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SELECTIVE REALISM *VERSUS* INDIVIDUAL REALISM FOR SCIENTIFIC CREATIVITY

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Individual realism asserts that our best scientific theories are (approximately) true. In contrast, selective realism asserts that only the stable posits of our best scientific theories are true. Hence, individual realism recommends that we accept more of what our best scientific theories say about the world than selective realism does. The more scientists believe what their theories say about the world, the more they are motivated to exercise their imaginations and think up new theories and experiments. Therefore, individual realism better fosters scientific creativity than selective realism.

Keywords: creativity, individual realism, motivation, pessimistic induction, selective realism.

Introduction

There are diverse versions of scientific realism in the philosophy of science literature. Which version has the most desirable impact on scientific creativity, the ability to come up with new scientific theories and experiments? This paper aims to show that individual realism better fosters scientific creativity than selective realism. I have chosen these two versions of scientific realism because selective realism is currently the most popular form of scientific realism and because individual realism starkly contrasts with selective realism.

The outline of this paper is as follows. In the next section, I explicate selective and individual realism, arguing that individual realism recommends that we accept more of what a scientific theory says about the world than selective realism does. In the subsequent section, I adjudicate between them in terms of their impacts on scientific creativity, arguing that scientists will be more motivated to devise a new theory and experiments for it if they choose individual realism than if they choose selective realism as their epistemic policy, whether the new theory is the first, second, or third theory in a given field.

It is important to find a version of scientific realism that significantly increases scientific creativity because scientific creativity makes scientific progress possible. Science has progressed by replacing old theories with new ones. Scientists replaced, for example, the Ptolemaic theory with the Copernican theory, the phlogiston theory with the oxygen theory, the caloric theory with the kinetic theory, the ether theory with the special theory of relativity, and so on. We know more about the world than our ancestors did thanks to the replacements of old theories with new ones. These replacements would have been impossible, if scientists had lacked the motivation to think up new theories and experiments.

Selective realism and individual realism

We first need to be clear about what the pessimistic induction asserts, for selective and individual realism are different responses to it. It asserts that since old theories, such as the Ptolemaic theory, the phlogiston theory, the caloric theory, and the ether theory of light, turned out to be false, new theories, such as the Copernican theory, the oxygen theory, the kinetic theory, and the special theory of relativity, will also turn out to be false. It is formulated by such thinkers as Henri Poincaré (1952: 160), Ernst Mach (1911: 17), Larry Laudan (1977: 126), Hilary Putnam (1978: 25), P. Kyle Stanford (2006: 19–20), and K. Brad Wray (2010: 311, 2013: 4327). Stanford (2006: 7–8) stresses that old theories were profoundly mistaken about the world, that their assertions about unobservables are radically distinct from those of new theories, and hence that old theories were not even approximately true.

Selective realists reply that a scientific theory is composed of stable and unstable posits, which are the theoretical constituents, respectively, that are used and not used to explain and predict phenomena. When scientific revolutions occur, stable posits are carried over from old to new theories, while unstable posits are thrown out. It follows that old theories were not profoundly mistaken about the world, contrary to what Stanford contends. Selective realism is endorsed by such thinkers as John Worrall (1989), Philip Kitcher (1993: ch. 4, 5), Stathis Psillos (1999: ch. 6, 2009), Anjan Chakravartty (2008), Patrick Enfield (2008), Peter Godfrey-Smith (2008), David Harker (2008), Juha Saatsi (2009), and Samuel Ruhmkorff (2011: 882). These philosophers believe that stable posits are true, but not that unstable posits are true.

Psillos (1999: 115–130) presents an impressive case study of the caloric and kinetic theories to illustrate what selective realism asserts. Briefly speaking, the caloric theory is composed of stable and unstable posits like other scientific theories. An example of its stable posits is the principle that the quantity of heat always remains the same. An example of an unstable posit is the hypothesis that the cause of heat is a material substance called caloric. The kinetic theory is also composed of stable and unstable posits. An example of its stable posits is the aforementioned principle of the conservation of heat. An example of an unstable posit is the hypothesis that the cause of heat is the motion of tiny particles. Psillos (1999: 127) claims that the caloric theory was approximately true on the grounds that its stable posits were true in light of the kinetic theory. His contention is intended to undercut Stanford's contention that old theories were not even approximately true.

