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DISCUSSION NOTE

Why Adding Truths Is Not Enough: A Reply to Mizrahi on Progress as Approximation to the Truth

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ABSTRACT

In a recent paper in this journal, entitled 'Scientific Progress: Why Getting Closer to Truth is Not Enough' (2017), Moti Mizrahi argues that the view of progress as approximation to the truth or increasing verisimilitude is plainly false. The key premise of his argument is that on such a view of progress, in order to get closer to the truth one only needs to arbitrarily add a true disjunct to a hypothesis or theory. Since quite clearly scientific progress is not a matter of adding true disjuncts to theories, the argument goes, the view of progress as approximation to the truth is untenable. We show that the key premise of Mizrahi's argument is false: according to verisimilitude-based accounts of progress, adding arbitrary true disjuncts to existing theories is just not enough to get closer to the truth.

1. What Is Scientific Progress?

The age-old controversy on how to best explicate the notion of scientific progress is today more current than ever. Over the last ten years, the publication of Bird's 'What Is Scientific Progress?' (2007) has engendered a lively debate among the champions of four conflicting accounts of progress (see Dellsén 2018b for an overview): the epistemic account, favoured by Bird and criticised by Rowbottom (2008, 2010; see Bird 2008 for a reply to Rowbottom); the semantic account defended by Rowbottom (2010); the noetic account, put forward by Dellsén (2016) and criticised by Park (2017; see Dellsén 2018a for a reply to Park); and the functional-internalist account originating in the works of Kuhn (1962/1970) and Laudan (1978), which Shan (forthcoming) has recently tried to revive by proposing it in an ameliorated version.

With a view to advancing such debate, Mizrahi (2017) has put forward an argument allegedly showing the untenability of what, following Bird, he calls the 'semantic' account of progress:

> (S) 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, 79)

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We already argued elsewhere (Cevolani and Tambolo 2013a, 2013b; see also Niiniluoto 2014, 2015) that this definition is misleading in that it conflates two non-equivalent accounts of progress that one should keep separated. Let us then emphasise that in what follows, we shall be concerned with defending only the view that progress is a matter of approximation to the truth or increasing truthlikeness (aka verisimilitude)—a view that corresponds to part (b) of Bird's definition, and to which we shall refer as 'verisimilitudinarian' (VS, for short). In any case, VS is in fact the main target of Mizrahi's critique, so for our present purposes, part (a) of Bird's definition can be safely put aside. The account of progress that will be defended here against Mizrahi's argument is then the following:

> (VS) Progress consists in increasing approximation to the truth. If T_1 and T_2 are theories, and Tr denotes the degree of truthlikeness or verisimilitude of a theory, then the step from T_1 to T_2 is progressive just in case $Tr(T_1) < Tr(T_2)$.

Notation-wise, this definition of VS refers directly to Niiniluoto's (1987), but it conveys the basic insight underlying the work of other proponents of VS, such as, for instance, Kuipers (1987; 2000) and Festa (2007). The central idea, going back to Popper, is that a theory is highly verisimilar if it says many things about a target domain, and many of these things are (almost exactly) true. This means that the truthlikeness of a theory T depends on both its content—how much T says—and its accuracy—how much of what T says is, in fact, true. In Popper's words, verisimilitude 'represents the idea of approaching comprehensive truth. It thus combines truth and content' (1963, 237).

In what follows, we shall show that one premise of Mizrahi's argument is false, and therefore his argument is unsound and ineffective as a criticism of VS (section 2). We shall concede that one basic intuition underlying Mizrahi's argument—adding truths to 'utterly false' theories may increase their verisimilitude—has something to it. Nevertheless, as we shall argue, such intuition in the end does not undermine, but rather, supports VS. We shall conclude by pointing to some connections between Mizrahi's discussion and the problem of theory-change as studied within the theory of belief revision (section 3).

2. What Is Wrong with Mizrahi's Argument

Let us start by recalling how Mizrahi's formulates his argument:

> P1: If the semantic view of scientific progress were true, 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 false (Mizrahi, 2017, 418).

Mizrahi claims that, if the argument is sound, 'then scientific progress is not simply a matter of […] increasing approximation to truth […], there must be more to scientific progress than just getting closer to the truth' (2017, 418). We shall contend that the argument, while clearly valid, is unsound, since premise 1 is false. If we are right, then

proponents of VS need not worry about the conclusion (and, as we shall argue below, the intuition underlying the argument in fact supports VS).

