketchy explication of what he takes to be an explanation. He pushes understanding in the epistemological register and offers a theory of explanatory understanding.

The other element of the distinction, the non-explanatory form of understanding, is harder to be tracked within the debate on understanding. Its plausibility emerges gradually and haphazardly — that is, more by tackling particular cases and specific scientific contexts and less by a general characterization. This emergent approach to understanding was framed by a recent particular approach in philosophy of science, the philosophy of science in practice, which aims to reshape the philosophical approach to understanding by overcoming the neopositivist setting that considers mainly the final products of science — that is, theories and their relation to the world. It intends to improve the understanding of science by recuperating the practice of science

[3] I call it reductive in trying to capture the intention of the authors to closely connect and reduce its inquiry to the one of explanation and its associated epistemology.

[4] Friedman's view could be called the "original" or "classical" attitude to understanding.

and the processes through which science unfolds and scientific results are elaborated (Ankeny, Chang, Boumans, Boon 2011). This approach rejects the classical theory-centered approach to science by reevaluating the role and importance of other scientific representations, especially scientific models. It also has a more pragmatics-friendly orientation by allowing pragmatics to play a major role in scientific practice and by explicitly embedding pragmatics in the account.

Usually, the philosophers of this approach engage in an investigation of particular scientific domains and contexts, and often their intention is to explore new ways of looking at the scientific inquiry process and knowledge production. It is in such contexts that the distinction between the two kinds of understanding became apparent, and therefore one might say that it was rather identified in case studies than theorized distinctly. The volume edited by de Regt and collaborators (2009) is representative of this approach, as most contributions do not even mention the distinction between the two forms of understanding, leaving it more implicitly stated. Lipton's contribution (2009) is nevertheless an exception to this approach, as he aims to provide a more general clarification of the distinction between the explanatory and non-explanatory understanding, and moreover, advances a bold theory of "understanding without explanation" (UwE). I will use this as the basis for my further discussion and defense of UwE.

Firstly, I will present a brief outline of key elements of Lipton's proposal in order to discuss later its importance for the issue under scrutiny. In his paper "Understanding without Explanation," Lipton (2009) argues that a non-explanatory understanding is possible by suggesting that understanding can be decoupled from explanation by the following two steps: (1) by identifying the cognitive benefits of an explanation with understanding (and not the explanation *per se*) and (2) by suggesting that such benefits could be gained also through other means than explanation. The benefits are identified in terms of knowledge such as: causality, necessity, possibility, or unity, through diverse non-explanatory means such as: models, visualizations, manipulations, thought experiments, or possible explanations. In Lipton's view, visual models and the manipulation of physical systems can provide a tacit knowledge of causes, hence causal information without explanation, as in the case of experiment manipulation (for example, through visualizing the retrograde motion of a planet by observing it at a planetarium). Optimization and symmetry arguments or thought experiments constitute examples of non-explanatory deductive inferences that usually provide knowledge of necessity, as is the case of Galileo's argument for the independence of acceleration and mass. The tacit knowledge of unification could be provided through non-explanatory analogies

as illustrated by the exemplars mechanisms that Kuhn emphasized, through the scientists' abilities to select problems and generate solutions. The last case that I will discuss in more detail in this paper is related to false explanations — that is, merely potential explanations that would provide modal information and knowledge of possibilities.

3. WHAT DO LIPTON'S PROPOSALS REVEAL?

In this section, I will address the question of why Lipton's proposals to approach understanding are important. If one looks at the reception and proliferation of Lipton's ideas, one might see how they became a challenge for some mainstream approaches. I will focus next on what this challenge might be and how Christoph Kelp's construal of this challenge does not settle the issue.

