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Extensional scientific realism vs. intensional scientific realism

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ABSTRACT

Extensional scientific realism is the view that each believable scientific theory is supported by the unique first-order evidence for it and that if we want to believe that it is true, we should rely on its unique first-order evidence. In contrast, intensional scientific realism is the view that all believable scientific theories have a common feature and that we should rely on it to determine whether a theory is believable or not. Fitzpatrick argues that extensional realism is immune, while intensional realism is not, to the pessimistic induction. I reply that if extensional realism overcomes the pessimistic induction at all, that is because it implicitly relies on the theoretical resource of intensional realism. I also argue that extensional realism, by nature, cannot embed a criterion for distinguishing between believable and unbelievable theories.

1. Introduction

The no-miracles argument (Psillos, 1999; Putnam, 1975) and the pessimistic induction (Laudan, 1977: 126; Poincaré, 1905/1952: 160; Putnam, 1978: 250; Stanford, 2006) are regarded as the best arguments for scientific realism and antirealism, respectively. The no-miracles argument holds that the success of scientific theories would be miracles if they are (completely) false. The realist hypothesis that they are (approximately) true provides the best explanation of their success. The pessimistic induction, on the other hand, holds that successful past theories, such as the phlogiston theory and the caloric theory, turned out to be (completely) false, so successful present theories, such as the oxygen theory and the kinetic theory, will also turn out to be (completely) false. These rough formulations of the no-miracles argument and the pessimistic induction do not accurately represent the sophisticated positions defended by philosophers in the literature, but they are good enough to serve the purpose of this paper.

This paper focuses on a certain trend in the literature concerning the no-miracles argument and the pessimistic induction. A growing number of philosophers (Achinstein, 2002; Enfield, 2008; Fitzpatrick, 2013; Lipton, 2001; Roush, 2010) argue that we should rely on scientists' arguments for scientific theories as opposed to the no-miracles argument to arrive at realism. This view has not yet received its due attention in the literature, although it contains a valuable insight on how we should evaluate scientific theories, as will become clear in this paper.

This paper is structured as follows. In Section 2, I clarify the key terms: 'extensional scientific realism' and 'intensional scientific realism.' In Section 3, I argue that the no-miracles argument is reducible to a collection of all the scientific arguments for successful theories, so it does not provide additional support for scientific theories. In Section 4, I argue that the mere difference between the first-order evidence for present theories and that for past theories does not make present theories immune to the pessimistic induction. What really makes present theories immune to it is that the first-order evidence for them is more powerful than that for past theories. In Section 5, I reply to a possible objection that it is problematic to develop a new position that gets around the pessimistic induction because the pessimistic induction has already been conquered.

2. Extensional vs. intensional

We teach our undergraduates that there are basically two ways to define a word like 'bachelor.' They are extensional and intensional definitions. An extensional definition specifies all the objects that a term can be correctly applied to. So 'bachelor' is extensionally defined as Tom, John, Eric, and so on. By contrast, an intensional definition specifies all the properties that the objects have in common. So 'bachelor' is intentionally defined as an unmarried adult male. It is much more cumbersome to give an extensional definition than to give an intensional definition. An intensional definition saves us from the pain of enumerating all the relevant

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objects in the world. The distinction between extensional and intensional definitions will be utilized in this section to cast light on scientific realism.

How can we go about picking out believable theories from science? Just as there are two ways to pick out bachelors, so there are two ways to pick out believable theories. The first method is to enumerate them. So believable theories are the oxygen theory, the kinetic theory, the general theory of relativity, evolutionary theory, and so forth. If challenged to justify the choice of these theories, we can specify the first-order evidence for each of them. The first-order evidence is the evidence that scientists provide to justify their theories. This method to choose believable theories leads to the view that I call 'extensional scientific realism' ('extensional realism,' for short). It asserts that we should enumerate believable theories and that we should rely on the unique first-order evidence for each theory to determine whether it is believable or not. On this account, the unit of evaluation is not a set of theories but an individual theory.

The second method to pick out believable theories from science is to use their common property. Hilary Putnam (1975), for example, suggests that success is the common property of all believable theories.[2] If challenged to justify the choice of the property, he would say that a false theory cannot have the property. This method to choose believable theories leads to the view that I call 'intensional scientific realism' ('intensional realism,' for short). It asserts that we should use a common property to pick out believable theories and cite the common property as the evidence for the choice of the theories. On this account, the unit of evaluation is not an individual theory but a set of theories. Intensional realists believe, for example, that successful theories are true on the grounds that false theories cannot be successful. Thus, intensional realism is built into the no-miracles argument.

