# Scientific Realism and the Future Development of Science

**Abstract**
Nickles (2016, 2017, forthcoming) raises many original objections against scientific realism. One of them holds that scientific realism originates from *the end of history illusion*. I reply that this objection is self-defeating and commits the genetic fallacy. Another objection is that it is unknowable whether our descendants will regard our current mature theories as true or false. I reply that this objection entails skepticism about induction, leading to skepticism about the world, which is inconsistent with the appeal to the end of history illusion. Finally, I argue that we have an inductive rationale for thinking that our descendants will regard our current mature theories as true.

Forthcoming in *Diametros – An Online Journal of Philosophy*

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**Keywords**
End of History Illusion, Mature Theories, Pessimistic Induction, Scientific Realism

## 1. Introduction

Nickles (2016, 2017, forthcoming) raises many original objections to scientific realism, the view that "our most mature science has already achieved the goal of providing a true representation of nature, or very nearly so" (Nickles, 2016: 370). This paper aims to refute two of them that I take to be the strongest and the most innovative. The first concerns a cognitive illusion that psychologists call *the end of history illusion*, and the second one is what I call *the argument from the future*. These two objections to scientific realism are similar in that they are both based upon the considerations of how science will develop in the future.

In Section 2, I spell out the end of history illusion, namely, we tend to think that our future lives will not be dynamic, although we think that our past lives were dynamic. I then argue that it is self-defeating and commits the genetic fallacy to appeal to the end of history illusion in order to reject scientific realism. In Section 3, I unfold Nickles's argument from the future that our current mature theories are unwarranted because it is unknowable whether our descendants will regard them as true or false. I then argue that the argument from the future entails skepticism about induction and amounts to skepticism about the world. I also point out that the argument from the future is inconsistent with the appeal to the end of history of illusion. In Section 4, I argue that we have an inductive rationale for thinking that our descendants will regard our current mature theories as true.

## 2. The End of History Illusion

Nickles (forthcoming) presents several cognitive illusions to discredit scientific realism. This section focuses on one of them, namely, the end of history illusion (Quoidbach, Gilbert, and Wilson, 2013), for the following two reasons. First, it poses the strongest threat to scientific realism. Second, Nickles (2017: 151–154) previously invoked it to confute scientific realism. My criticisms against his appeal to it, however, apply no less to his appeals to the other cognitive illusions. In the interest of saving space, this paper does not spell out what the other

cognitive illusions are and how my criticisms against his appeal to the end of history illusion apply to his appeals to them.

We first need to be clear about what the end of history illusion is. Psychologists (Quoidbach, Gilbert, and Wilson, 2013) observe that our preferences, values, and personalities radically change as we grow old. For example, children are moved by fairy tales, but adults are not. Children are not interested in reproduction-related activities, but adults are. We, however, tend to think that our preferences, values, and personalities will change little in our future lives, although we think that they changed a lot during our past lives. We are under the illusion that our eventful lives end in the present.

What is the relationship between the end of history illusion and scientific realism? Nickles thinks that there is a causal relationship between them. Scientific realism asserts that our current mature theories are (approximately)[1] true, which indicates that mature disciplines will be uneventful, although they were eventful. Nickles says that just "as our personal futures look uneventful or flat compared with our pasts, so does the future history of science," and he says that the end of history illusion "invites scientists and science observers to be realists" (forthcoming: 6). He also says that "Applied to science, the temptation is to see the future of a currently successful field as similarly flat – as if the dynamical, innovative history of the field is now ended" (2017: 152). All these remarks indicate that Nickles takes the end of history illusion to lead scientists and scientific realists to the realist belief that our current mature theories are true.

Admittedly, scientific realism goes hand in hand with the end of history illusion, so it sounds plausible that scientific realism is generated by the end of history illusion. It should be noted, however, that no realist in the literature has appealed to the illusion to justify scientific realism. That is, no realist has stated that since we tend to believe that our future lives will not be transformative, although we believe that our past lives were transformative, we should also tend to believe that our current mature theories will be retained, although we believe that our past mature theories were discarded. Consequently, it is merely an assumption that there is a causal relationship between the end of history illusion and scientific realism.

Suppose, however, for the sake of argument that there is the causal relationship, i.e., that the end of history illusion generated scientific realism unbeknownst to scientific realists. An interesting question is what we should conclude from the causal relationship between them. Nickles concludes that we should resist the psychological tendency "to project our present views and preferences forward, as if the transformative changes are now over" (2017: 152). Resisting the psychological tendency in this context means resisting scientific realism.

