Vilnius University Press

Vilnius University Press

Problemos
2019, vol. 95, pp. 94–104

ISSN 1392-1126 eISSN 2424-6158
DOI: https://doi.org/10.15388/Problemos.95.8

The Absolute and Relative Pessimistic Inductions

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Abstract. The absolute pessimistic induction states that earlier theories, although successful, were abandoned, so current theories, although successful, will also be abandoned. By contrast, the relative pessimistic induction states that earlier theories, although superior to their predecessors, were discarded, so current theories, although superior to earlier theories, will also be discarded. Some pessimists would have us believe that the relative pessimistic induction avoids empirical progressivism. I argue, however, that it has the same problem as the absolute pessimistic induction, viz., either its premise is implausible or its conclusion does not probably follow from its premise.
Keywords: Absolute Pessimistic Induction, Empirical Progressivism, Historical Optimism, Relative Pessimistic Induction

Absoliučioji ir santykinė pesimistinė indukcija

Santrauka. Pagal absoliučiąją pesimistinę indukciją, ankstesnės teorijos, nors ir sėkmingos, buvo atmestos, todėl dabartinės teorijos, nors ir sėkmingos, taip pat bus atmestos. O santykinė pesimistinė indukcija teigia, kad ankstesnės teorijos, nors ir pranašesnės už jų pirmtakus, buvo atmestos, todėl dabartinės teorijos, nors ir pranašesnės už ankstesnes teorijas, taip pat bus atmestos. Kai kurie pesimistai manytų, kad santykinė pesimistinė indukcija išvengia empirinio progresyvizmo. Šiame straipsnyje teigiu, kad ji turi tokį patį trūkumą kaip ir absoliučioji pesimistinė indukcija, t. y. jos prielaida yra neįtikėtina arba jos išvada, veikiausiai, neišplaukia iš jos prielaidos.
Pagrindiniai žodžiai: absoliučioji pesimistinė indukcija, empirinis progresyvizmas, istorinis optimizmas, santykinė pesimistinė indukcija

I thank the two anonymous referees of this journal for useful comments. This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2018S1A5A2A01039606).

Received: 29/1/2019. **Accepted:** 8/3/2019

1. Introduction

The pessimistic induction (PI) asserts that "we are in the midst of an ongoing historical process in which our theoretical conceptions of nature will continue to change just as profoundly and fundamentally as they have in the past" (Stanford 2015: 875). The PI is widely regarded as the most powerful criticism of scientific realism (Sankey 2017: 201), the position that mature theories "are typically approximately true" (Putnam 1975: 73). If the PI is cogent, i.e., if the premise is true, and if the premise makes the conclusion likely, we should believe that alternative theories will supersede current theories.

A standard response to the PI is that current scientific theories are more successful than their forerunners (Devitt 2011; Doppelt 2014). In other words, current theories predict and explain more phenomena than their forerunners did. Consequently, the downfall of current theories cannot be inferred from that of earlier theories, and whether current theories will be superseded is an open issue. Let me call *empirical progressivism* the historical observation that new theories are empirically superior to old theories, i.e., scientific revolutions are accompanied by empirical progress.

Empirical progressivism has begun to receive probing criticisms from philosophers. K. Brad Wray (2013) and Mario Alai (2017) contend that current theories, although more successful than their predecessors, will suffer the same fate. To justify this contention, they have constructed a new PI, which I call *the relative pessimistic induction* (RPI). The RPI is more sophisticated than the original PI, which I call *the absolute pessimistic induction* (API). This paper, however, aims to show that neither the API nor the RPI is cogent.

Admittedly, achieving this aim does not count as establishing scientific realism. Refuting the two PIs and establishing scientific realism are different affairs. Establishing scientific realism requires not only refuting the two PIs, but also constructing positive arguments for it. This paper does not attempt to construct such arguments.

In Section 2, I expound the API and the RPI. In Section 3, I criticize the API, arguing that either its premise is implausible, or its conclusion does not probably follow from its premise. In Section 4, I raise the same objection to the RPI. In Section 5, I elucidate an implication of my objection to the API and the RPI for selectivism. In Section 6, I address five possible objections from pessimists. It will become clear that given how science has developed, pessimists cannot achieve both a plausible premise and a conclusion that is made probable by that premise.