Let us consider how Mizrahi argues in favour of premise 1. He discusses three toy examples in which the following intuition plays a central role: given a false theory T_1 and some true proposition A, one should expect the theory $T_2 = T_1 \vee A$ (obtained by adding A to T_1 as a new disjunct) to be closer to the truth than T_1. It follows that, on VS, the shift from T_1 to T_2 is progressive; which cannot be the case in general, given that A may be some arbitrary proposition, and hence T_2 any arbitrary disjunctive weakening of T_1. Mizrahi is correct on this latter point; however, we argue, his intuition fails to hold in general. In fact, he seems to implicitly assume the following principle:

(M1) If T is false and A is true, then $T \vee A$ is closer to the truth than T.

However, such a principle would be rejected by virtually all truthlikeness theorists, and certainly by all the proponents of VS. The reasons are simple. First, since $T \vee A$ is logically weaker, and hence less informative, than T, the former theory may well be less verisimilar than the former. As noted, in fact, truthlikeness is a combination of truth and content, so one cannot expect in general weaker theories to be more verisimilar than stronger ones. This may be the case, but cannot be generally true. Second, whether or not $T \vee A$ is closer to the truth than T crucially depends on whether A itself is close to the truth or not (cf. Figure 1).

For instance, suppose T_1 is the false theory that there are 50 planets in our solar system (the truth being that there are 8 planets). Then consider the true proposition A that there are either 8 or 100 planets, i.e. $A = 8 \vee 100$. Adding A to T_1, as Mizrahi suggests, leads to the new theory:

$$T_2 = T_1 \vee A = 8 \vee 50 \vee 100$$

Is T_2 closer to the truth than T_1? This is highly debatable. After all, even if T_2 is true, it also makes very bad guesses about the truth—and at least one much worse guess than the one made by T_1.

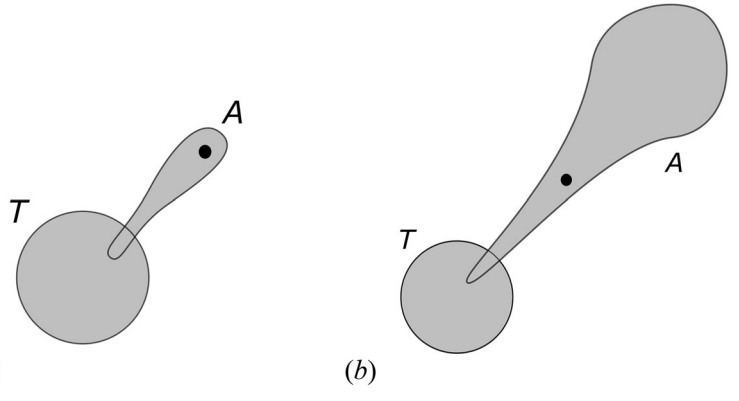

Figure 1. A false theory *T* and a true proposition *A* represented as sets of possible worlds, with the black dot representing the actual world, i.e. 'the truth'. On the left (a), the theory $T \vee A$ (shadowed in grey) is closer to the truth than *T*; vice versa, on the right (b), *T* is closer to the truth than $T \vee A$. Accordingly, the step from *T* to $T \vee A$ is progressive in the former case, but not in the latter.

A precise answer to the above question can be given only by defining an appropriate measure Tr of the truthlikeness of different theories. Assume for instance, to keep things simple, that we measure the distance between the truth and each guess of a theory as the plain arithmetic difference between the two figures, so that $T_1 = 50$ will be at distance 50–8 = 42 from the truth. Moreover, assume that we measure the overall distance of a theory from the truth as the average distance of all of its guesses, so that $T_2 = 8 \vee 50 \vee 100$ will be at distance $\frac{8 + 50 + 100}{3} - 8 \cong 44,6$ from the truth. Then, T_1 is more verisimilar than T_2, and not vice versa as Mizrahi would claim, since T_2 is farther from the truth than T_1 (other measures of truthlikeness will yield similar results; cf. Oddie 2016, sec. 1.4). It follows that, on VS, the step from T_1 to T_2 would be regressive, not progressive. In short, then, not all disjunctions are equal, with respect to how useful they are for the purpose of approaching the truth.

