

THE UNVIRTUOUS PREDICTION OF THE PESSIMISTIC INDUCTION¹

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Pessimists predict that future scientific theories will replace present scientific theories. However, they do not specify when the predicted events will take place, so we do not have the chance to blame them for having made a false prediction, although we might have the chance to praise them for having made a true prediction. Their predictions contrast with astronomers' predictions. Astronomers specify when the next solar eclipse will happen, so we have both the chance to blame them for having made a false prediction and the chance to praise them for having made a true prediction. The pessimists' prediction remains unvirtuous until they specify when scientific revolutions will occur. This critical point applies no less to the selectivist's prediction.

Keywords: Pessimistic induction – Prediction – Scientific realism – Scientific revolution

1. Introduction

In our daily lives, we make predictions about the future. Some of them are virtuous, while others are unvirtuous. For example, the astronomer makes the virtuous prediction that a solar eclipse will occur at a particular time and in a certain place, while the fortuneteller makes the unvirtuous prediction that a mishap will befall you. Why is the astronomer's prediction virtuous? Why is the fortuneteller's prediction unvirtuous? Under what conditions is a prediction virtuous? This paper answers these questions, giving an account of what makes a prediction virtuous and then applying the account to the prediction of the pessimistic induction that current theories will succumb to scientific revolutions.

Why is it important to determine whether the prediction of the pessimistic induction is virtuous or unvirtuous? According to such philosophers as K. Brad Wray

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(2013: 4321) and Howard Sankey (2017: 201), the pessimistic induction is regarded as the most compelling argument against scientific realism, the view that “the theories accepted in a mature science are typically approximately true” (Putnam, 1975: 73). In addition, the pessimistic induction is endorsed by major contributors to the scientific realism debate, such as Wray (2007, 2010, 2013), Kareem Khalifa (2010), P. Kyle Stanford (2015, 875), Thomas Nickles (2017, 153), and Greg Frost-Arnold (2019).

The organization of this paper is as follows. In Section 2, I specify three conditions that a prediction should meet to be virtuous. In Section 3, I determine whether the prediction of the pessimistic induction meets the three conditions. In Section 4, I explore why it is problematic for a prediction not to refer to the time of a predicted event, using the example of the fortuneteller’s prediction. In Section 5, I reply to the following seven possible objections: (i) Philosophical and scientific predictions should be evaluated by different standards; (ii) The pessimist can retreat to the skeptical position that we do not know whether present theories will be overthrown; (iii) The pessimist’s prediction specifies the conditions for a scientific revolution; (iv) The pessimist’s prediction is similar to some scientific predictions; (v) If current theories persist for a long time, we will be optimistic about them; (vi) Hilary Putnam’s (1978) formulation of the pessimistic induction refers to a specific time; (vi) The pessimist’s prediction refers to the earth.

The main thesis of this paper is that the pessimist’s prediction is unvirtuous because it does not refer to the times of the predicted events. This paper should be of interest not only to the contributors to the scientific realism debate but also to philosophers of science who wonder what makes a prediction virtuous and what sort of predictions scientists strive for.

2. The Three Conditions

Some predictions are virtuous, while others are unvirtuous. What makes a prediction virtuous? Under what conditions can we say that a prediction is virtuous? Park’s (2022, Subsection 3.4, Chapter 11) answer to this question is as follows.

First, a prediction should be specific. A prediction is specific when it refers to a specific time and a specific place. For example, it is a specific prediction that a tidal wave will engulf Tokyo at 3 a.m. on June 30 in 2050. By contrast, it is an unspecific prediction that a tidal wave will engulf Tokyo. It is also an unspecific prediction that a tidal wave will occur at 3 a.m. on June 30 in 2050. In general, the more specific the time and place a prediction refers to, the closer it is to a virtuous prediction, other things being equal.

