Scientific Progress without Problems

Finnur Dellsén[1]

[To appear in I. Lawler, K. Khalifa, and E. Shech, Scientific (eds.), *Scientific Understanding and Representation: Modeling in the Physical Sciences* (Routledge)]

1. Introduction

In the course of developing an account of scientific progress, C. D. McCoy (2022) appeals centrally to *understanding* as well as to *problem-solving*. On the face of it, McCoy's account could thus be described as a kind of hybrid of the understanding-based account that I favor (Dellsén 2016, 2021) and the functional (a.k.a. problem-solving) account developed most prominently by Laudan (1977; see also Kuhn 1970; Shan 2019). In this commentary, I offer two possible interpretations of McCoy's account and explain why I do not find it entirely compelling on either interpretation.

2. Problem-Solving as Promoting Progress?

Like other understanding based accounts, e.g. the noetic account (Dellsén 2016, 2021), McCoy identifies scientific progress with "increase in understanding" (12). What's distinctive about McCoy's account as compared to other understanding-based accounts, however, is what he says about the type of understanding that increases as science progresses:

> "Progress in understanding simply involves improvement in theoretical understanding, which is a matter of improved ability to explain and describe phenomena, the degree of which is something evaluable by a problem-solving standard." (11)

In the second part of this passage, we seem to be given something like a hybrid account of scientific progress. Understanding is there said to be "evaluable by a problem-solving standard". What does this mean?

Earlier in the paper, McCoy suggests that the primary function of problem-solving is twofold, depending on the stage of development the scientific discipline in

[1] University of Iceland & Inland Norway University of Applied Sciences.

question finds itself in. In 'normal science', i.e. as scientists are working within a Kuhnian paradigm, the main point of problem-solving is "to evaluate the degree of understanding *so far achieved* in the current, established paradigm" (7). By contrast, in 'revolutionary science', i.e. as scientists are replacing one paradigm with another, problem-solving serves primarily "to evaluate the potential for understanding […] furnished by the future paradigm under development" (7). In both cases, then, problem-solving serves primarily to *evaluate* how much understanding is, or could be, achieved within a paradigm.

Why would scientists need to evaluate how much understanding has or will be achieved within different paradigms? The only sensible answer that I can think of is that, in evaluating how much understanding has been, and will be, achieved within paradigms, scientists will be better placed to choose to adopt those paradigms that in fact maximize understanding – and, consequently, scientific progress. After all, scientists wouldn't know whether to abandon their current paradigm P_c in favor of a newfangled paradigm P_n unless they knew whether P_c or P_n is more likely to better serve the scientific aim of increasing understanding. So a perfectly straightforward rationale for spending time and resources evaluating paradigms, through problem-solving, is to maximize the amount of scientific progress made at any given time.

But if that's the role of problem-solving in McCoy's views about scientific progress, then I am not sure problem-solving really is an essential part of McCoy's account. To explain why, let me introduce a distinction between *constituting* and *promoting* progress. A scientific development *constitutes progress* if and only if it is an improvement in and of itself, i.e. regardless of what other developments are thereby brought about (or made more likely to be brought about). By contrast, a scientific development *promotes progress* if and only if it is an improvement because and in so far as it brings about other developments that constitute scientific progress (or makes it more likely that they are brought about). So a progress-promoting episode would contribute to progress only to the extent that it leads to—or is likely to lead to—scientific progress at a later time; whereas a progress-constituting episode would do so regardless of its actual or probable causal effects.

Given this distinction, it seems quite clear what the relationship between problem-solving, understanding, and scientific progress would be on McCoy's account: problem-solving enables scientists to evaluate the extent to which paradigms foster understanding, thereby causing or probabilifying increases in understanding,

which in turn constitutes progress. Thus the problem-solving aspect of McCoy's account should, I believe, be seen as a view of what promotes, rather than what constitutes, scientific progress. This is important for how McCoy's account is situated among other accounts of scientific progress, because other accounts of scientific progress are not intended to be accounts of what promotes progress; rather, they are accounts only of what constitutes progress (see Bird 2008, 280; Dellsén 2018, 73).