It is, however, the genetic fallacy to reject scientific realism for this reason. The genetic fallacy occurs when we regard "factors in the discovery, or genesis, of a statement relevant, *ipso facto*, to the truth or falsity of it" (Salmon, 1984: 12). To use Wesley Salmon's example, the Nazis rejected Einstein's theory of relativity on the grounds that it was produced by a Jewish person. They took the cause of the theory as evidence against it. Similarly, Nickles's appeal to the end of history illusion amounts to taking the cause of scientific realism as evidence against it.

It is one thing to say that a belief is produced by a cognitive illusion; it is another to say that the belief is untenable. In general, a belief is tenable as long as it is supported by a strong argument. Just as the theory of relativity is warranted as long as it is supported by a strong argument, so scientific realism is warranted as long as it is supported by a strong argument. It does not matter whether the theory of relativity was generated by a Jewish person or not. Analogously, it does not matter whether scientific realism is produced by the end of history

[1] I drop 'approximately' henceforth for the sake of convenience.

illusion or not. Just as the theory of relativity should be accepted or rejected exclusively on the basis of whether arguments for it are strong or weak, so scientific realism should be accepted or rejected exclusively on the basis of whether arguments for it are strong or weak.

The most famous argument for scientific realism is the no-miracles argument (Putnam, 1975: 73; Psillos, 1999). It holds that scientific realism provides the best explanation of why science is successful. New positive arguments for scientific realism have recently been brought into the literature. They are "the optimistic argument from unconceived methods" (Park, 2018a: 59), "the anti-induction for scientific realism" (Park, 2018b: 329), "the optimistic induction over optimistic realists" (Park, 2018c: 9), and "scientists' arguments for scientific theories" (Park, forthcoming: Section 3). Scientific realism should be accepted or rejected on the basis of whether such arguments are strong or weak, so Nickles has the burden to refute all of them.

Nickles rejects the no-miracles argument on the grounds that it relies on inference to the best explanation (IBE), a rule of inference that scientific antirealists take to be problematic. We are using IBE when we choose a theory over its competitors on the grounds that it best explains the relevant phenomena. Nickles says, "nonrealists do not regard apparent explanatory success as sufficient reason to conclude truth, owing to underdetermination, etc., yet the inference to truth as the best explanation for the success of science makes a similar move at the metalevel" (2017: 159). On his account, both scientific and philosophical uses of IBE are problematic.

Nickles's skepticism about IBE, however, does not go hand in hand with his appeal to the end of history illusion. We believe that the end of history illusion is operative in our cognitive life because the psychological hypothesis that it is operative in our cognitive life best *explains* the experimental outcome of a psychology experiment (Park, 2018d: 74). In a psychological experiment, a group of subjects stated that they had changed a lot over the past ten years, while the other group of subjects stated that they would change little over the next ten years. The best explanation of these conflicting reports of the psychological subjects is that "people underestimate the extent to which their personalities, values, and preferences will change in the future" (Quoidbach, Gilbert, and Wilson 2013: 98). Thus, IBE is used as the means to arrive at the end of history illusion. Since Nickles is skeptical of IBE, he cannot appeal to the end of history illusion. In general, if you are skeptical of IBE, you cannot appeal to a scientific hypothesis to defend a philosophical view of science.

## 3. The Argument from the Future

In this section, I argue that Nickles's second objection is different from K. Brad Wray (2013) and Mario Alai's (2017) pessimistic induction, and that it entails skepticism about induction and reduces to skepticism about the world.

Nickles invites us to imagine what our descendants will think of our current mature theories. He says that "when we look at scientific progress from a deep historical perspective – one that allows for a long future of continued research – today's claims of scientific realism look vulnerable, even arrogant" (2016: 368). He also says as follows:

> Modern physics is, at best, four hundred years old. So even if the next four hundred years look tame compared to the past four hundred, what about the next thousand years, or two thousand? Even if a science changes more slowly in the future than in the past, it can still, eventually, outdo its past, making today's science look just as wrong or primitive to future researchers as our past looks to us. Maybe. No one knows. No one can know. (Nickles, forthcoming: 5)

This argument against scientific realism might be called *the argument from the future*. It says that there were scientific revolutions, so we do not know whether there will be scientific

revolutions in the future or not. This argument implies that we do not know whether our offspring will regard our current mature theories as true or false, which in turn implies that we do not know whether they are true or false. The argument from the future does not claim that there will be scientific revolutions, but rather that we do not know whether there will be scientific revolutions or not. Hence, it does not claim that we know that our current mature theories are false, but rather that we do not know whether they are true or false.