Second, a prediction should refer to a high probability. Suppose that there are two predictions regarding whether there will be a tidal wave at a specific time and in

a specific place. The first one says that it is 90 % probable that it will occur, whereas the second one says that it is 70 % probable that it will occur. In such a case, the first prediction is more virtuous than the second one. In general, the higher the probability a prediction refers to, the closer it is to a virtuous prediction, *ceteris paribus*.

Third, a prediction should be true. A false prediction is not virtuous. However, a false prediction can be close to or far from being a true prediction. Consequently, the more a false prediction approximates a true prediction, the closer it is to a virtuous prediction. Suppose, for example, that a tidal wave will engulf Tokyo on June 30 in 2050, and that there are two false predictions regarding this event. The first one says that a tidal wave will hit Tokyo on June 29 in 2050, and the second one says that a tidal wave will hit Tokyo on June 28 in 2050. The first prediction approximates the true prediction more than the second one. Therefore, the first one is closer to a virtuous prediction than the second one, other things being equal.

Let me make the following three comments on the foregoing three conditions: (i) One condition might be more important than another, depending on what our interests are in particular contexts; (ii) The more of the three conditions a prediction meets, the closer it is to a virtuous prediction. For example, a prediction that meets the first and second conditions is closer to a virtuous prediction than another prediction that meets only the second condition; (iii) The three conditions are not intended to be exhaustive. There might be other conditions such that if a prediction meets any of them, it gets closer to a virtuous prediction.

Where should we draw the line between virtuous and unvirtuous predictions? Answering this question requires that we should first answer the following questions. How specific a time and a place should a prediction mention to be virtuous? Exactly what probabilities should virtuous predictions refer to? How should we prioritize the three conditions? How many of the three conditions should a prediction meet to be virtuous? There are no correct answers to these questions, given that the term “virtuous” is a vague predicate. It is clear, though, that a prediction that does not meet the first condition, i.e., a prediction that does not refer to a specific time and a specific place is not virtuous, as the examples of the pessimist’s prediction and the fortuneteller’s prediction in Sections 3 and 4 below illustrate.

3. The Pessimistic Induction

Many writers have formulated the pessimistic induction. For brevity’s sake, I quote only Stanford’s and James Ladyman’s formulations. Stanford says that “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). Ladyman states that

“reflection on the abandonment of theories in the history of science motivates the expectation that our best current scientific theories will themselves be abandoned, and hence that we ought not to assent to them” (Ladyman 2014).

As these quoted sentences indicate, the pessimistic induction predicts that current theories will be abandoned. Does this prediction meet the three conditions sketched in Section 2? It does not refer to the times when present theories will be abandoned. Therefore, it does not meet the first condition that a prediction should refer to a specific time and a specific place. How about the second condition that a prediction should refer to a high probability that a predicted event will occur? Strictly speaking, the pessimist’s prediction says that it is *likely* that present theories will be abandoned. Therefore, we can grant that it refers to a high probability. How about the third condition that a prediction should be true? It is under dispute between the realist and the pessimist whether the pessimist’s prediction is true or false. Thus, to say that it is false is to beg the question against the pessimist.

Is the pessimist’s prediction virtuous or unvirtuous? In Section 2, I claimed that we cannot draw a line between virtuous and unvirtuous predictions. It appears, therefore, that I cannot say that the pessimist’s prediction is unvirtuous. Contrary to this expectation, however, I construct an analogical argument in the next section, according to which the pessimist’s prediction is similar to the fortuneteller’s prediction, which is unvirtuous, so the pessimist’s prediction is also unvirtuous.

4. The Fortuneteller’s Prediction

Imagine that you are worried about your future, so you consult a fortuneteller at the fee of \$100. She predicts that a misfortune will befall you, but she does not tell you when it will happen. She adds that an amulet would ward off the misfortune, and that she can sell you one at \$100. Without buying it, you say goodbye to her. Ten years later, you come across her on the street, complain to her that no misfortune has befallen you, and ask for the fee back. She replies that you are only closer to the misfortune, and that you now need a more expensive amulet from her. You realize that your personal history thus far does not conflict with her prediction because her prediction did not refer to a time. Imagine now that a misfortune never befalls you until you die a natural death. This time, it looks like you can blame her for having made a false prediction because it turned out that your personal history conflicts with the fortuneteller’s prediction. On closer examination, however, you cannot because you are dead! Thus, when the fortuneteller predicted that a mishap would befall you, you did not have the chance all long to disconfirm her prediction, although you might have had the chance to confirm it. The fortuneteller’s prediction was an unvirtuous one (Park 2022, Subsection 3.4, Chapter 11).