Selective realists believe that past theories were approximately true, and that present theories will be supplanted by future theories, just as past theories were supplanted by present theories. The former belief, however, is challenged by Stanford (2015: 876), and the latter belief by Ludwig Fahrbach (2011a, 2011b), Moti Mizrahi (2013, 2015, Forthcoming) and Seungbae Park (2016, 2017b, Forthcoming). This paper, however, sets these challenges aside. The aim of this paper is not to pursue them but to expose the negative impact of selective realism on scientific creativity.

Another group of philosophers developed an alternative realist strategy to tackle the pessimistic induction. They are Peter Lipton (2001), Peter Achinstein (2002), Enfield (2008), Sherrilyn Roush (2010), and Simon Fitzpatrick (2013). They observe that each scientific theory is supported by scientists' unique arguments for it. For example, scientists' arguments for the kinetic theory are different from the arguments for the caloric theory. Scientific theories should be evaluated solely on the basis of how powerful scientists' arguments for them are. Hence, we should engage with the details of scientists' arguments for scientific theories to determine whether they are true or false.

Let me distinguish between scientific individualism and collectivism, which make different claims about the unit of evaluation. Individualism claims that the unit of evaluation is a single theory, while collectivism claims that it is a set of theories. Individualists may or may not believe, for example, that the general theory of relativity is true. If they believe that it is true, they are individual realists about it. If they do not, they are individual antirealists about it. Collectivists also may or may not believe that a set of scientific theories are true. If they believe that they are true, they are collective realists about them. If not, they are collective antirealists about them. There is an important difference between individualism and collectivism. Individualism affirms, while collectivism denies, that a scientific theory should be evaluated solely on the basis of how powerful scientists' arguments for it are.

How does individual realism get around the pessimistic induction? It asserts that the fate of each theory depends not on that of its predecessors, but on scientists' arguments for it. If those arguments are correct, we are justified in believing that it is true, even if it inherited only a slender, or even no, theoretical claim from its predecessors. Thus, to determine our epistemic attitudes towards it, we should not investigate what happened to its predecessors, but rather closely analyze and evaluate scientists' arguments for it. For example, the epistemic status of the kinetic theory depends not on that of the caloric theory, but on scientists' arguments for the kinetic theory. Thus, to determine our epistemic attitudes towards the kinetic theory, we should not consider what happened to the caloric theory, but rather engage in the details of scientists' arguments for the kinetic theory. Individual realists believe that the kinetic theory is true on the grounds that scientists' arguments for it are correct. Individual antirealists do not believe so on the grounds that scientists' arguments for it are incorrect.

Selective realism is a form of collectivism, for it asserts that we should assess a series of successive theories collectively. It claims that since a past theory was superseded by a present theory, the present theory will also be superseded by a future theory, and that since stable posits of the past theory were preserved in the present theory, stable posits of the present theory will also be preserved in the future theory. Such inferences are deplorable from the individualist point of view.

In this section, I clarified what selective realism and individual realism assert. Keep in mind that individual realism recommends that we accept more of what our best theories say about the world than selective realism does, given that selective realism maintains, while individual realism does not, that we should consider the epistemic status of old theories when we assess the epistemic statue of new theories. In the next section, I adjudicate between selective and individual realism in terms of their effects on scientific creativity.

Adjudication

The first theory

Imagine that some scientists aim to open a new field of research. They have discovered new phenomena, but have not yet conceived of a scientific theory to explain them. How motivated would they be to think up T_1, the first theory in the new field? My answer is that they would be motivated to different degrees, depending on whether they embrace selective or individual realism. Let me first clarify what selective and individual realism assert concerning the epistemic status of T_1.

Selective realism maintains that no theoretical constituent of T_1 is worthy of our belief because it does not have a predecessor. We should withhold our judgment until T_1 is superseded by T_2, the successor of T_1. If T_1 and T_2 share a theoretical constituent, we can believe that the common theoretical constituent is true. If T_1 and T_2 have no such constituent, we should believe that no theoretical constituent of either T_1 or T_2 merits our doxastic commitment.

By contrast, individual realism maintains that T_1 may be worthy of our beliefs, even if it does not have a predecessor. The absence of the forerunner is not a factor that we should take into account when deciding whether T_1 is true or false. We only need to analyze and evaluate scientists' arguments for it. Recall that according to individualism, the epistemic status of a theory rests exclusively on the force of scientists' arguments for it.