3. What Mizrahi Gets (Nearly) Right

The example discussed above suffices to show that M1 is untenable in general. This undermines Mizrahi's criticism of VS, since it shows that the premise 1 is just wrong, and hence the argument is unsound.[1] However, Mizrahi's intuition that adding truths to 'utterly false' theories may increase their verisimilitude has something to it. In fact, it may well happen that T_2 is closer to the truth than T_1 even if T_2 is obtained by disjunctively weakening T_1 with the addition of some truth A: this will indeed be the case when, roughly, T_2 improves the best guesses of T_1 without worsening its worse guesses (cf. Niiniluoto 1987, 224–231 for detailed technical discussion).

To illustrate, let us slightly change our example below. Suppose now that T_1 says that there are 100 planets in our solar system and that A says that there are either 8 or 50 planets. The addition of A to T_1 leads (again) to

$$T_2 = T_1 \vee A = 8 \vee 50 \vee 100,$$

which is clearly an improvement on $T_1 = 100$ as far as closeness to the truth is concerned. (In fact, the average distance of T_2, i.e. 44,6, is now much smaller than the average distance of T_1, which is 92.) This is because A is, so to speak, a true proposition of 'the right kind': the new guesses made by A about the number of planets are all better than that made by T_1. Since truthlikeness is a matter of including possibilities that are close to the truth and, at the same time, excluding possibilities that are far from the truth, in this case progress towards the truth is guaranteed (cf. Figure 1(a)). In particular, if T^* denotes 'the whole truth' about the domain of interest, the following 'truth content' principle can be defended as a general adequacy condition for truthlikeness (Niiniluoto 1987, 233):

(TC) If T is false, then $T \vee T^*$ is closer to the truth than T.

For instance, if $T^* = 8$ is the truth about the number of planets in our solar system, any false theory $T = n$, with $n \neq 8$, will be improved by adding the truth to it. In general, however, the simple addition of a true proposition to a false one does not guarantee truth approximation (cf. Figure 1(b)). This is also relevant, by the way, for another claim made by Mizrahi (2017, 418), which basically amounts to the following principle:

(M2) If T is false, then either $T \vee A$ or $T \vee \neg A$ is closer to the truth than T.

Note that M2 follows from M1: adding either a proposition or its negation to a false theory will improve its truthlikeness, since one of the two must be true. However, it is easy to see that M2 is false, as M1 is, for the reasons already discussed above. For instance, suppose that we believe there are most 100 planets in the solar system. Moreover consider two false propositions about the number of planets: $T = 40$ and $A = 100$. Of course, $T \vee A = 40 \vee 100$ is farther from the truth than T (the average distance is 62 for $T \vee A$ vs. 32 for T). However, also $T \vee \neg A$ is less verisimilar than T, even if $\neg A$ is true. In fact, $\neg A$ is the theory that there are between 1 and 99 planets: and, as one can check, the average distance of $T \vee \neg A$ is here the same of $\neg A$, i.e. $\left(\frac{99(99+1)}{2} \times \frac{1}{99}\right) - 8 = 42$: smaller than the distance of $T \vee A$ (62) but still greater than that of T (32). In short, both adding a false proposition and its true negation to a false theory may lead one farther from the truth (see again Figure 1(b)).

The latter point highlights another interesting aspect of Mizrahi's discussion, which connects the debate on scientific progress and truthlikeness to the problem of theory-change as studied within the theory of belief revision (cf. Hansson 2017 for details). In this area, one may investigate the question of whether incorporating true information into, or removing false information from, one's false beliefs improves their overall truthlikeness. For instance, consider a false set of beliefs T and a piece of information A. If one denotes $T + A$ and $T - A$, respectively, the new belief set obtained by incorporating A into T or by removing A from T, one may expect that:

If A is true, then $T + A$ is closer to the truth than T

If A is true, then T is closer to the truth than $T - A$

If A is false, then T is closer to the truth than $T + A$

If A is false, then $T - A$ is closer to the truth than T

Interestingly, none of the above conditions is tenable as a general principle of belief revision aiming at truth approximation: adding truths or removing falsehoods is just not enough, in general, to get closer to the truth. Of course, exploring specific conditions under which theory change actually leads theories closer to the truth and thus guarantees cognitive progress is an important open issue (for detailed discussion, see the contributions collected in Kuipers and Schurz 2011). To do this, however, the technical work on the notion of truthlikeness and on the best way to explicate it cannot be bypassed in favour of informal intuitions concerning the idea of scientific progress as increasing approximation to the truth.

Notes

1. In a reply to Mizrahi's attack against VS published after the submission of this paper (cf. Mondragón 2017), the author advances similar worries concerning Mizrahi's central argument.

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