Like the fortuneteller's prediction, the pessimist's prediction does not refer to a time. Imagine that present theories persist for one billion years. The realist complains to the pessimist that no scientific revolution has occurred for the past one billion years. The pessimist replies that they are only closer to scientific revolutions. The realist realizes that the development of science thus far does not disagree with the pessimist's prediction because the pessimist's prediction did not refer to a time. Imagine now that a scientific revolution never occurs until the end of time. This time, it looks like the realist can hold the pessimist accountable for having made a false prediction because it turned out that the development of science disagrees with the pessimist's prediction. On closer inspection, however, the realist cannot because time has stopped! Thus, the realist did not have the chance all along to blame the pessimist for having made a false prediction, although the realist might have had the chance to praise the pessimist for having made a true prediction. The pessimist's prediction was an unvirtuous one, just like the fortuneteller's.

The pessimist's prediction contrasts with the astronomer's prediction. The astronomer predicts that the next solar eclipse will occur on a particular date. She specifies the time of the predicted event, so it is clear exactly when we will be able to confirm or disconfirm her prediction and hence exactly when we will be able to praise her for having made a true prediction or blame her for having made a false one. Her prediction is a virtuous one.

My foregoing criticism against the pessimistic induction applies no less to the selective induction. The selective induction holds that some components of present theories will survive future scientific revolutions, just as some components of past theories have survived past scientific revolutions, and that other components of present theories will fail to survive future scientific revolutions, just as other components of past theories failed to survive past scientific revolutions. The selective induction is incompatible with Putnam's definition of scientific realism in Section 1 above in that the former affirms, while, the latter denies, that most current theories will succumb to scientific revolutions. The selective induction is embraced by many eminent philosophers, such as Stathis Psillos (1999), Ladyman (2014), and Peter Vickers (2017). The selectivist and the pessimist commonly predict that current theories will succumb to scientific revolutions (Park 2017, 98 – 99; Stanford 2018, 79). However, the selectivist does not specify the times of the predicted events any more than the pessimist does.

How about the realist's prediction that present theories will not be overturned? At first blush, it does not seem to refer to a time, so it seems that it is in principle impossible to accuse the realist of having made a false prediction. However, imagine that alternatives will supersede present theories tomorrow. If such an event takes

place, we can accuse the realist of having made a false prediction. Thus, on close examination, the realist's prediction is similar to the astronomer's in that we can imagine a situation in which the realist and the astronomer take responsibility for having made false predictions.

Is the pessimist's prediction falsifiable? The answer to this question depends on what the term "falsifiable" means. Karl Popper states that a statement is falsifiable if and only if it is "capable of conflicting with possible, or conceivable, observations" (Popper 1963, 39). Unfortunately, this definition admits of two different interpretations due to the ambiguity of the term "observations." Whose observations does Popper mean? He might mean the observations of the thought-experimenter, who is not placed in the imagined state of affairs, or the observations of the imagined observer, who is placed in the imagined state of affairs.

Suppose that Popper means the observations of the thought-experimenter, who is not part of the imagined state of affairs. On this interpretation, the pessimist's prediction is falsifiable. The thought-experimenter can conceive of a future state of affairs in which current theories will remain unrefuted until the end of time. She is not part of the imagined state of affairs where time stopped, so she can observe the frozen state of affairs, and her observation conflicts with the pessimist's prediction. Accordingly, the pessimist's prediction is falsifiable.