Mathew Sample (2015) essentially constructs the same argument against scientific realism as Nickles. Sample claims that scientists ought not assent to our current mature theories because they cannot take a diachronic perspective on our current mature theories, i.e., because they do not know what scientists in all ages would think of our current mature theories:

> ..scientists ought not believe a theory on the basis of a contextually contingent eliminative inference. In other words, the scientist should be able to distinguish between two scenarios: (1) situations where the last theory standing is, in all contexts, the only theory that explains the evidence; and (2) situations where the last theory standing is the last theory only because some contextual feature prevents scientists from conceiving of genuine alternatives. (Sample, 2015: 864)

Let me provide an example to illustrate what Sample has in mind here. Scientists have eliminated the humoral theory and miasma theory, and arrived at the germ theory in the history of science. They cannot, however, distinguish between two situations: (1) the germ theory is the theory of disease that scientists in all ages would regard as the best theory of disease; and (1) they think that the germ theory is the best theory of disease because they cannot conceive of a better theory of disease. Consequently, they ought not believe that the germ theory is true. In a nutshell, Sample's suggestion is that scientists should be skeptical of our current mature theories because our descendants might have better theories.

A different, albeit similar, line of argumentation has been constructed by other philosophers, such as Wray and Alai:

> ..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)

> ..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)

These philosophers argue that just as there have been scientific revolutions which have ousted our past mature theories in the past, so there will be scientific revolutions in the future which will replace our current mature theories. This pessimistic induction supports the prediction that our descendants will regard our current mature theories as false.

There is a similarity and a difference between Wray and Alai's argument and Nickles's argument from the future. The similarity is that we should take into account what our future generations will think of our current mature theories. The difference is that while Wray and Alai's argument states that our current mature theories will be discarded, Nickles's argument from the future is neutral as to whether they will be discarded or retained. Nickles's argument only asserts that we do not know beforehand either way. In sum, Wray and Alai's argument

makes the *pessimistic* inference that since there were scientific revolutions, there will be others, while Nickles's argument makes the *skeptical* inference that since there were scientific revolutions, we do not know whether there will be others or not. The pessimistic inference entails that we know that our current mature theories are false, while the skeptical inference entails that we do not know whether our current mature theories are true or false.

Which is a more reasonable inference? Wray and Alai's pessimistic inference is similar to other inductive inferences in science, such as the one that since copper conducted electricity, it will conduct electricity. In contrast, Nickles's skeptical inference is not similar to any other inductive inferences in science. Scientists seldom reason that since copper conducted electricity, we do not know whether it will conduct electricity or not. If skeptics run such an argument, we can point out that the premise does not justify the conclusion at all. We should say the same thing about Nickles's skeptical inference, i.e., the premise does not justify the conclusion.

Let me say more on this issue. Suppose that there were no scientific revolutions at all in the history of science, and that skeptics argue that since there were no scientific revolutions, we do not know whether there will be scientific revolutions or not. We would point out that their premise does not justify their conclusion at all. By parity of reasoning, we should say that Nickles's premise does not justify his conclusion at all. His conclusion that it is unknowable whether there will be scientific revolutions or not is neither supported by his premise that there were scientific revolutions nor by the opposite premise that there were no scientific revolutions. Both premises are simply irrelevant to the conclusion. So it is not clear why skeptics cite the historical fact that there were scientific revolutions with the intent to justifying skepticism about the future development of science. They might as well state that we do not know whether there will be scientific revolutions without saying anything about what happened in the history of science.

In my view, Nickles is a skeptic about induction. Given that there were scientific revolutions, if he believed in induction, he would assert that there will be scientific revolutions, as Wray and Alai do, and he would not assert that we do not know whether there will be scientific revolutions or not. Thus, Nickles is different from Wray and Alai in that the former is a Humean skeptic whereas the latter believed in induction.

It is inappropriate to conjure up Humean skepticism in the debate concerning scientific realism. Scientific realists and antirealists agree that induction is reliable. They only disagree over whether it is reasonable to believe that our current mature theories are true. Suppose that Humean skeptics come along and argue that induction is problematic, and hence that both scientific realism and antirealism are problematic positions. Scientific realists and antirealists would reply that to take issue with the reliability of induction is to open a debate that is different from the scientific realism debate, for the scientific realism debate already presupposes that induction is reliable.