Indeed, there is reason to be pessimistic about the prospects of providing any general account of what promotes progress that can do much philosophical work. The point applies to any attempt at giving an account of promoting progress, but for specificity let's consider the claim (which I'm tentatively attributing to McCoy) that problem-solving promotes scientific progress. If this is meant to be an exceptionless generalization, then it seems empirically unsubstantiated. After all, it seems at least possible for solutions to problems to lead researchers into blind alleys, prolonged fruitless debates, and so forth, which do not promote progress in the long (or short) run. So if we are to accept the exceptionless generalization, it would need to be backed up by (surprising) empirical data. If, by contrast, the claim that problem-solving promotes scientific progress is meant to be a more qualified type of generalization (e.g., that solving problems *often* promotes progress), then it is not clear that anyone would ever have disagreed. Moreover, there are surely lots of *other* activities that promote progress as well, such as collecting data, developing scientific concepts, and refining theoretical arguments. So why single out problem-solving specifically as the progress-promoting activity to highlight in discussions of scientific progress?

3. Problem-Solving as Constituting Progress?

In this section, I will consider a different possible role for problem-solving in an otherwise understanding-based account of scientific progress. To be clear (and fair), I don't think the following is particularly plausible as an interpretation of McCoy's contribution. But the discussion below may be of some general interest in so far as it develops and criticizes a genuinely hybrid account in which understanding and problem-solving both play central roles.

Consider an account of what constitutes scientific progress on which progress consists in increasing understanding, and where understanding is itself constituted by problem-solving. On this (hypothetical) account, what it is to understand something is to have (or have the ability to provide) solutions to scientific problems,

and one's understanding increases precisely to the extent that one has (or has the ability to provide) a greater number of such solutions. If this account is meant to combine elements of understanding-based and standard functional accounts of scientific progress, the notion of 'problem-solving' used here must bear some close relation to that used by proponents of the latter, such as Kuhn and Laudan.[2]

So what notion of 'problem-solving' do we find in the standard functional accounts of scientific progress? Let us focus on Laudan (1977, 1981), who provides by far the most detailed characterization of what a 'problem' and a corresponding 'solution' would be. According to Laudan (1977, 11-69), there are two distinct kinds of problems: *empirical problems* are questions concerning the objects or entities that a particular scientific theory is meant to explain or account for; and *conceptual problems* are questions about the theories themselves or how they relate to other theories. Since there are clearly infinitely many questions of either kind in logical space, Laudan holds that only some of these constitute genuine scientific problems such that solving them would constitute progress on his functional account. But which ones? And which ones of the infinitely many answers to a given problem-question count as genuine solutions?

In each case, Laudan's view is that this is entirely determined by what he calls a *research tradition* (corresponding roughly to Kuhn's notion of a paradigm). For Laudan (1977, 78-95), a research tradition is a set of assumptions about the entities and processes in some domain and the appropriate methods for studying them. So which questions are problems, and which answers are solutions, is fully determined by these assumptions (i.e. by the research tradition). There is no requirement here that these assumptions are in any way true, truthlike, or otherwise anchored in some type of objective reality (Laudan 1977, 16-17, 24-25). This departure from 'scientific realism' (in one sense of the term) is not a coincidence or oversight from Laudan; on the contrary, the whole point of developing a functional, i.e. problem-solving, account of scientific progress was to get away from the supposedly 'utopian' idea that scientific progress must consist in revealing an objective reality, e.g. by increasing the truthlikeness of our theories (see, e.g., Laudan 1981, 145). Laudan's research traditions

[2] I do not here consider the possibility of appealing to the notion of problem-solving used by more recent proponents of functional accounts, such as Shan (2019), since McCoy refers only to Kuhn and Laudan in his contribution.

are, in effect, what replaces objective reality as the determiner of whether, and the extent to which, some scientific activity constitutes progress.