By contrast, suppose that Popper means the observations of the imagined observer, who is part of the imagined state of affairs. On this interpretation, the pessimist's prediction is unfalsifiable. The thought-experimenter cannot conceive of a future state of affairs in which the imagined observer makes observations that conflict with the pessimist's prediction. After all, since time has stopped in the imagined state of affairs, the observer can do nothing, which implies that the act of observation cannot occur. Consequently, the pessimist's prediction is not falsifiable.

I am neutral on the issue of whether the pessimist's prediction is falsifiable. This paper does not need to be embroiled in the interpretational issue of what Popper has in mind with observations. To emphasize, I do not claim that the pessimist's prediction is unfalsifiable and hence unscientific. Therefore, it is wrong for the pessimist to reject my criticism against her prediction on the grounds that falsifiability is not a tenable standard for scientific predictions, or on the grounds that falsificationism is an obsolete philosophical theory.

The pessimistic induction has been under critical scrutiny for the past several decades, and the critical scrutiny has revealed several intrinsic problems with it (Park 2018, 11). For example, the pessimist offers the sample of past theories to argue that past theories were abandoned. However, it turns out that the sample is biased. Such

problems were hidden when the pessimistic induction was constructed by Larry Laudan (1977, 126) and Putnam (1978, 25). Park (2018, 11 – 12) infers that there are more hidden problems with it, and predicts that they will be revealed. This paper is intended to confirm the prediction.

5. Objections and Replies

5.1. Naturalism

The pessimist might argue that her prediction is not a scientific one but rather a philosophical one, so we should apply a lower standard to it. Specifically, a philosophical prediction is respectable even if it does not mention a time, but a scientific prediction is not respectable if it does not mention a time.

Let me make two critical comments on this defense of the pessimist's prediction. First, the fortuneteller would wholeheartedly agree with it. She would say that just as we should apply a lower standard to philosophy than to science, so we should apply a lower standard to fortunetelling than to science, and that just as the pessimist's prediction is respectable even though it does not refer to a time, her prediction is respectable even though it does not refer to a time. It is not clear on what grounds the pessimist could say that her prediction is respectable while the fortuneteller's is not.

Second, the foregoing defense of the pessimist's prediction runs counter to naturalism. According to naturalism, there is no fundamental difference between scientific and philosophical methodologies. In the naturalist vein, Laudan says, "The suggestion that epistemological doctrines have much the same empirical status as the sciences is a welcome one" (Laudan 1981, 19). Frost-Arnold rejects scientific realism on the rounds that it "neither makes new predictions nor unifies previously disparate claims" (Frost-Arnold 2010, 47). Moti Mizrahi accuses scientific realism of failing "to yield independently testable predictions that alternative explanations for success do not yield" (Mizrahi 2012, 137). Nickles dismisses the realist's prediction, saying it "is not really a scientific prediction, I would claim, but a forecast or even a prophesy" (Nickles 2017, 157). All these naturalists would reject the pessimist's possible suggestion that we should apply a lower standard to a philosophical prediction.

5.2. Humean Skepticism

The pessimist might argue that the pessimistic induction is a simple enumerative induction: alternatives surpassed past theories, so alternatives will surpass present theories. It is not clear how our grounds for making this inductive argument depend upon making a specific prediction about when scientific revolutions will occur. In other words, how does the absence of a reference to a time undermine the simple enumerative induction?

My response to this objection is to point out that the astronomer's prediction about the next solar eclipse is also a product of a simple enumerative induction: when certain astronomical conditions have been met, solar eclipses have occurred, so when those conditions are met, solar eclipses will occur.² However, the astronomer specifies exactly when those conditions will be met, i.e., when the next solar eclipse will occur. By contrast, the pessimist does not specify when scientific revolutions will occur. Consequently, we do not have a chance to accuse her of having made a false prediction.

In response, the pessimist might reformulate the pessimistic induction, arguing now that because past theories were abandoned, we do not know whether present theories will be abandoned, so we ought not to believe them. Note that this new argument does not predict that present theories will be ousted, so my criticism against the pessimist's prediction does not apply to it.