Selective realism recommends that scientists accept less of what T_1 says about the world than individual realism does. If scientists adopted selective realism, they would believe that no theoretical constituent of T_1 is warranted on the grounds that T_1 does not have a predecessor. Their colleagues, who have also adopted selective realism, would believe that no theoretical constituent of T_1 is warranted. By contrast, if scientists espoused individual realism, they would believe that T_1 is true. Their colleagues, who have also espoused individual realism, would believe that T_1 is true. In short, these scientists would accept more of what T_1 says about the world, and hence they would be more motivated to entertain T_1 and construct arguments for it. In other words, individual realism has a more positive impact on scientific creativity than selective realism.

My contention that individual realism provides scientists with more motivation to be creative than selective realism rests on the assumption that the more scientists and their colleagues accept what scientific theories say about the world, the more scientists will be motivated to exercise their imaginations and think up new theories and experiments. This assumption is reasonable. Suppose that you spent your entire life formulating and justifying a new scientific theory. Once you think that your arguments for it are correct, you would believe that it is true, and would hope that your colleagues also believe that it is true. You would be thrilled, if your colleagues accepted it, and dejected, if they rejected it. As this story suggests, we have two epistemic goals. One is to believe that our own theories are true. The other is "to propagate to others our own theories which we are confident about" (Park 2017a: 58). It follows that belief is an incentive, whereas disbelief is a disincentive, for scientists to entertain new theories and experiments. This paper operates under this assumption.

The second theory

Imagine that scientists have been working with T_1 in their new field, and that anomalies have piled up against it. In such a situation, how motivated would scientists be to conceive of T_2? My answer is again that they would be motivated to different degrees, depending on whether they embrace selective or individual realism. Let me first clarify what selective and individual realism assert concerning the epistemic status of T_2.

Selective realism suggests that we should investigate whether T_2 inherits any theoretical constituent from T_1. Suppose that T_1 is composed of c_0 and c_1, and that T_2 is composed of c_2 and c_3, so they do not have any common theoretical constituent. In such a case, we should believe that no theoretical constituent of T_2 is warranted. Suppose now that T_1 is composed of c_0 and c_1, and that T_2 is composed of c_0 and c_2, so they have c_0 in common. In such a case, we can believe that c_0 is true. What about c_2? It is up for grabs whether it is a stable or unstable posit. Until it is shown that it is a stable posit, we should not believe that it is true.[1]

In contrast, individual realism suggests that it is pointless to look for a common theoretical constituent of T_1 and T_2. We should rather look for scientists' arguments for T_2, and should engage with the details of the arguments for it. After all, T_2 should be evaluated solely on the basis of how powerful scientists' arguments for it are. If they are correct, we can believe that it is true, regardless of whether it inherited a theoretical constituent from T_1, and regardless of whether T_1 was overturned.

Selective and individual realism provide scientists with motivations of different degrees to formulate T_2 and construct arguments for it. If scientists adopted selective realism, they would believe that the common theoretical constituent of T_1 and T_2 was warranted. Their colleagues, who also adopted selective realism, would take the same attitude. By contrast, if scientists embraced individual realism, they would believe that T_2 is true. Their colleagues, who also embraced individual realism, would take the same attitude. In short, individual realist scientists would accept more of what T_2 says about the world, and hence be more motivated to exercise their imaginations and come up with arguments for it.

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[1] It is controversial whether we can classify c_2 as a stable posit or an unstable posit before T_2 is displaced by T_3. While selective realists claim that we can, Stanford (2009: 385) is sceptical that we can. He argues that selective realists have not yet offered a tenable criterion for distinguishing between stable and unstable posits.

The preceding difference between selective and individual realism can be illustrated with the example of the caloric and kinetic theories. Recall that they share the stable posit that the quantity of heat is conserved, and that they have the differing unstable posits that the cause of heat is caloric, or the motion of particles. Selective realism asserts that we can believe that the quantity of heat is conserved, but that we can believe neither that the cause of heat is caloric nor that the cause of heat is the motion of particles. By contrast, individual realism asserts that we can believe that the quantity of heat is conserved, and that the cause of heat is the motion of particles.

Imagine that you were a scientist in the mid-19th century when the caloric theory was accepted, but anomalies were accumulating against it. How motivated would you have been to entertain the kinetic theory and experiments for it? You and your colleagues would have believed more of what the kinetic theory says about the world, and hence you would have been more motivated to ideate the kinetic theory and experiments for it, if you and your colleagues had espoused individual realism than if you and your colleagues had espoused selective realism. Thus, individual realism would have created a more favourable atmosphere than selective realism for the advent of the kinetic theory.