Lipton's examples seem uncomfortable for the reductionist approaches, but not to all the parties involved. Some of the adherents of this view, such as Michael Strevens (2012) or Khalifa (2012, 2013, 2017) admit that these examples threaten their approaches and engage with them directly. Khalifa takes great pains to offer a general argument against Lipton's proposals, and he rejects them as not providing a genuine form of understanding.[5] But no author, apart from Kelp, advances a construal of the challenge that Lipton's proposals might raise. I will first discuss Kelp's approach, and then show how I partially agree with his interpretation. Nevertheless, I will argue that his theory of understanding, which was intended to meet the challenge, is not satisfactory from the perspective of the inquiry into understanding in scientific contexts.

Kelp (2015) tries to explicitly state the threat that Lipton's proposal constitutes for the other accounts. He claims that it exposes the overintellectualization of the approaches, which he divides into two major groups: the explanationist and the manipulationist. Explanationism invokes explanation as the key to understanding, whereas manipulationism appeals to the ability to manipulate certain representations as central to characterizing understanding.[6] The "overintellectualization" refers to the fact that these approaches theorize understanding at an inadequate level by asking for more demanding intellectual capabilities than are involved in the act of understanding. In Kelp's

[5] I will discuss his argumentation in more detail in the next section.

[6] For the explanationists, "understanding in essence involves knowledge of correct explanations," while for manipulationists, "understanding involves a specific kind of ability on the part of the cognitive agent, roughly, an ability to perform manipulations of representations of the phenomena understood" (Kelp 2015: 3800).

words, "the intellectual demands they place on understanding — knowledge of an explanation — are unrealistically high. Less sophisticated cognitive achievements can qualify as understanding" (Kelp 2015: 3801). In the case of the explanationist accounts this might be clear, as a full-blown explanation is needed to fully grasp understanding. In the case of de Regt's manipulationist account, the invocation of a scientific theory and the related skills that are needed to apply it supports Kelp's criticism. It is less clear in the case of Daniel Wilkenfeld, whose theory construes understanding as manipulation of a representation in a quite broad and unspecified way.[7]

Kelp's theory of understanding is intended to overcome the limitations of the other approaches, including the one of overintellectualization. His account is articulated in three main steps: by defining maximal understanding (MAX-U), degrees of understanding (DEG-U), and outright understanding (OUT-U). Maximal understanding of a phenomenon *P* is attributed to someone who has "fully comprehensive and maximally well-connected knowledge of a phenomenon P" (Kelp 2015: 3811). In the next step, different degrees of understanding of *P* are modeled as a function of the distance from this maximal state of knowledge. The last step introduces a contextually variable threshold of the distance from maximal understanding that characterizes the outright understanding of *P* in a context *c* of a subject *S* if "*S* approximates fully comprehensive and maximally well-connected knowledge of *P* closely enough to be such that *S* would (be sufficiently likely to) successfully perform any task concerning *P* determined by *c*, if, in addition, *S* were to have the skills needed to do so and to exercise them in suitably favorable conditions" (Kelp 2015: 3813).

I argue that Kelp's account reaches its intended goal only to a certain degree and fails to provide a final answer to Lipton's challenges. His theory escapes the shortcoming he identifies in the other approaches: the overintellectualization, a reference to an "all inclusive" notion of representation as in Wilkenfeld's theory, or Khalifa's wrong choice for the ideal standard for understanding. Therefore, one might see his account as providing a viable epistemological solution where all the other have failed. Nevertheless, it fails to meet the challenges raised by Lipton's examples.

Kelp's theory is intended to accommodate Lipton's examples, but this is done in a too general and unfruitful way. Through DEG-U he avoids the overintellectualization by making room for lower non-demanding forms of understanding as instantiated in Lipton's examples, and through the OUT-U step it should capture the variety of these UwE, seen as instances of "outright under-

[7] Kelp identifies the main drawback of Wilkenfeld's theory in the use of a too "inclusive" notion of representation.

standing." But applying the OUT-U to Lipton's examples does not clarify further UwE. For example, the UwE gained through implicit causal knowledge might identify the successful performance with the successful manipulation of the system; but the other cases of UwE as the one through visual means or the one through the possible explanations are opaque through OUT-U.[8] It does not give us a clear understanding of which tasks could be successfully performed in the different contexts. It fails therefore to discriminate and characterize these forms in a way that should provide insights in their particularity. Therefore, from the perspective of an inquirer in philosophy of science, it fails to provide a satisfactory tool for inquiry into understanding in scientific contexts.