Suppose that extensional realists have enumerated all believable theories in consideration of how strong scientists' arguments are. Would this show that all believable theories have a common property? P. D. Magnus and Craig Callender (2004) would answer no to this question. They claim that reflecting "on the vast complexities of various historical episodes in science, there is no reason to think that the general assumptions one finds will be at all simple, natural, or even non-disjunctive" (2004: 335). Therefore, it is one thing that all believable theories are enumerated, yet it is another that a common property emerges from the collection of all believable theories. In any event, intensional realists have, while extensional realists do not, the burden to specify the common property.

A terminological issue needs to be addressed. How does the distinction between extensional realism and intensional realism relate to Magnus and Callender's (2004) distinction between retail and wholesale arguments and to Simon Fitzpatrick's (2013) distinction between local and global strategies? Are the three distinctions different distinctions or the same distinction in different guises?

Magnus and Callender say that retail arguments are "arguments about specific kinds of things such as neutrinos" whereas wholesale arguments are "arguments about all or most of the entities posited in our best scientific theories" (2004: 321). In business, to sell goods in retail is to sell them one by one to consumers, whereas to sell wholesale goods is to sell them as a group to other businesses. As such, retailism and wholesalism in the realism debate could be taken to mean that we should evaluate scientists' arguments for the existence of theoretical entities one by one and as a group, respectively. Retailists might think, for example, that scientists' argument for the existence of neutrinos is convincing, while their argument for the existence of top quarks is not. As a result, retailists might embrace realism about neutrinos while embracing antirealism about top quarks (Magnus & Callender, 2004: 333). In contrast, wholesalists evaluate general arguments, ranging over all theoretical entities of our best theories, such as the no-miracles argument, the pessimistic induction, and the problem of underdetermination. As a result, they embrace either realism or antirealism *en masse* concerning all theoretical entities of our best theories, i.e., they believe either that all of them exist or that neither of them exists.

The retail/wholesale distinction differs somewhat from the extensional/intensional distinction. Retailists and wholesalists may disagree as to which theoretical entities we are justified in believing in and not justified in believing in. For example, retailists might believe that neutrinos exist but that top quarks do not, whereas wholesalists might believe that both neutrinos and top quarks exist or that neither of them does. By contrast, extensionalists and intensionalists agree about which theories are warranted and which theories are not, just as they agree on who are bachelors and who are not. They agree, for example, that the oxygen theory, the kinetic theory, and evolutionary theory are warranted, just as they agree that John, Tom, Eric, and so on are bachelors.[3]

Fitzpatrick's local/global distinction does not differ from the extensional/intensional distinction. 'Extensional realism,' however, better captures what Fitzpatrick has in mind. Local realism can be interpreted as the view that all the theories in a particular field of science are warranted, but all the theories in another field of science are not, given that Samuel Ruhmkorff (2014: 410) distinguishes between the local pessimistic induction and the global pessimistic induction. Local pessimists are pessimistic about all the theories in a particular field of science, but not about other theories in other fields of science. In contrast, global pessimists are pessimistic about all the theories in all fields of science. Extensional realists, however, reject the suggestion that all the theories in a particular field of science can be evaluated as a whole. They believe that different theories, even if they belong to the same field of science, say, physics, should be evaluated on a case-by-case basis, the reason being that they are supported by different sets of first-order evidence. Thus, 'extensional realism' better captures than 'local realism' the view that the unit of evaluation is not a set of theories but an individual theory.

How does the extensional/intensional distinction relate to the first-order/second-order distinction? The first-order evidence for scientific theories is the evidence that scientists provide to justify them, whereas the second-order evidence for scientific theories is the evidence that allegedly arises when philosophers reflect on the first-order evidence. Both extensional realism and intensional realism are committed to the existence of the first-order evidence, but not to the existence of the second-order evidence. As we will see in the next section, Stathis Psillos (2011) argues that the no-miracles argument provides the second-order evidence for scientific theories. I will argue, however, that the alleged second-order evidence is reducible to the first-order evidence and that the no-miracles argument does not provide the second-order evidence for scientific theories.

An objection against extensional realism arises. Extensional realists would believe such theories as the oxygen theory and the

[2] Different intensional realists put forward different common properties. Jarrett Leplin (1997) and Juha Saatsi (2009: 358) propose that believable theories make novel predictions. Seungbae Park (2011a) proposes that believable theories are successful ones that cohere with each other.

[3] My interpretation of the retail/wholesale distinction is endorsed by Callender (Personal Communication).