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DISCUSSION NOTE

The Inference Rule of Addition and the Semantic View of Scientific Progress: Reply to Mizrahi

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ABSTRACT

This discussion note aims to show that Moti Mizrahi does not make clear whether the proponents of the semantic view of scientific progress reject or accept the inference rule of Addition. If they reject the rule, then it does not make sense that Mizrahi contrives different types of disjuncts 'on behalf of' proponents of the semantic view. If they accept the rule, then the characterisation of the semantic view that Mizrahi discusses has nothing to do with the supposedly arbitrariness of scientific progress, as Mizrahi contends.

The word 'progress' comes from the Latin *progressus*, which means 'advance', that is, the action of going forward. So, this term implies a kind of *move* from a specific situation (a) to a different one (b). When the concept of 'progress' is applied to science, this move is usually seen as implying a kind of accumulation. But what exactly is accumulated throughout the process from (a) to (b) that makes us regard it as progressive? According to Stathis Psillos (1999) and Jarrett Leplin (1997), what science accumulates is predictive success; Thomas S. Kuhn (1962), Karl R. Popper (1963), and Larry Laudan (1977) say that science accumulates problem-solving ability, in an approach that can be traced back to William Whewell and Charles S. Peirce; Imre Lakatos (1978) claims that science accumulates excess empirical content; Philip Kitcher (1993) thinks that what science accumulates is significant truths, etc.

The inclination for one or another criterion to detect and assess scientific progress depends on the philosophical position that is defended. For example, according to the realism developed by Peter Smith (1981), science shows a diachronic cognitive accumulation and continuity; llkka Niiniluoto's verisimilitude approach says that such accumulation can be measured in relation to proximity to the truth (Niiniluoto 1984, 1990); Richard Rorty's pragmatic antirealism (Rorty 1998) asserts that the concept of 'truth' is not a cognitive goal because it is unattainable. In a lengthy paper, Alexander Bird (2007) argues in favour of an epistemic view of scientific progress, according to which science progresses when it shows accumulation of scientific knowledge. In his paper, Bird discusses what he calls the 'semantic' and the 'functional-internalist' positions on scientific progress.

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Bird's epistemic view of scientific progress has generated several philosophical reactions in recent years. For instance, Gustavo Cevolani and Luca Tambolo have contended that Bird misunderstood the main arguments developed by the verisimilitude approach to scientific progress. Nonetheless, they suggested that Bird's attack on the functional-internalist approach developed by Kuhn and Laudan was 'substantially correct' (Cevolani and Tambolo 2013, 924). I have shown that Bird's position against Kuhn and Laudan fails, although for different reasons (Islas Mondragón 2014). Darrell P. Rowbottom (2008, 2010) has challenged Bird's idea that scientific progress should be understood in terms of knowledge rather than truth. Bird (2008) has defended his position against Rowbottom's semantic view of scientific progress. Niiniluoto (2014) defended the verisimilitude approach from Bird's attack. In his paper, Niiniluoto claimed that Bird failed to understand that the verisimilitude approach might be understood in two different ways from the point of view of likelihood, i.e. as real progress and as estimated progress. Against Bird—and against Rowbottom—Niiniluoto countered that their arguments were 'problematic … artificial and irrelevant to the verisimilitude approach' (Niiniluoto 2014, 75–76). Rowbottom (2015, 100) has responded to Niiniluoto, arguing that it was possible to find a case, hypothetical or actual, where science made progress in the absence of increasing verisimilitude, and the debate goes on.

In his discussion note, 'Scientific Progress: Why Getting Closer to Truth Is Not Enough', Moti Mizrahi argues against the semantic view of scientific progress as follows:

> P1: If the semantic view of scientific progress were correct, then scientists would make scientific progress *simply by arbitrarily adding* true disjuncts to their hypotheses or theories, regardless of whether those hypotheses or theories are true.
>
> P2: It is not the case that scientists could make scientific progress simply by arbitrarily adding true disjuncts to their hypotheses or theories, regardless of whether those hypotheses or theories are true.
>
> Therefore,
>
> C: The semantic view of scientific progress is incorrect. (Mizrahi 2017, 418; emphasis added)

The semantic view of scientific progress that Mizrahi is discussing corresponds to the characterisation (S) of the semantic view offered by Bird:

> An episode constitutes scientific progress precisely when it either (a) shows the accumulation of true scientific belief, or (b) shows increasing approximation to true scientific belief. (Bird 2008, 279)

Mizrahi uses (S) to argue against the semantic view of scientific progress, applying the inference rule of Addition and the truth tables. He presupposes two scientific theories, T_1 and T_2, which are utterly false theories that are 'equally as far from the truth as possible'. Then, he adds to T_2 a disjunct that is true by definition, e.g. 'squares are rectangles'. So, we have:

(1) T_2
(2) T_2 or squares are rectangles

According to Mizrahi, since the second disjunct added to T_2 in (2) is true by definition, (2) becomes true 'even if its first disjunct, i.e. T_2, is utterly false'. Since (2) is now closer to the truth than (1), the *move* from (1) to (2) is progressive, according to (S).