In sum, individual realism provides scientists with more motivation than selective realism to conceive of T_2 and justify it.

The third theory

Suppose that T_1 has been surpassed by T_2, and that T_2 runs into anomalies. In such a situation, how motivated would scientists be to formulate T_3? To answer this question, I first differentiate between the cases in which T_1 and T_2 do not share a theoretical component and the cases in which T_1 and T_2 share a theoretical component. Next, I clarify selective and individual realists' attitudes towards the content of T_3 which is not formulated yet, and then what selective and individual realists assert concerning the epistemic status of T_3 which has been formulated.

Suppose that T_1 and T_2 do not have a common theoretical component, and that T_3 has not been formulated yet. In such a case, selective and individual realists take different attitudes towards the content of T_3. Selective realists predict that T_3 will not inherit a theoretical constituent from T_2, just as T_2 did not inherit one from T_1. By contrast, individual realists make no prediction about whether T_3 will inherit a theoretical constituent from T_2. On the individual realist account, the content of T_3 depends not T_1 and T_2, but on scientists' imaginations, just as the epistemic status of T_3 depends not T_1 and T_2, but on scientists' arguments for T_3. Thus, individual realists do not use an old theory at all to predict the contents of a new theory nor to assess the epistemic status of a new theory.

It would be self-defeating for selective realists to predict that T_3 will inherit a theoretical claim from $T_{2.}$ Selective realism is built upon the uniformity principle (Hume 1978: 89) that the future will resemble the past. For this reason, selective realists claim that there will be scientific revolutions in the future as in the past, and that only stable posits of new theories merit our beliefs, just as only stable posits of old theories merited our beliefs. If, however, they reject the uniformity principle and predict that T_3 will inherit a theoretical claim from its antecedent although T_2 did not, they might as well predict, I suggest, that T_3 will not be ousted although T_2 was. If T_3 is not fated to be abandoned, it is pointless to distinguish between the stable and unstable posits of T_3. In general, without scientific revolutions, selective realism has no application.

Suppose now that scientists have formulated T_3. If T_3 has not inherited a theoretical constituent from T_2, selective realism suggests that we place our belief in none of the theoretical constituents of T_3. If T_3 has inherited a theoretical claim from T_2, selective realism suggests that we believe that the common theoretical constituent of T_2 and T_3 is true. In contrast, individual realism suggests that we believe that T_3 is true, regardless of whether T_3 has inherited a theoretical claim from T_2 or not. Thus, scientists would accept more of what T_3 says about the world if they embrace individual realism than if they embrace selective realism.

Let me now turn to the cases in which T_1 and T_2 share a theoretical constituent. Suppose that T_1 is composed of c_0 and c_1, and that T_2 is composed of c_0 and c_2. In such cases, selective realists predict that T_3 will inherit c_0 from T_2, just as T_2 inherited c_0 from T_1. By contrast, individual realists make no prediction about the contents of T_3.

Suppose that scientists have formulated T_3. What epistemic attitudes do selective and individual realism recommend vis-à-vis T_3? If T_3 is composed of c_3 and c_4, selective realism suggests that we believe in no theoretical constituent of T_3. If it is composed of c_0 and c_3, selective realism suggests that we believe that c_0, but not c_3, is true. By contrast, individual realism suggests that we believe that T_3 is true regardless of whether T_3 has inherited c_0 from T_2. Note again that scientists would accept more of what T_3 says about the world if they adopt individual realism over selective realism as their philosophical framework.

The upshot is that it does not matter whether T_1 and T_2 share a theoretical constituent. Nor does it matter whether T_2 and T_3 share a theoretical constituent. Individual realism recommends that scientists accept more of what T_3 says about the world than selective realism does. Hence, individual realism provides scientists with more motivation than selective realism to develop T_3. This difference can be illustrated with an example involving the humoral theory, the miasma theory, and the germ theory of diseases.

According to the humoral theory of diseases (Lloyd 1983: 262), health and diseases are determined by four distinct bodily fluids called humors: blood, yellow bile, black bile, and phlegm. Health results from an evenly balanced mixture of the four humors, and disease results from an imbalance. All the liquids in a human body are made out of the four humors, which also determine peoples' personalities. The humoral theory was accepted from the time of Hippocrates into the 19th century.