However, this argument is not the pessimistic induction but rather an entirely new argument. The inference that since past theories were overthrown, we do not know whether present theories will be overthrown is similar to the inference that since the moon has been rising, we do not know whether it will rise. These two inferences embody the Humean idea that past events cannot serve as evidence for predicting a future event. They are clearly different from the pessimistic induction, 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).

Moreover, the pessimistic induction and Humean skepticism conflict with each other (Park 2019, 142 – 144). The pessimistic induction relies on the uniformity principle (Hume, 1888/1978: 89) that the future will be like the past, while Humean skepticism rejects the uniformity principle on the grounds that there is no rational justification for it. Therefore, it is problematic for the pessimist to fall back on Humean skepticism to get around my objection that the absence of any reference to times makes the pessimist's prediction unvirtuous.

5.3. Time vs. Condition

The pessimist might object that her prediction refers to a time, viz., future theories will oust present theories when enough contradictory evidence has been accumulated to demand a change in theoretical principles. Many scientific hypotheses make references to such times. The economist, for example, predicts that prices will go down

² This claim is compatible with the fact that the astronomer's prediction is a consequence of a theory and auxiliary hypotheses, and thus that it suits well with the hypothetico-deductive model of testing.

when supply exceeds demand. Therefore, the pessimist's prediction is just as scientific as such scientific predictions.

This objection confuses the condition for an event to occur with the time of an event. Of course, a scientific revolution will occur when serious anomalies accumulate against an old theory and a new theory handles them, as Thomas Kuhn (1962/1970) has already observed. His observation has become common knowledge in the philosophy of science community. This paper does not challenge the pessimist to specify this common knowledge. It rather challenges her to specify when, exactly, the conditions for scientific revolutions will be met for each present theory. For example, when will serious anomalies be piled up against the theory of plate tectonics? When will an alternative theory handle those anomalies? In what years will these events occur?

Moreover, imagine that the astronomer predicts that a solar eclipse will occur. You ask her when it will occur. She answers that it will occur when the sun, the moon, and the earth are lined up on the ecliptic, but she does not give the date of the solar eclipse. What is worse, she insists that there is nothing wrong with this prediction because it refers to a time. You would think that her attitude does not live up to your expectation.

5.4. Some Scientific Predictions

The pessimist might argue that a prediction does not have to be true to be virtuous. In science, there are many great predictions which turned out to be false, but were well-defined, well-tested, and served the progress of our knowledge. Therefore, it is wrong for me to advance the third condition that a prediction should be true.

This line of reasoning could be the starting point of an interesting new debate. I leave the task of fleshing it out to future researchers. I only remind them that the fortuneteller might appeal to their research result to defend her prediction. She might say that some predictions in science are virtuous although they are false, and thus that her prediction might be virtuous although it is false.

Consider the predictions that all humans will die, and that an earthquake will happen in London. These predictions are scientific and respectable, although they do not mention times. It follows that the pessimist's prediction is also scientific and respectable.

Let me make three comments. First, the fortuneteller would wholeheartedly support this objection, claiming that her prediction is also scientific and respectable even though it does not refer to a time. If the pessimist disagrees with the fortuneteller, the pessimist should tell us what the relevant difference is between her prediction and the fortuneteller's prediction that would entitle her to say that her prediction is scientific

and respectable, whereas the fortuneteller's prediction is not. In a nutshell, the pessimist only creates a burden of proof on herself if she emphasizes the similarity between her prediction and certain scientific predictions.

The fortuneteller would add that her prediction is more virtuous than the pessimist's prediction, pointing out that her prediction makes a vague reference to the time, while the pessimist's prediction does not even make such a reference. Her prediction implies that a misfortune will befall you before you die, which in turn implies that the predicted event will take place in less than 80 years. By contrast, the pessimist's prediction does even not imply that the predicted events will take place in 100 million years. Therefore, if the pessimist's prediction is scientific and respectable, the fortuneteller's prediction is all the more scientific and respectable.