On the one hand, Kelp's overintellectualization interpretation and his request for allowing "less sophisticated cognitive achievements" to provide understanding clearly provides us with the possibility of distancing ourselves from an explanation-centered approach to understanding. In fact, the challenge to explanationism lies exactly in this move that cuts off the inquiry from the "safe" way of unfolding in the shadow of explanation. On the other hand, Kelp's account does not tell us to how to approach Lipton's examples and does not provide the necessary power and resolution of getting useful insights in concrete contexts of building scientific knowledge. This inability to provide proper resources to deal with concrete cases in scientific activity might be due to a wrong methodological take, and I will discuss this further below.

In order to substantiate the last suspicion and support my earlier claim, I will recall some recent remarks provided by Finnur Dellsén (2018) in a review-analysis of the recent volume *Explaining Understanding: New Perspectives from Epistemology and Philosophy of Science* edited by Grimm, Baumberger, and Ammon (2017). Dellsen exposes the failure of the volume to fulfill its main intention: bringing together the two main approaches — epistemology and the philosophy of science. The gap is identified in the difference between the two methodologies. While the philosophers of science develop ideas by appealing to specific aspects of scientific practice, epistemologists proceed by analyzing pre-theoretical epistemological concepts, like the one of understanding. The former try to capture a concept suited for scientific practice, while the latter focus on the ordinary concept of understanding. So, the danger arises that we produce results that fit with our pre-theoretical intuitions for explaining scientific practice. In fact, Dellsén suspects that Kelp's contribution in the volume does exactly this: it appeals to a number of intuitive results about people who show a better understanding of a subject than others.

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[8] One might suspect that the "successful performance" is related to the manipulation of representations of *P*, but Kelp does not endorse this interpretation.

I agree with Dellsén that Kelp's solution is not relevant to an investigation of understanding in scientific contexts. I think it fails to provide the necessary resolution to dissociate the diverse aspects of understanding in a scientific context, and therefore it cannot provide a starting point for characterizing different forms of understanding at work in scientific practice. In contrast, Lipton's examples instantiate or are similar enough to such type of understanding. The challenges posed by Lipton's examples are only partially rendered through the "overintellectualization" avoidance request that Kelp claims to have met by his theory. The most challenging aspect of the problem is to account for the types of understanding that the examples instantiate. The "high-level" approaches to understanding proffered by the philosophy of science are explanation-centered and fail to do justice to the full range of types of understanding. Therefore, the central element of Lipton's challenge remains open.

A discussion of this subject will not be complete without a close examination of Khalifa's fully-articulated explanation-centered account of understanding, which rebuts the non-explanatory type of understanding and subsumes any understanding to explanation-centered approach. I will turn to this in the following section.

4. REJECTING AN EXPLICIT CRITIQUE

I will now turn to Khalifa's explicit critique of Lipton's position, which is probably the most extensive critique of Lipton's proposal that has been articulated. I will sketch out a rejection of this critique and demonstrate that Khalifa's argument has weaknesses.

Khalifa first articulated his critique on non-explanatory understanding in his paper "The Role of Explanation in Understanding" (Khalifa 2013) and then reiterated it with some modifications in his 2017 book *Understanding, Explanation, and Scientific Knowledge* (Khalifa 2017). His position is clearly a reductionist one, with him denying any philosophical value to an approach that decouples understanding from explanation, and he boldly states that "any philosophically relevant ideas about scientific understanding can be captured by philosophical ideas about the epistemology of scientific explanation without loss" (Khalifa 2012: 17). In (Khalifa 2013) he scrutinizes Lipton's proposal by grounding his critique in what he calls "explanatory idealism," which claims that "other modes of understanding ought to be assessed by how well they replicate the understanding provided by knowledge of a good and correct explanation" (Khalifa 2013: 165). In the synthetic view articulated