2. The Absolute and Relative Pessimistic Inductions

Recall that according to empirical progressivism, current scientific theories are more successful than their precursors. In response, Wray (2013) states:

> The previous generation could construct a similar argument with respect to the generation that preceded them. They had instruments their predecessors could not fathom, and they achieved degrees of accuracy never achieved before. The pattern is clear. What looks like a brave new world to our predecessors does not look new to us. And similarly what looks new to us will not look so new to our offspring. (Wray 2013: 4327)

Alai (2017) constructs a similar argument while responding to Gerald Doppelt (2014), who appeals to empirical progressivism to defend realism. Alai states that "even in the past empirical knowledge and scientific methodology had improved steadily: for instance, they had improved a lot from 100 A.D. to 1700 A.D., yet many wrong theories were still held at that date, and even thereafter" (Alai 2017: 3282).

Wray and Alai have constructed the RPI. Its premise states that earlier theories, although more successful than their predecessors, were discarded, and it concludes that current theories, although more successful than their forerunners, will also be discarded. This argument is named the relative pessimistic induction, because it appeals to the relative notion that theories are *more* successful than their forerunners.

The RPI contrasts with the API, according to which "the scientific theories of the past have turned out to be false despite exhibiting just the same impressive sorts of virtues that present theories do, so we should expect our own successful theories to ultimately suffer the same fate" (Stanford 2006: 7). The premise of the API states that earlier theories, although successful, were abandoned, and its conclusion states that current theories, although successful, will also be abandoned. This argument is named the absolute pessimistic induction because it appeals to the absolute notion that past and current theories are successful. It appears that empirical progressivism nullifies the API, but not the RPI, and hence that the RPI is better than the API.

Like other inductions, the API and the RPI are cogent or uncogent, depending on whether their premises are true, and whether their conclusions probably follow from their premises. In the following sections, I argue that neither the API nor the RPI can simultaneously meet these two conditions and, hence, that the RPI fares no better than the API at showing that current theories will follow the unfortunate path of their predecessors.

3. Against the API

The premise of the API is that earlier theories were overturned. Pessimists typically appeal to Larry Laudan's (1981: 33) list and P. Kyle Stanford's (2006: 19–20) list of earlier theories to support the premise. These lists include the humoral theory, the Ptolemaic theory, and so on. After providing his list, Laudan declares that "for every highly successful theory in the past of science which we now believe to be a genuinely referring theory, one could find half a dozen once successful theories which we now regard as substantially non-referring" (1981: 35). After providing his list, Stanford declares that "the history of scientific inquiry itself offers a straightforward rationale for thinking that there typically are alternatives to our best theories" (2006: 20). If Laudan and Stanford are right about the history of science, the premise of the API is plausible.

Laudan's and Stanford's gloomy depictions of the history of science, however, clash with the bright depictions of historical optimists (Fahrbach 2011; Park 2011; Mizrahi 2013; 2016). Historical optimists point out that both Laudan's and Stanford's lists are biased in favor of absolute theories, such as the phlogiston theory and the Ptolemaic theory, which were discarded before the 20th century. They are called *distant* past theories, and should

be distinguished from *recent* past ones. Recent past ones enjoyed acceptance during the 20th century. The theory of plate tectonics and the oxygen theory are examples of recent past theories. Some recent past theories were formulated before the 20th century, while others were formulated in the 20th century. All of them, however, were accepted in the 20th century. Interestingly, *most* of them are not yet rejected in the early 21st century. For example, the kinetic theory was accepted in the 20th century, and has not yet been rejected. Such theories are recent past-cum-current theories, i.e., they can be regarded as both recent past theories and current theories. Keep in mind that most recent past theories are still retained in the early 21st century, so they also can be seen as current theories.

Most past theories are recent past ones. Only a handful are distant past ones. Ludwig Fahrbach states that "at least 95% of all scientific work ever done has been done since 1915" (2011: 149). Park says that "the body of scientific knowledge exploded in the 20th century" (2011: 79). Moti Mizrahi (2013: 3219–3220; 2016) employs the random sampling method to demonstrate that most past theories are recent past ones. This optimistic portrayal of the history of science is called *historical optimism* (Park 2017a: 616). It implies that most past theories are not overthrown yet, and it confutes the premise of the API that earlier theories were overthrown.

How would absolute pessimists respond to this objection that the premise of the API is false? They might replace it with a new one: *distant* past theories were overturned. This new premise would not clash with historical optimism, which says nothing about what portion of distant past theories are retained and discarded.

