Optimistic Realism over Selectivism

Abstract
Selectivism holds that *some* theoretical contents of most present theories will be preserved in future theories. By contrast, optimistic realism holds that *most* theoretical contents of most present theories will be preserved in future theories. I construct a pessimistic induction over selectivists to undermine selectivism, and an optimistic induction over optimistic realists to support optimistic realism. The former holds that since the selectivists of the early twentieth century were overly cautious about their present theories, those of the early twenty-first century are also overly cautious about their present theories. The latter holds that since the optimistic realists of the early twentieth century were right about their present theories, those of the early twenty-first century are also right about their present theories.

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1. Introduction
This paper aims to undermine selectivism and to support an alternative position that I call optimistic realism. According to selectivism, scientific revolutions will oust *most* successful present theories, as they did in the distant past, but *some* theoretical contents of most successful present theories will be preserved in successful future theories. According to optimistic realism, in contrast, scientific revolutions will oust *some* successful present theories, as they did in the recent past, and *most* theoretical contents of most successful present theories will be preserved in successful future theories.[1]

This paper is organized as follows. In Section 2, I introduce historical optimism, according to which most recent past theories have been stable. In Section 3, I explicate selectivism and subsequently construct a pessimistic induction over selectivists to undermine selectivism. In Section 4, I formulate optimistic realism, construct an optimistic induction over optimistic realists to support optimistic realism, and then display three advantages of optimistic realism over selectivism. In Section 5, I reply to possible objections. This paper primarily proposes that realists have good reasons to choose optimistic realism over selectivism.

2. Historical Optimism
Some philosophers paint a gloomy picture of the history of science. For example, Larry Laudan says that "for every highly successful theory in the past of science which we now

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[1] Throughout this paper, 'some' is intended to express a weaker notion than 'most.' Also, I drop 'successful' from now on for the sake of brevity.

believe to be a genuinely referring theory, one could find half a dozen once successful theories which we now regard as substantially non-referring" (1981: 35). In a similar vein, Peter Lipton says that the "history of science is a graveyard of theories that were empirically successful for a time, but are now known to be false, and of theoretical entities – the crystalline sphere, phlogiston, caloric, the ether and their ilk – that we now know do not exist" (2005: 1265). In short, the history of science is filled with false theories that were once regarded as true.

Other philosophers, however, paint a bright picture of the history of science. They are Ludwig Fahrbach (2011a: 148), Seungbae Park (2011: 79), and Moti Mizrahi (2013: 3220, 2015, 2016). They distinguish between distant and recent past theories. Distant past theories are such theories as the ones on Laudan's list:

Laudan's List
- the crystalline spheres of ancient and medieval astronomy;
- the humoral theory of medicine;
- the effluvial theory of static electricity;
- "catastrophist" geology, with its commitment to a universal (Noachian) deluge;
- the phlogiston theory of chemistry;
- the caloric theory of heat;
- the vibratory theory of heat;
- the vital force theories of physiology;
- the electromagnetic aether;
- the optical aether;
- the theory of circular inertia;
- theories of spontaneous generation. (Laudan, 1981: 33)

These theories were accepted for certain periods of time and then rejected before the early twentieth century. Recent past theories, on the other hand, are those that were accepted at least for certain periods of time in the twentieth century, such as the oxygen theory, the kinetic theory, the germ theory, evolutionary theory, the special theory of relativity, and the Big Bang theory. They either are the successors of distant past theories or are the theories that were formulated in new fields of science during the twentieth century.

Pessimists might object that the theories that are classified as recent past theories above are instead present theories; after all, they are accepted in the early twenty-first century. This objection, however, is misguided. Of course, those theories are accepted in the early twenty-first century, but they were also accepted at least for certain periods of time in the previous century, and the previous century is the recent past from the perspective of the early twenty-first century. Therefore, they are recent past theories as well as present theories.