According to the miasma theory of diseases (Hannaway 1993: 295), infectious diseases result from miasma, a noxious vapor emanating from decaying organic matter. On this account, diseases proliferate not through physical contact but through the air. A foul odor indicates the presence of miasma. Miasma can be altered by changes in the environment. The way to control diseases is to clean up waste. The miasma theory was accepted until the end of the 19th century.

The humoral and miasma theories do not share a theoretical constituent. The former claims that the cause of a disease is located inside the human body, whereas the latter claims that it is located outside. Moreover, according to the former, the cause of a disease is an organic material, whereas according to the latter, it is an inorganic material. The two theories are radically distinct from each other.

According to the germ theory, infectious diseases result from microorganisms called germs, such as bacteria and viruses. On this account, different germs cause different diseases. For example, different germs cause typhoid fever and pneumonia. Also, diseases spread both through physical contact and through the air. One way to control diseases is to forestall interaction between a host and germs. It was generally accepted at the end of the 19th century.

The miasma theory and the germ theory make different claims about the cause of a disease. The miasma theory claims that it is an inorganic material, whereas the germ theory claims that it is organic material. But they both make the same claims about wherein the cause of a disease lies, and how diseases spread. Specifically, they claim that a disease originates outside of a human body, and that diseases spread through the air.

Imagine that there were selective and individual realists in the mid-19th century, when the miasma theory was accepted. Selective realists would have predicted that the successor of the miasma theory would not inherit any theoretical constituent from the miasma theory, just as the miasma theory had not inherited any theoretical claim from the humoral theory. By contrast, individual realists would have made no prediction about whether the successor to the miasma theory would inherit a theoretical constituent from the miasma theory. Individual realists' attitude would have been compatible with the history of medicine, whereas selective realists' attitude would not.

How motivated would scientists have been to devise the successor of the miasma theory in the mid-19th century? If they had espoused selective realism, they would have believed that the successor of the miasma theory would not have a trustworthy theoretical constituent. By contrast, if they had espoused individual realism, they would have believed that the successor of the miasma theory would be true. It follows that they would have been more motivated to develop the germ theory, if they had advocated individual realism than if they had advocated selective realism. Thus, individual realism would have been a better philosophical framework than selective realism for the advent of the germ theory.

It is fortunate that early exponents of the germ theory in the 19th century – Agostino Bassi, Ignaz Semmelweis, John Snow, Louis Pasteur, and Robert Koch – were not selective realists but individual realists. If they had been selective realists, they would have been less motivated to formulate the germ theory. Since they were individual realists, they thought up the germ theory, even though the humoral theory and the miasma theory did not share a theoretical constituent. Selective realism is not a philosophical framework that goes well with the practice of the creative scientists who made monumental achievements in the history of medicine.

Conclusions

I explored the impacts of selective and individual realism on scientists' motivation to conceive of the first, second, and third theories in a new field of science. My conclusion is that scientists would accept more of what a theory says about the world under the individualist framework than under the selectivist framework. Given that belief is an incentive, whereas disbelief is a disincentive, for scientists to think up and justify new theories, scientists should adopt individual realism over selective realism, if they aim to make scientific progress. Finally, the historical episode concerning the humoral, miasma, theory, and germ theories exhibits that creative scientists were not selective realists but individual realists. In sum, individual realism creates a more favourable atmosphere than selective realism for the advent of new theories.

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SELEKTYVUSIS REALIZMAS *VERSUS* INDIVIDUALUSIS MOKSLINIO KŪRYBINGUMO REALIZMAS

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Santrauka

Remiantis individualiuoju realizmu, mūsų geriausios mokslinės teorijos yra (tikėtinai) teisingos. Remiantis selektyviuoju realizmu, priešingai, tik nekintami mūsų geriausių mokslinių teorijų pagrindai yra teisingi. Taigi individualusis realizmas pataria labiau sutikti su tuo, ką apie pasaulį teigia mūsų geriausios mokslinės teorijos, o ne selektyvusis realizmas. Kuo labiau mokslininkai įsitikinę dėl to, ką jų teorijos sako apie pasaulį, tuo labiau jie yra motyvuoti patikrinti savo vaizdinius bei permąstyti naujas teorijas ir eksperimentus. Todėl individualusis realizmas mokslinį kūrybingumą skatina kur kas labiau nei selektyvusis realizmas.

Reikšminiai žodžiai: kūrybingumas, individualusis realizmas, motyvacija, pesimistinė indukcija, selektyvusis realizmas.