Nickles's prediction about the prospect of scientific revolutions does not go well with his criticism against that of scientific realists. Scientific realists claim that our current mature theories are true, which implies that our descendants of thousands of years from now will regard our current mature theories as true. Nickels retorts that "such a claim is not really a scientific prediction, I would claim, but a forecast or even a prophesy" (2017: 157). Note that he accuses scientific realists' prediction of being not scientific. It seems to me, however, that Wray and Alai's prediction about our current mature theories is more scientific than Nickles's. No scientist would say that since copper conducted electricity, we do not know whether it will conduct electricity or not.

Furthermore, Nickles's reasoning scheme implies that observational beliefs are untrustworthy (Park, 2018e: 439). We believe, for example, that an apple is red. Consider,

however, that our distant ancestors, single-celled organisms, could not see anything. There were a series of genetic mutations between our distant and close ancestors. As a result, our close ancestors could see colors. Imagine that our descendants will undergo genetic mutations, and that as a result, an apple will appear to be white to them. If that happens, they will regard our current observational belief that an apple is red as being false. We do not know whether such genetic mutations will occur or not, so we do not know whether an apple is red or not. As this example illustrates, Nickles's argument from the future reduces to skepticism about the world.

The most famous argument for skepticism about the world was proposed by Descartes in the history of philosophy. His argument states that we do not know whether it is the world or the evil demon that causes sensations in our mind, so we do not know whether the world exists or not. By contrast, Nickles's argument from the future states that we do not know whether our descendants will regard our theoretical beliefs as true or false, so we do not know whether our theoretical beliefs are true or false. This reasoning scheme can be extended, although Nickles did not intend to, to observational beliefs, viz., we do not know whether our descendants will regard our observational beliefs as true or false, so we do not know whether our observational beliefs are true or false. In this sense, Nickles's argument from the future is different from Descartes's argument from the evil demon, although they commonly undermine our beliefs about the world.

Nickles's original argument, however, has the following unsavory effect on his own position. On the one hand, Nickles appeals to the end of history illusion to undercut scientific realism, as we have seen in Section 2. On the other hand, he runs the argument from the future to undercut scientific realism, as we have seen in this section. He, however, cannot appeal to the end of history illusion and run the argument from the future at the same time. The end of history illusion is postulated by the psychological hypothesis that the end of history illusion is operative in our cognitive life, as we have seen in Section 2. The argument from the future, however, implies that we do not know whether our future generations will regard the psychological hypothesis as true or false. Therefore, we do not know whether it is true or false, and hence whether the end of history illusion is operative or not in our cognitive life.

In this section, I accused the argument from the future of implying skepticism about induction and leading to skepticism about the world. In the next section, I argue that our future generations will regard our current mature theories as true.

## 4. The Optimistic Induction

What is the positive reason for thinking that our scientific offspring will regard our current mature scientific theories as true? In Section 2, I introduced four new positive arguments for scientific realism. They are "the optimistic argument from unconceived methods" (Park, 2018a: 59), "the anti-induction for scientific realism" (Park, 2018b: 329), "the optimistic induction over optimistic realists" (Park, 2018c: 9), and "scientists' arguments for scientific theories" (Park, forthcoming: Section 3). All four arguments imply that our future generations will regard our current mature theories as true. In this section, I spell out how "the optimistic induction over optimistic realists" (Park, 2018c: 9) has such an implication.

Historical optimists (Fahrbach, 2011: 148; Park, 2011: 79; Mizrahi, 2013, 2015, 2016) paint a bright picture of past science. They make the distinction between distant and recent past theories. Some examples of distant past theories are the Ptolemaic theory and the phlogiston theory. They were thrown out before the twentieth century. Some examples of recent past theories are the special theory of relativity and the kinetic theory. They were accepted in the twentieth century and have not been thrown out yet. The collection of recent

past theories is far larger than the collection of distant past theories, so *most* past theories have not been abandoned yet, contrary to what pessimists contend. Mizrahi (2013: 3219–3220, 2016) randomly selects some theories from the collection of past theories, demonstrating that *most* past theories have not been overturned yet. This bright picture of past science is called *historical optimism* (Park, 2017: 616).

Historical optimism can be the basis of "the optimistic induction over optimistic realists" (Park, 2018c: 9). Suppose that optimistic realists in the early twentieth century predicted that their contemporary theories, such as the special theory of relativity and the kinetic theory, would be retained. Their prediction has been borne out for the last one hundred years, given that as historical optimism asserts, most of the recent past theories have remained unrefuted so far. Optimistic realists in the early twenty-first century predict that their contemporary theories will not be thrown out. Their prediction will be borne out for the next hundred years, just as their predecessors' prediction has been for the past one hundred years. The same holds for optimistic realists in the distant future.