Second, consider the prediction that all humans will die. It appears not to refer to a time. On closer examination, however, it does. Suppose that you were born in 2000. The prediction implies that you are likely to die around 2080. Thus, the prediction refers to times once it is supplied with individuals' years of birth. Furthermore, the times can become more specific these days with the advent of the technique to estimate life expectancy on the investigation of the length of the telomere, the termini of chromosomes. Molecular biologists today can tell you, for example, that you will die at the age of around 82. Scientists are not content with the mere prediction that all humans will die. They strive to give the specific times of the predicted events. By parity of reasoning, the pessimist should not be content with the mere prediction that current theories will be ousted. She should strive to give the specific times of the predicted events (Park 2022, Subsection 3.4, Chapter 11).

Third, let me turn to the prediction that an earthquake will happen in London. Imagine that you live in London, and that the seismologist tells you that an earthquake will happen in London. You ask her when it will happen. She answers, "It may happen tomorrow or a billion years later. No one knows, but it will happen." You would not be impressed by such a prediction, and you would tell her that her prediction will remain unvirtuous until she comes up with the specific time of the predicted event. Imagine now that you believe that current theories are true, and that the pessimist tells you that they will be overturned. You ask her when the predicted events will happen. She answers, "They may happen tomorrow or a billion years later. No one knows, but they will." By parity of reasoning, you should not be impressed by such a prediction, and you should tell her that her prediction remains unvirtuous until she comes up with the specific times of the predicted events.

We should distinguish between the prediction that an earthquake will happen in London and the prediction that an earthquake will happen in London *in the near fu-*

ture. A vague temporal predicate is in the latter, but not in the former. If the seismologist makes the vague prediction, we may press her to give a precise definition of “in the near future.” If her definition is precise enough, we will have the chance to blame her for having made a false prediction or to praise her for having made a true prediction. However, as Stanford’s formulation and Ladyman’s formulation of the pessimistic induction in Section 3 above indicate, the pessimist does not even make the vague prediction that current theories will be overthrown *in the near future*. She merely predicts that they will be overthrown, leaving us with no clue when the predicted events will occur. Therefore, we will never have the chance to blame her for having made a false prediction.

Let me turn to the following question. What if the pessimist predicts that current theories will be abandoned in *approximately* 1,000 years, but they will actually be abandoned in 950 years? Astronomers predict that the sun will run out of nuclear energy in approximately 5 billion years. We would not say that their prediction is unvirtuous although the sun will actually run out of nuclear energy in 5.2 billion years.

I am inclined to say that such a prediction is virtuous. Let me remind readers, however, that such a prediction cannot be found in Stanford’s formulation and Ladyman’s formulation of the pessimistic induction quoted in Section 3 above. Those formulations do not even give us the slightest idea when scientific revolutions will occur.

The key message of this subsection is that the pessimist should specify the times of her predicted events instead of arguing that her prediction is similar to some scientific predictions.

5.5. The Tentative and Definitive Pessimistic Inductions

In light of the discussion of the earthquake in London in Subsection 5.4 above, the pessimist might propose that present theories will be overturned *in the near future*, and that if present theories persist even after the near future, she will be happy to give up on the pessimistic induction and believe that present theories are true. On this proposal, there is no reason to adhere to the pessimistic induction, come what may. As time passes, we will gradually lose confidence in it.

This possible move motivates me to distinguish between the tentative and definitive pessimistic inductions. The tentative pessimistic induction says that the theories that have persisted for a short period of time will be discarded, but the theories that have persisted for a long period of time will not. Tentative pessimists’ attitude toward young theories is tentative. In contrast, the definitive pessimistic induction says that no matter how long theories persist, they will turn out to be false. Definitive pessimists’ attitude toward young theories is definitive. The tentative pessimistic induction

fares better than the definitive pessimistic induction *vis-à-vis* my criticism that the pessimist's prediction is unvirtuous.