later in his book (Khalifa 2017), he re-centers the critique by putting forward a more complete account of scientific understanding, which he calls the EKS-model (Explanation–Knowledge–Science model). This approach is based on two major principles: the Nexus Principle and the Scientific Knowledge Principle. His view takes a similar starting point as Kelp's account (Kelp 2015) by emphasizing a comparative perspective of understanding and by purporting those degrees of understanding are the central aspect of the approach. In this sense, the Nexus Principle states that a subject has better understanding than another subject by grasping more of the complete explanatory nexus. According to the second principle a better understanding involves a greater resemblance of this nexus to scientific knowledge.

In both versions (Khalifa 2012, 2017), the critique of non-explanatory understanding might be seen as unfolding in two major steps. The first one is a reconstruction of Lipton's framework that examines its main assumptions by focusing on the one called Lipton's Assumption (LA). The second step seeks to show that the explanatory sort of understanding is greater[9] than the non-explanatory one as instantiated in Lipton's examples. In the 2013 version this step gets implemented through a General Argumentative Strategy that measures the degrees of understanding while in the 2017 version the critique is articulated through the formulation of three major objections. I will concentrate on the central points of Khalifa's critique.

Lipton's Assumption (LA) refers to Lipton's claim that "it is more natural to identify understanding with the cognitive benefits that an explanation provides rather than with the explanation itself" (Lipton 2009: 43). In his attempt to clarify the assumption, Khalifa's "friendly" (as he puts it) reconstruction of LA states that: "If knowing that b constitutes understanding of p, then *there exists* a correct explanation e of p such that knowing that e explains p entails knowing that b" (Khalifa 2013: 165, my emphasis). The emphasis on "there exists" is meant to mark the particularity of the reading Khalifa is proposing — that is, a strong ontological sort of reading. We could therefore claim that there is always a correct explanation behind any non-explanatory form of understanding provided through a specific benefit. Khalifa's reading pushes this ontological claim as the only possible one, ignoring other variants. From the

[9] Where "greater" is rendered in a general form in the Superior Explanation Thesis, which states that: "For any non-explanatory way, w, to understand p, there exists a correct and reasonably good explanation, e, such that the understanding of p provided by w is a proper subset of the understanding of p provided by knowing that e," and in the particular case of the possible explanations "greater" is quantified through the number of answers to the w-questions — i.e., "what-if-things-would-have-been-different" questions that an explanation is supposed to provide. See below for more details.

fact that a benefit could be provided through an explanation it does not necessarily follow that such an explanation always exists, much less that there is a correct one. Moreover, it contradicts Lipton's main intention to open a gap between explanation and understanding by reorienting the entire inquiry in exactly the opposite direction. In fact, it could be said that once one accepts this interpretation, the entire subsequent critique is easy to accept. However, Khalifa might have realized this was his weak point, since in the book version of the critique, the strong ontological reading is dropped for the following more neutral interpretation: "If an explanation of p provides a kind of knowledge about p, then that kind of knowledge amounts to understanding why p" (Khalifa 2017: 127). Moreover, LA also becomes just a premise in a larger reconstruction of Lipton's entire argument for the existence of UwE.

In the chapter dedicated to UwE from his book, Khalifa formulates three main objections, which he calls: the Right Track Objection (RTO), the Wrong Benefit Objection (WBO), and the Explanatory Objection (EO) (Khalifa 2017: 127-130). The RTO claims that the sort of understanding gained through Lipton's examples might be just a provisional sort of understanding — "merely a way station for understanding with explanation" (Khalifa 2017: 129). The WBO cashes on the issue of the possible different natures of the benefits provided via an explanation versus a non-explanatory way. The EO objection claims that in fact the agents in Lipton's examples might "actually grasp a correct explanation" (Khalifa 2017: 130). From these three, just the last one reiterates openly the previous ontological claim. Nevertheless, the RTO, which could be claimed to be the most complete one, under which all of Lipton's examples might succumb, does also include this assumption, even if it is less explicitly stated. RTO in fact reiterates in a more condensed way the earlier version of the critique: RTO does not state the ontological claim explicitly but comprises the second major move of the critique. This second move is concerned with the unfolding of the General Argumentative Strategy in support of the claim that any non-explanatory form of understanding is a diminished one in comparison to the explanatory form; or, in Khalifa's words, the last one is always "greater" than the non-explanatory form. I describe this as the "bigger than" strategy, and I discuss it in more detail below.