This optimistic induction parallels other ordinary inductions, such as the induction that since copper conducted electricity, it will conduct electricity, and the pessimistic induction over scientific theories that since earlier theories were falsified, current theories will also be falsified. All of them embed the same principle, viz., David Hume's (1888/1978: 89) uniformity principle that the future resembles the past. The only difference between the optimistic induction and the pessimistic induction is that the former has the premise that most past theories have been stable, whereas the latter has the premise that most past theories have been unstable. The former trumps the latter, given that the former is justified by the random sampling process mentioned above, whereas the latter is not.

What can we conclude from the optimistic induction with respect to our descendants' attitudes towards our current mature theories? They will regard our current mature theories as true. We have an inductive rationale for thinking so. It is wrong for Wray and Alai to say that our descendants will regard our current mature theories as false. Nor is it right for Nickles to say that we do not know whether they will regard our current mature theories as true or false. These criticisms against Wray, Alai, and Nickles are unavoidable under the assumption that induction is reliable.

Nickles might argue that it is near-sighted to predict that our current mature theories will persist for the next one hundred years on the grounds that they persisted for the past one hundred years. All of them *might* not last for one thousand years.

Note that this objection is cast in terms of possibility, and hence that it is compatible with the optimistic induction. The optimistic induction does not assert that optimistic realists in the early twenty-first century are *guaranteed* to be right in their prediction about our current mature theories. It rather asserts that they are *likely* to be right. So the refutation of the optimistic induction requires not the mere possibility but rather the likelihood that our current mature theories will be overthrown.

Nickles might now assert that it is likely that mature fields will undergo dynamic changes over the next one thousand years, since they underwent few dynamic changes over the past one hundred years. Note that this prediction is cast not in terms of possibility but in terms of likelihood. So it is incompatible with the optimistic induction.

It is not clear, however, whether the conclusion follows from the premise. What would be the reason for thinking that since there were few scientific revolutions, there will be many scientific revolutions? In the absence of a convincing answer to this question, the argument commits a fallacy that I call *the start of history fallacy*. It is a fallacious inference that since the past was uneventful, the future will be eventful. I do not claim that a philosopher has ever

committed the start of history fallacy in the literature. But I do claim that you commit it if you reason that since the past was not transformative, the future will be transformative.

The start of history fallacy is just the opposite of the end of history fallacy. Nickles (2018: 13) calls the end of history fallacy the inference that since the past was dynamic, the future will not be dynamic. Similarly, I call the start of history fallacy the inference that since the past was not transformative, the future will be transformative. These two inferences rise or fall together. There is no reason for thinking that the former is an incorrect inference while the latter is a correct inference.

Pessimists should use the uniformity principle consistently, whether they believe that past science was eventful or uneventful. That is, if they believe that there were few scientific revolutions, they should predict that there will also be few scientific revolutions. If they believe that there were many scientific revolutions, they should predict that there also will be many scientific revolutions. It is arbitrary and dogmatic for pessimists to believe that there will be many scientific revolutions, regardless of whether they believe that they were few or many scientific revolutions. If they are dogmatic in this manner, realists likewise can be dogmatic in the opposite manner, i.e., they can believe that there will be few scientific revolutions regardless of whether they believe that there were few or many scientific revolutions.

## 5. Conclusion

Nickles rejects scientific realism on the grounds that it stems from the end of history illusion. The appeal to the cognitive illusion, however, commits the genetic fallacy. Scientific realism should be accepted or rejected exclusively depending on how strong an argument for it is. It sounds initially intuitive that our past mature theories were false, so our current mature theories are also false or we do not know whether they are true or false. A close inspection on past science, however, reveals that scientific revolutions were rare in mature fields. The history of science entitles us to be optimistic about our current mature theories. Moreover, one commits the start of history fallacy when one says that since scientific revolutions were rare, they will be frequent.

In addition, it is self-defeating for Nickles to appeal to the end of history illusion to undermine scientific realism. To reject scientific realism means to reject the psychological hypothesis that the end of history illusion is operative in our cognitive life. Also, the argument from the future implies that we do not know whether the psychological hypothesis is true or false, which in turn implies that we do not know whether the end of history illusion is operative or not in our cognitive life. A philosophical moral is that if you are skeptical of science, you cannot avail yourself of science to develop a philosophical view of science. Let me end this paper with a motto: "To reject scientific realism is to suffer from a cognitive famine."

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