A new problem, however, would then arise for absolute pessimists. Empirical progressivism implies that it is fallacious to infer that because *distant* past theories were discarded, current ones will also be discarded. We should not investigate distant past theories, but rather recent past ones, to predict the course of current ones because "only the fate of our most recently developed theories are relevant to determining what we can expect of today's best theories" (Wray 2015: 63). To use an analogy, suppose you are twenty years old, and a disease has spread to your community. You are more likely to get the disease, if the disease has so far attacked people up to eighteen years old than if it has only attacked people up to five years old, given that your resistance to the disease is likely more similar to that of eighteen year olds than to that of five year olds. Thus, you should investigate eighteen year olds, rather than five year olds, to estimate how probable it is that you will contract the disease. Similarly, current theories are more likely to be thrown out, if recent past ones were thrown out than if distant past ones were thrown out, given that the capacity of current theories to explain and predict phenomena more resembles that of recent past ones than that of distant past ones. So pessimists should investigate recent past theories, rather than distant past ones, to gauge the probability that current ones will be ousted.

Admittedly, this analogy breaks down at some point. Five, eighteen, and twenty year olds exist simultaneously, but distant past, recent past, and present theories do not.[1] This criticism against the analogy, however, does not refute the suggestion that we should

[1] I thank an anonymous referee for this sharp observation.

investigate not distant past theories but rather recent past ones to predict the course of current ones because the level of success of current theories is more similar to that of recent past theories that to that of distant past theories.

In sum, the premise of the API states either that *distant* past theories were overturned or that *recent* past theories were overturned. If it states that *distant* past theories were overturned, the premise is plausible, or at least does not clash with historical optimism, but the conclusion does not probably follow. If it states that *recent* past theories were overturned, the conclusion probably follows, but the premise is implausible. What if the premise states that both distant and recent past theories were overturned? The premise is still implausible, given that historical optimism suggests that the former group is much smaller than the latter. Therefore, empirical progressivism and historical optimism jointly thwart absolute pessimists' aspiration to have both a plausible premise and a conclusion that probably follows from the premise.

4. Against the RPI

The RPI holds that earlier theories, although more successful than their predecessors, were ousted, so current theories, although more successful than forerunners, will also be ousted. Like the API, the RPI has either an implausible premise or an unjustified conclusion, depending on whether "earlier theories" refers to distant past theories or recent past theories.

If "earlier theories" refers to distant past theories, the premise is plausible, i.e., it is plausible that distant past theories, although more successful than their predecessors, were ousted. The conclusion, however, does not probably follow from this premise. Empirical progressivism invalidates the pessimistic inference, for example, that the miasma theory (a distant past theory) was ousted, although more successful than the humoral theory (the predecessor of the distant past theory), so the germ theory (a present theory) will be also ousted, although more successful than the miasma theory (a distant past theory).

If "earlier theories" refers to recent past theories, then the inference is legitimate, i.e., it is legitimate to infer that recent past theories, although more successful than their precursors, were ousted, so current theories, although more successful than their precursors, will also be ousted. This premise, however, is implausible. For example, it would be legitimate to infer that since the germ theory (a recent past theory) was ousted, although more successful than the miasma theory (a distant past theory), so the germ theory (a present theory) will also be ousted, although more successful than the miasma theory (a distant past theory). But the premise is false, i.e., it is false that the germ theory (a recent past theory) was ousted.

Pessimists might admit that the pessimistic inference from distant past theories to current ones is weak in the case of the API, since current ones are much more successful than distant past ones. They might maintain, however, that it is by no means obvious that it is weak in the case of the RPI, for distant past ones were only a little more successful than their immediate predecessors, yet they were overturned; exactly in the same way, it can be argued, current ones will be discarded because they are only a little more success-

ful than their immediate predecessors. Thus, there is the same relation between distant past theories and their immediate predecessors, and between current theories and their immediate predecessors. Therefore, the RPI is fully warranted.

Historical optimism suggests, however, that the immediate predecessors of current theories are distant past ones, and they are *far* less successful than current ones. I will assume however, for the sake of argument, that current theories are only a little more successful than their immediate predecessors (distant past theories), and that distant past ones were also only a little more successful than their immediate predecessors. Even under such conditions, we can show that the RPI is fallacious, using the following two examples.

Suppose that the water in a kettle gets hotter little by little. The temperature of the water is 98 °C at T_1, 99 °C at T_2, and 100 °C at T_3. One makes the following inference: The water at T_2 was just a little hotter than at T_1, and it did not boil, so it will not boil at T_3 because it is just a little hotter than at T_2. This inference is fallacious. A moral is that a little increase in temperature may make a big difference, viz., a difference between boiling and not boiling. In other words, from the fact that a little increase in temperature did not make a big difference, it does not follow that another little increase will not make a big difference.