If this is correct, says Mizrahi, 'then it means that scientists could make scientific progress *simply* by applying the inference rule of Addition to their hypotheses or theories, regardless of whether those hypotheses or theories are true' (Mizrahi 2017, 416; emphasis added). Mizrahi claims that this result is unacceptable to supporters of (S).

Later, Mizrahi discusses some arguments by means of which the proponents of (S) could block this 'unacceptable consequence'. For example, one of these arguments is to point out that the disjunct 'squares are rectangles' is not a scientific truth. However, according to Mizrahi, the use of a 'scientific' disjunct, such as the formula for the area of an ellipse, $A = ab\pi$, will fail too. So, now we have:

(1) T_2
(2) T_2 or $A = ab\pi$ (by Addition from 1)

In this case, the move from (3) to (4), says Mizrahi, 'remains an unacceptable consequence of the semantic view of scientific progress' because 'whether or not their hypotheses or theories are true, scientists could make scientific progress *simply by arbitrarily adding* true disjuncts to them under the inference rule of Addition' (Mizrahi 2017, 417; emphasis added). According to Mizrahi, the proponents of the semantic view might possibly contrive more arguments for (S), such as arguing that the added disjunct to (1) must consist in a new truth or not imply a triviality.

It seems to me that Mizrahi's argument does not make clear whether the proponents of the semantic view of scientific progress reject or accept the inference rule of Addition. According to Mizrahi's text, we know that the proponents of the semantic view of scientific progress accept (S). However, after showing that the addition to T_2 in (2) of different disjuncts such as 'squares are rectangles' would make scientific progress 'arbitrary', Mizrahi asserts that proponents of the semantic view of scientific progress would not accept such a result. However, if this is so, it does not make sense that Mizrahi contrives different types of disjuncts 'on behalf of' proponents of (S) in order to 'block' its 'unacceptable consequence'. Doing so makes sense *only if* the proponents of the semantic view of scientific progress accept the inference rule of Addition in advance.

I am not sure that the proponents of the semantic view of scientific progress, as Bird characterises it and which Mizrahi discusses, actually reject the addition of this type of disjunct by applying the inference rule of Addition. If supporters of the semantic view of scientific progress actually accept clause (b) of (S), then, unless they reject the proposition that approximation to the truth cannot come about by the addition of a disjunct, it seems that Mizrahi's argument does not conform to what (S) actually asserts. Moreover, adding to T_2 in (2) a true disjunct actually makes clause (a) of (S) true. In sum, for the semantic view of scientific progress, the acceptance of a disjunct, whatever its nature, depends not on (S), but on the *methodological* acceptance or rejection of the use of the inference rule of Addition as an acceptable strategy to achieve scientific progress. The point is methodological, not logical.

Finally, premise (1) of Mizrahi's argument against the semantic view of scientific progress seems to be false, that is, it is not true that 'If the semantic view of scientific progress

were correct, *then* scientists would make scientific progress *simply by arbitrarily adding* true disjuncts to their hypotheses or theories, regardless of whether those hypotheses or theories are true' (Mizrahi 2017, 418; emphasis added). Nowhere in (S) is there implied the supposedly arbitrariness to which Mizrahi refers. Of course, Mizrahi's methodological intuition is correct, i.e. such arbitrariness is not desirable; but the point is that such arbitrariness does not follow from (S) as Mizrahi contends.

As previously mentioned, the cognitive criteria associated with the idea of scientific progress are plural. One consequence of this plurality is that it is difficult to articulate a broad idea of scientific progress using only a narrow set of cognitive criteria such as 'problem solving', 'approach to the truth', 'accumulation of true scientific beliefs' or 'accumulation of scientific knowledge'. These 'general' criteria of scientific progress are insufficient to assess the progressiveness of specific episodes of scientific activity. So, one way to approach scientific progress is from particular case studies that exhibit the plurality of ways in which the diachronic development of science has progressed. In this sense, the historical review of the theoretical superstructures—paradigms, research traditions, and scientific practices—indicates that the scientific criteria and values, as well as the framework of beliefs from which these criteria and values come, not only very with time, but also change as scientists' beliefs alter. That is why the scientific criteria and values that we consider valuable today might be different from the scientific criteria and values that will be considered valuable in the future.

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