However, the tentative pessimistic induction is vulnerable to the following objection. Most theories that were held to be true in the early 20th century, such as the kinetic and oxygen theories, have persisted for more than 100 years, as observed by historical optimists (Fahrbach 2011; Park 2011; Mizrahi 2013, 2015, 2016). This historical fact generates difficult questions for the tentative pessimist. Can we be confident that past theories, such as the kinetic and oxygen theories, will persist? Is 100 years a short or a long period of time? How long is long enough?

The tentative pessimist might complain that these questions are too demanding. It is a daunting task to specify how long a theory should persist for us to be confident that it is true. In response, I point out that the antirealist raises a similar objection to scientific realism. The realist argues that theories have been increasingly successful, so although earlier theories were false, current theories are true. However, Florian Müller objects 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" (Müller 2015, 406). It is a daunting task for the realist to specify the degree of success required for theories to be confirmed true. Therefore, my request to the tentative pessimist and Müller's request to the realist are in the same boat.

5.6. Putnam's Formulation

The main thesis of this paper is that just as the fortuneteller's prediction is unvirtuous because it does not refer to the time of the predicted event, so the pessimist's prediction is unvirtuous because it does not refer to specific times of the predicted events. However, Putnam's formulation of the pessimistic induction does refer to a specific time. It says that "just as no term used in the science of more than fifty (or whatever) years ago referred, so it will turn out that no term used now (except maybe observational terms, if there are such) refers" (Putnam 1978, 25). This formulation of the pessimistic induction can be interpreted as predicting that the theoretical terms which were presumed to refer in 1978 will turn out not to refer in 2028 or so. Therefore, my criticism against Stanford's formulation and Ladyman's formulation of pessimistic induction does not apply to Putnam's formulation of the pessimistic induction.

Let me make two comments on this objection. First, it was wrong for Putnam to say that the theoretical terms that were presumed to refer in 1927 turned out not to refer in 1978. As noted in Subsection 5.5 above, most theories that were held to be true in the early 20th century have persisted for more than 100 years. Consequently, most theoretical terms that were presumed to refer in 1927 still referred in 1978. Second, our philosophical predecessors of the 1980s could not tell whether Putnam's

prediction was true or false. However, more than 40 years have passed since he made the prediction. We have almost reached the time when we will be able to blame him for having made a false prediction. Contrary to his prediction, most theoretical terms of his time still refer. Accordingly, his prediction fails to meet the third condition of a virtuous prediction that it should be true.

What follows from the fact that Putnam's prediction turned out to be false? We can predict that his philosophical offspring will specify the times of future scientific revolutions, and that just as his prediction turned out to be false, their predictions will also turn out to be false. Imagine, for example, that some pessimists will predict in 2050 that the oxygen theory will be overthrown in 2100. Their prediction will follow the fate of Putnam's as a matter of induction. The same will hold for the predictions of their successors. This prediction about some pessimists' predictions is a positive argument for Putnam's definition of scientific realism in Section 1 above according to which most current theories will not succumb to scientific revolutions.

5.7. The Earth

The pessimist might argue that her prediction refers to a specific place, viz., the earth, and thus it is problematic for me to say that her prediction does not meet the first condition that a prediction should refer to a specific time and a specific place. My response is to this defense of the pessimist's prediction is to say that the fortuneteller can say the same thing about her prediction, viz., her prediction refers to a specific place, viz., the earth. My intuition is that her prediction is unvirtuous, although it refers to the earth. By parity of reasoning, the pessimist's prediction is unvirtuous, although it refers to the earth.

6. Conclusion

The pessimist predicts that current theories will succumb to scientific revolutions. However, her prediction does not refer to the times when the predicted events will take place. In the absence of a reference to these times, we do not have a chance to blame her for having made a false prediction. In this sense, her prediction is an unvirtuous one. Despite this objection to the pessimistic induction, however, many readers will continue to believe that like past theories, present theories will undergo scientific revolutions. Selectivism is so popular these days that many readers will maintain that we should believe only some components of present theories, be they working posits, mathematical structures, or what have you. This paper poses a simple question to them: "In what year will the oxygen theory be overturned?"

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