Now, do these conceptions of scientific 'problems' and their 'solutions' help us get a grip on what constitutes (increased) understanding of the type that might in turn be taken to constitute scientific progress? Can we define (increased) understanding in terms of having (the ability to provide) 'solutions' to scientific 'problems', in the above sense of the latter terms? I think not. The main problem, as I see it, is that this would fail to make sense of one of the most basic facts about understanding, viz. that it is possible to *mis*-understand, i.e. to have a mistaken understanding of something. Relatedly, it also fails to make sense of the possibility of scientists being *mistaken* about whether a given scientific development is progressive.

Consider a concrete example of something that Laudan himself classified as a 'problem' relative to a once-dominant research tradition in medicine, viz. "that bloodletting cured certain diseases" (Laudan 1977, 16). According to Laudan's account, medical theories that answer questions about why bloodletting (allegedly!) cure certain diseases, e.g. by appealing to some version of the humoral theory, provide 'solutions' to this 'problem'. Thus if we identify understanding with problem-solving in Laudan's sense, humoral explanations of the (alleged) benefits of bloodletting would count as increasing our understanding, and thus, on an understanding-based account of scientific progress, as constituting progress. Apart from being wildly counterintuitive, this seems to me to make a mockery of the distinction between understanding and mis-understanding. Humoral explanations of bloodletting were *attempts* to understand what cures certain diseases, but these attempts were mistaken. They were mis-understandings. Relatedly, this muddles the distinction between (genuine) progress and what scientists at the time *believed* was progress. The doctors who developed humoral medicine certainly thought they were making progress with their explanations of how bloodletting (allegedly) cures diseases, but we now know that they did not.

Now, you might agree with the argument of the last two paragraphs and yet think that *a* notion of problem-solving might still be used to define (increasing) understanding – and, consequently, progress. The idea would be to adopt a *factive*, or at least *quasi-factive*, notion of problem-solving, where genuine problems are required to have some basis in reality (e.g. in being questions with approximately true presuppositions) and similarly for genuine solutions (e.g. in that they must appeal to

approximately true theories). However, I fail to see how this maneuver constitutes a step forward in our thinking about scientific progress. After all, as I noted above, the whole point of introducing the notion of problem-solving was, at least for Laudan, to *replace* objective reality as a determiner of whether something counts as progress or not. If we add requirements to the effect that genuine problem-solving must be anchored in objective reality, then why not cut out the middleman and define understanding and progress directly in terms of having a more accurate representation of some aspect of that objective reality?

References

Bird, Alexander. 2008. "Scientific progress as accumulation of knowledge: A reply to Rowbottom." *Studies in History and Philosophy of Science* 39: 279-281. https://doi.org/10.1016/j.shpsa.2008.03.019

Dellsén, Finnur. 2016. "Scientific Progress: Knowledge versus Understanding." *Studies in History and Philosophy of Science* 56: 72-83. https://doi.org/10.1016/j.shpsa.2016.01.003

Dellsén, Finnur. 2018. "Scientific progress, understanding, and knowledge: Reply to Park." *Journal for General Philosophy of Science* 49: 451-459. https://doi.org/10.1007/s10838-018-9419-y

Dellsén, Finnur. 2021. "Understanding Scientific Progress: The Noetic Account." *Synthese*. https://doi.org/10.1007/s11229-021-03289-z

Kuhn, Thomas S. 1970. *The Structure of Scientific Revolutions*, 2nd edition. Chicago: University of Chicago Press.

Laudan, Larry. 1977. *Progress and Its Problems: Towards a Theory of Scientific Growth*. London: Routledge and Kegan Paul.

Laudan, Larry. 1981. "A Confutation of Convergent Realism." *Philosophy of Science* 48: 19-49. https://doi.org/10.1086/288975

McCoy, Casey D. (2022). "Understanding the Progress of Science." In *Scientific Understanding and Representation: Modeling in the Physical Sciences*, ed. by Kareem Khalifa, Insa Lawler, and Elay Shech. London: Routledge.

Shan, Y. (2019). "A New Functional Approach to Scientific Progress." *Philosophy of Science* 86: 739-758. https://doi.org/10.1086/704980