In the earlier version of his critique, Khalifa appeals to a quantitative measuring of understanding that was presented in the Superior Explanation Thesis (SET). SET states that: "For any non-explanatory way, w, to understand p, there exists a correct and reasonably good explanation, e, such that the understanding of p provided by w is a proper subset of the understanding of p provided by knowing that e" (Khalifa 2013: 169). He implements SET through the General Argumentative Strategy with the intention of "measuring" the

degrees of understanding, and then applying this to each of Lipton's examples. I will focus on just the example of the benefit that provides modal knowledge through possible explanations, as rejecting this specific critique will be enough to show that Khalifa's strategy does not work, as it fails to rebut Lipton's challenge.

For Lipton, possible explanations, even false ones, could provide understanding through the modal information of the actual mechanism; they tell us something either about the contingency or about the necessity of the mechanism. In this sense they would offer understanding not only of possible worlds, but also of the actual world. Such a scientific example mentioned by Lipton is Darwin's explanation of natural selection through artificial selection, which illuminates the mechanism of natural selection. Other more fictional examples are discussed in more detail, such as a rigged boxing match between two boxers A and B, where B, far more experienced than A, agrees to take a dive in the tenth round and let A win. By chance, A knock-outs B in the fifth round through a lucky uppercut. The explanation that involves the rigging becomes in this way a possible explanation, which is in fact false, but still provides us with understanding, *pace* Lipton, through the modal knowledge on the actual mechanism.[10] For Khalifa, this could not offer any genuine understanding. This must be gained just if the explainer knows the actual cause — the existence of the lucky uppercut.

In the above case of modal understanding, Khalifa specifies further the "subset" relation mentioned in SET as involving the sets of w-answers that an explanation should always provide. According to James Woodward's account (2003), which is widely accepted nowadays, an explanation should provide w-answers — that is, answers to counterfactual questions of the form "what-if-things-would-have-been-different." The explainer would answer such questions by varying the conditions in the *explanans* and seeing the corresponding variation in the *explanandum*. The explanatory relation would define the set of w-questions and w-answers, such that the set will be relative to the specific *explanans*. The inclusion relation between the sets of answers to w-questions could therefore not be defined in a proper way; the sets would intersect but not include each other. In fact, to obtain such a strict inclusion

[10] In this case we get knowledge of necessity "by revealing fail-safe overdetermination." In Lipton's wording: "if the merely possible mechanism is such that it would have been actual, had the actual mechanism not been in operation, then showing how the phenomenon would have been produced by the alternative mechanism may help to show that the phenomenon had to occur, one way or another. Even though we already know how the phenomenon actually came about, the merely possible explanation thus improves our understanding" (Lipton 2009: 51).

relation one needs to make an assumption that is totally implausible — namely, that knowledge of the actual explanation implies knowledge of all possible explanations. There were also other voices to expose this tacit assumption in Khalifa's argument, since he feels the need to mention it. Nevertheless, his answer remains unconvincing, since it relies on the same initial strong ontological reading — the existence of a correct explanation.

In the above-mentioned case of exemplification, we could see how the inclusion relations between these sets fail. Suppose that we asked a subject who knows only the actual explanation what would have happened if A had missed the lucky uppercut. The normal answer would be that A would not have won. So, we could not get the right answer — provided by the one who would know the possible explanation that the match was rigged, and A would have won anyway — unless one assumes that the subject also knows the answers to the possible explanation and by extension to all possible explanations, justifying in this way the inclusion relation between w-answers. This additional assumption vitiates the argumentation.