To take another example, suppose John and Tom are running a marathon. John is just one step ahead of Tom at times T_1 and T_2. John has not yet reached the final destination at T_1, but he has reached the final destination at T_2. One makes the following inference: Since John was just a step ahead of Tom at T_1, and was not the winner of the race, so he will not be the winner of the race at T_2, because he is still just a step ahead of Tom. This inference is fallacious. A moral is that a small lead in a race may make a big difference, viz., the difference between winning and losing. In other words, from the fact that a small lead in a race did not make a big difference earlier in the race, it does not follow that it will not make a big difference later in the race.

Such examples can be extended *ad nauseam*. They all show that the conclusion of the RPI does not follow from its premise, even if we assume that new theories are only a little more successful than their predecessors. It is simply fallacious to infer that since distant past theories were abandoned, although only a little more successful than their precursors, so too current theories will be abandoned, although just a little more successful than their predecessors. Just a little increase in success could make a big difference, viz., the difference between being retained and discarded. In other words, from the fact that a little increase in success did not make a big difference at an earlier point, it does not follow that it will not make a big difference at a disparate later point.

Pessimists might object that there is a relevant difference between scientific theories and the water in the kettle or the marathon racers. Water has a boiling point; races have a finish line. This is not so in theory development; alternative theories will keep replacing accepted theories *indefinitely*, and we will never arrive at a true theory.[2]

[2] I thank an anonymous referee for this interesting comment.

This suggestion, however, conflicts with the presupposition of both the API and the RPI, which are built upon "proportional pessimism: as theories are discarded, the inductive rationale for concluding that the next theories will be discarded grows stronger" (Park 2016: 835). Consider, for example, that the humoral theory was superseded by the miasma theory, and that the miasma theory by the germ theory. According to proportional pessimism, the inductive rationale for the falsity of the germ theory is stronger than it was for the falsity of the miasma theory, because germ theory has two false forerunners whereas the miasma theory had only one false forerunner, and the inductive rationale for the falsity of the miasma theory, in turn, was stronger than that for the falsity of the humoral theory (Park 2016: 838). The referee's suggestion, however, implies that all three theories are all equiprobable, i.e., that they are all 0% probable, given that there are infinitely many theories of disease. In general, a theory is 0% probable if it has infinitely many rivals. Therefore, we should reject the referee's suggestion or both the API and the RPI.

5. Implication for Selectivism

In Sections 3 and 4, I argued that either the premises of the API and the RPI are implausible, or their conclusions do not follow from the premises. This criticism against the API and the RPI has a negative implication for selectivism, including structuralism, as advocated by John Worrall (1989), Stathis Psillos (1999: Chapter 6; 2009), and Peter Vickers (2017).

Selectivism asserts that a scientific theory is composed of credible and incredible theoretical constituents. The credible constituents fuel the theory's success, survive scientific revolutions, and carry over to the theory's successor. Meanwhile, incredible constituents do not. Note that, like pessimism, selectivism presupposes that current theories will be superseded by future successors. This presupposition leads selectivists to attempt to come up with criteria for distinguishing between the believable and unbelievable posits of *current* theories. Thus, selectivism and pessimism share the prediction that scientific revolutions will oust current theories (Park 2017b: 65; Stanford 2018: 79). This prediction, however, is dubious, given that neither the RPI nor the API is cogent.

Selectivism should be distinguished from scientific realism. Scientific realists do not believe that current theories will succumb to scientific upheavals, so they do not try to distinguish between the trustworthy and untrustworthy posits of current theories. Selectivism, which is regarded as a form of scientific realism, is usually called *selective realism* in the literature. It is not well-known, however, that there is not much of a difference between selectivism and pessimism. As Stanford argues, it is not clear that the theoretical assumptions common to both past and current theories are rich and thick enough to entitle selectivists to say that the theories are approximately true (Stanford 2015: 875). Stanford is right on this count. I believe that "pessimists might covet selectivism" (Park 2018a: Section 3.3). For this reason, this paper uses "selectivism" instead of "selective realism ".

6. Objections and Replies

6.1. Possibility vs. Likelihood

Pessimists might withdraw their view that it is *likely* that current theories will undergo scientific revolutions, and put forward a new view that it is *possible* that current theories will undergo scientific revolutions. This new position is not refuted by my contention that neither the API nor the RPI is cogent.

This mere possibility, however, is compatible with scientific realism according to which current theories "are typically approximately true" (Putnam 1975: 73). We should interpret scientific realism "not as saying that present theories are definitely approximately true, but as saying that they are likely to be approximately true" (Park 2017b: 71). Scientific realists do not rule out the possibility that current theories will undergo scientific revolutions. Thus, it is not the mere possibility but rather a high probability that is required to refute scientific realism.