Moreover, we might further claim that the subject who believes just the possible explanation — that the match was rigged — engages on a further investigation track which proves to be much more fruitful for expanding our knowledge. Under a special construal, such as the one proposed by de Regt and Victor Gijsbers (de Regt, Gijsbers 2017), who argued that effectiveness should be considered as a requirement for understanding (that is, that one should take into account the effectiveness in further expanding our knowledge, in acquiring new results, better methodologies, etc.), one could obtain a greater understanding from the possible explanation than from the actual one in our case. The understanding gained from the possible explanation would further direct our investigation towards the rigging practices and expand our knowledge more than by simply accepting that the match was won by simple chance.

In the 2017 version of his critique, Khalifa takes another path by invoking the Right Track Objection. He characterizes Lipton's cases as preliminary and incomplete forms of understanding, or proto-understanding, as he calls them. Such forms are "merely a way station for understanding with explanation" (Khalifa 2017: 129) — that is, they are on the right track. According to Khalifa, being on the right track means that one does not know the proper answer to a relevant explanation-seeking question but has information that would be useful in acquiring such knowledge. This characterization is on the one hand too inclusive, since in an inquiry context there are plenty pieces of information of this kind; and on the other hand, it ignores the fact that possible explanations are also involved in changing tracks and reorienting inquiry to-

wards a better track. Like in our example, the track of the correct explanation might be meager and irrelevant for the knowledge-expansion in comparison to the one of the possible explanations.

Another characterization of non-explanatory understanding in Khalifa's reconstruction is the one of proto-understanding, which refers to a sort of understanding provided by grasping just the explanatory roles of some propositions and not the full explanation (Khalifa 2017: 129). Grasping the direct explanatory roles involves grasping the *explanans* or *explanandum*, while indirect roles are attributed to other background information. Proto-understanding refers to this latter case, and we could quite well expose in this case an underdetermination, since many different explanations might appeal to the same pieces of information in the background involving indirect explanatory roles. So, grasping them does not warrant the uniqueness of the explanatory track — that is, the right track.

To conclude the discussion of Khalifa's criticism, we could say that, in order to bolster his argument, he overlooks and ignores important aspects of non-explanatory understanding. These forms are presented in the first criticism as diminished forms that can be retrieved from the full explanatory one. As we saw in the case of possible explanation, the argument fails to establish the inclusion relation. In the other attempt, they are presented just as stations — provisory stages on the track towards the full explanation. This view proves to be a narrow one that raises a series of unsolved questions.

5. SOME POSITIVE REASONS AND PERSPECTIVES

I have shown that there are no good reasons to reject the non-explanatory understanding, and that Khalifa's critique — at least one of the arguments, the most complete one — fails to achieve its aim. But there are also positive reasons why we should keep investigating these non-explanatory forms of understanding. In this section, I will briefly discuss some of the main reasons that support the fact that in the case of non-explanatory understanding the jury is still out.

The first reason which supports my claim points to the initial driving force of the research on understanding and the motivation of the pro-understanding camp. As was already mentioned above, the initial main intention was to liberate understanding from the subordinated position relative to explanation. The non-explanatory forms of scientific understanding fulfill this desideratum in the most direct way and bring it to its ultimate consequences. Lipton's sug-

gestions discussed in the previous sections are a good starting point in this sense. Nevertheless, focusing on such non-explanatory means should not imply dropping any reference to explanation. On the contrary, investigations such as Lipton's have to be completed by a reference to explanatory understanding, by an explication of the relations such non-explanatory means have to explanation and the role they play in the process of building the explanatory form of understanding.

Another important reason puts an emphasis on philosophical research into scientific practice,[11] rather than its end-products, as the main focus of investigation in philosophy of science. According to this approach, scientific practice would unveil more interesting philosophical insights into scientific knowledge than the focus on the finished products presented usually in textbook format. This philosophical investigation would avoid the artificial reconstructions that are characterized by the classical approaches. It enhances the contact between the scientific and the philosophical communities, making the work of philosophers more relevant to the scientists.

From this perspective, the non-explanatory forms of understanding might hardly be ignored, since they are so pervasive. One might mention here especially the exploratory aspects of scientific practice that were situated by the neopositivists in the realm of the context of discovery and considered therefore unsuited for a philosophical analysis. The non-explanatory forms of understanding might be crucial in this context, where achieving a sort of understanding about the inquired situation is the main goal of the investigative process. Nevertheless, this might not be the only realm that involves these forms of understanding, given that it is widely accepted that the distinction between the two contexts is unattainable. One might see an intermingled set of distinctions (Hoyningen-Huene 1987), or one might propose other, more situated ones (Echeverria 1995). If we are to conduct such a specific analysis as the last one, in which four such more particular contexts are identified — the contexts of education, of innovation, of evaluation, and of application (Echeverria 1995) — we can find in each of them the presence of non-explanatory forms of understanding as indispensable ingredients.

One might also be optimistic about the newly opened areas of research. If we move beyond the *Angst* of stepping outside the known routes, the novelty of these areas of research should be an incentive to advance in the exploration of such forms of understanding. Lipton's examples are not to be seen just as challenges to the classical position but also as starting options for an agenda for

[11] The philosophy of science in practice approach, which became bolder in the last twenty years, is best exemplified by the increasing influence of the SPSP (Society of Philosophy of Science in Practice).

further research. This will require further investigations into each non-explanatory form *per se*. One important direction of the investigation needs to target their conditions of validation, in order to distinguish them from ungenuine forms of understanding or, to put it in Khalifa's words, "misunderstandings without explanation" (Khalifa 2013: 167). The positive contributions to the inquiry and the productive dimension of the understanding acquired has to be closely considered as a central criterion of validation. Furthermore, the investigation will not be limited to such inquiry, but it will have to look at the relation between these forms and the explanatory ones, as was mentioned above. Moreover, we have to take into account the possible relationship between the different sorts of non-explanatory understanding that comprise the more dynamic frames of scientific inquiry. I cannot see a better strategy for the aforementioned goals than the one unfolding in a particular scientific context, considering the particularity of a scientific domain and a specific methodology.

This quite novel perspective of research opens up another issue discussed in the philosophy of science: the methodological differences between major scientific outlooks: that of the natural sciences and that of the social sciences and humanities. Notwithstanding the classical separation of explanation and understanding, which assigns explanation to the natural sciences and understanding to the other, the distinction between the two branches of academic enquiry might reveal the existence of different sorts of non-explanatory understanding. The methodological specificity of the social sciences and humanities that was invoked by some authors was linked to such forms of understanding as the one of intentions or the presence of empathy or the more theorized methodology of "participant observation" in anthropological research. These could be recast in the form of a type of non-explanatory understanding, which could either *per se* or as a provisional format contribute to the furthering of the explanatory inquiry.

CONCLUSION

The present contribution calls for a reconsideration of a neglected form of scientific understanding. My argument shows that there are no good reasons to ignore this form of understanding — understanding without explanation — either by dismissing it as an unimportant issue or by rejecting it through an articulated critique from the perspective of a reductionist account on understanding.

I have begun by a brief introduction to the subject of scientific understanding after it reached a more independent status in the philosophy of science. The second section has discussed the dichotomy between explanatory and non-explanatory understanding. I have concluded the second section by presenting the analysis put forward by Lipton, who is the first and the only author to offer an explicit account of the non-explanatory forms of understanding. I have examined the possible challenges that his proposal raises for other theories of understanding and discussed Kelp's interpretation. I argued that Kelp's construal does not exhaust the core of the challenge, nor does his theory offer a satisfactory answer to it. The core challenge is to account for these forms of understanding that are so pervasive in the scientific practice and to do justice to their particularities. The explanation-centered approach to understanding fails in this sense, and I have offered a rejection of Khalifa's reductive critique of Lipton's examples. In the last section I have suggested that one can find some positive reasons for considering understanding without explanation, which point to fruitful areas for further research.

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