6.2. Scientists' Capability

Let me address another possible objection from pessimists. To get around empirical progressivism, Stanford (2006) claims that just as past scientists could not ideate current theories, so they now cannot ideate future successors. Scientists are all "creatures whose cognitive constitutions are not well suited to the task of exhausting the kinds of spaces of serious candidate theoretical explanations from which our scientific theories are drawn" (Stanford 2006: 45). Therefore, current theories, although superior to earlier ones, will be surpassed by future successors.

Historical optimism, however, can nullify this strategy, suggesting that most past theories have been retained, so "past scientists conceived of *most* of their future theories" (Park 2017a: 618). Stanford is thus wrong to say that scientists of the past could not entertain current theories. As a matter of fact, past scientists did conceive of most current theories. If pessimists want to refute this conclusion, they should show that most recent past theories are distinct from current ones.

6.3. General Relativity and Quantum Theory

Pessimists might raise another objection. Some recent past theories are definitely false. For example, general relativity and quantum theory conflict with each other, as do the different interpretations of quantum mechanics. General relativity and quantum theory are recent past theories, although they are also current theories. Therefore, historical optimism is false.

This objection commits the straw man fallacy. Historical optimism does not assert that *all* recent past theories have remained unrefuted. Rather, it asserts that *most* recent past theories have remained unrefuted. Thus, it remains unscathed, even if both general relativity and quantum theory prove to be false.

It is worth mentioning that the inconsistency between general relativity and quantum theory does not show that both of them will be supplanted by future successors. While

it is, of course, possible that both of them will be, it is also possible that neither of them will be. After all, it is possible that consistency between them will be achieved through a minor modification of one or both of them. And it is also possible that only one of them will be supplanted. In short, their future developments are underdetermined by their present status (Park 2015: 223).

6.4. Significant vs. Insignificant

How might pessimists respond to Mizrahi's random sampling? They might argue that emphasizing the *number* of scientific theories is not the best strategy for painting an optimistic picture of the history of science. It *might* be that the majority of recent past theories, which have been retained, are insignificant, while the minority of recent past theories, which have been discarded, are significant. Significant theories are those on which many other theories depend, and those whose truth is presumed for theory-building in many disciplines. Consequently, showing that a large number of *insignificant* theories were stable would be insufficient to justify historical optimism.

This objection, however, does not successfully strike at historical optimism. Historical optimism is not refuted by the mere possibility, but rather only by the likelihood, that the majority of retained ones are insignificant, and that the minority of discarded ones are significant. It is much harder to establish this likelihood than it is to merely point out the possibility, and this much harder work is required to refute historical optimism.

6.5. Müller's Objection

Pessimists might also raise the following objection. In the discussion over the PI, realists have argued that we are at a time in history where the quality of science is sufficiently good, i.e., current theories are successful enough to warrant the realist belief that they are true. No realist, however, has developed a good argument to show that now is that time. Florian Müller states that it "is not at all obvious why science, or at least our current best theories, should have achieved a degree of success that warrants their truth" (2015: 406).

As mentioned in Section 1, however, this paper does not aim to establish scientific realism. Interested readers can find a summary of several new arguments for scientific realism in Park (forthcoming, Section 2). All these arguments are distinct from each other, and from the no-miracles argument defended by Hilary Putnam (1975: 73). Different realist answers to Müller's objection can be extrapolated from those arguments. For example, Park (2018b: 57–59) argues that special relativity has been reinforced by several scientific tests, such as those using atomic clocks and fast-flying jets. Those tests were not yet conceived when Einstein proposed his theory. It follows that special relativity will be bolstered by an unlimited number of heretofore unconceived scientific tests. Therefore, it is warranted *now*.

7. Conclusion

The API says that earlier theories, although successful, were overthrown, so current theories, although successful, will also be overthrown. The RPI says that earlier theories, although more successful than their predecessors, were ousted, so current theories, although more successful than their forerunners, will also be ousted.

The API and RPI are subject to the same criticism. The phrase "earlier theories" in their premises either refers to distant past theories or recent past theories. If it refers to distant past theories, the two premises are plausible, but empirical progressivism nullifies the inferences from the premises to the conclusions. If it refers to recent past theories, the inferences are legitimate, but historical optimism confutes the premises.

Therefore, empirical progressivism and historical optimism jointly make both the API and the RPI not cogent. They cast a damper over absolute and relative pessimists' aspirations for both a plausible premise and a legitimate inference from that premise to the conclusion.

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