Three noteworthy differences exist between distant and recent past theories. First, most recent past theories are still accepted, whereas most distant past theories were rejected before the early twentieth century. Second, the number of recent past theories far exceeds the number of distant past theories. Fahrbach says that "at least 95% of all scientific work ever done has been done since 1915, and at least 80% of all scientific work ever done has been done since 1950s" (2011a: 148). Park states that "the body of scientific knowledge exploded in the twentieth century with far more human and technological resources" (2011: 79). Mizrahi (2013: 3219–3220, 2016) randomly selects some theories from the population of past theories. It turns out that *most* of the selected theories were recent past theories. Third, recent past theories were far more successful than were distant past theories, as pointed out by many philosophers, including Jarrett Leplin (1997: 141), Gerald Doppelt (2007: 111, 2014), Juha Saatsi (2009: 358), Michael Devitt (2011: 292), Fahrbach (2011b: 1290), Park (2011: 80),

and Mizrahi (2013). These three differences between distant and recent past theories constitute what Park (2017a) calls historical optimism, which holds that the history of science is much brighter than Laudan and Lipton suggest.

The three historical optimists – Fahrbach, Park, and Mizrahi – claim that Laudan's list is biased.[2] As noted earlier, Laudan's list is composed exclusively of distant past theories. However, a fair list of past theories would rarely include distant past theories and mostly include recent past theories, given that the set of the former is much smaller than that of the latter. Laudan did not use random sampling to ensure that each member of the population of past theories had an equal opportunity to be selected for his list of past theories. Since Laudan's list is biased, any pessimistic induction based on it commits the fallacy of biased statistics.

To go further, historical optimism rebuts the pessimistic induction over scientific theories constructed by Henri Poincaré and Ernst Mach in the early twentieth century. It asserts that since most past theories were overthrown, most present theories will also be overthrown:

> The ephemeral nature of scientific theories takes by surprise the man of the world. Their brief period of prosperity ended, he sees them abandoned one after the other; he sees ruins piled upon ruins; he predicts that the theories in fashion today will in a short time succumb in their turn, and he concludes that they are absolutely in vain. (Poincaré, 1905/1952: 160)

Mach also says that "Whoever knows only one view or one form of a view does not believe that another has ever stood in its place, or that another will ever succeed it" (1911: 17). The conclusion of this pessimistic induction predicted that most theories which were accepted in the early twentieth century would be rejected. This prediction, however, was not borne out in the history of science. Most theories which were accepted in the early twentieth century are still accepted in the early twenty-first century, as historical optimism suggests.

In this section, I showed how historical optimism rebuts the pessimistic induction over scientific theories that Poincaré and Mach constructed in the early twentieth century. But how about selectivism? Is selectivism safe from the onslaught of historical optimism? In the next section, I elucidate a disastrous implication of historical optimism for selectivism.

3. Selectivism
3.1. Content
Selectivists note that some theoretical contents of distant past theories survived scientific revolutions while others did not. Their observations are based on several impressive case studies. John Worrall's (1989) case study delves into the transitions of theories of light: classical particle theory, Fresnel's wave theory, Maxwell's electromagnetic theory, and the photon theory. Philip Kitcher's (1993: Chapters 4 and 5) case studies investigate the transition from the phlogiston theory to the oxygen theory and the transition from the ether theory to Maxwell's electromagnetic theory. Stathis Psillos's case studies (1999: Chapter 6) scrutinize the transition from the caloric theory to the kinetic theory and the transition from the ether theory to Maxwell's electromagnetic theory. Considering such case studies, selectivists conclude that the stable components of theories are trustworthy, but that the unstable components are not, irrespective of whether the theories are past or present ones. Keep in mind that this conclusion presupposes that present theories will be displaced by

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[2] Mizrahi (2015) also accuses Stanford's list (2006: 19–20) of being similarly biased.

future theories, just as past theories were displaced by present theories (Park, 2017b: 98−99, 2017c: 65, 2018: 60−61; Stanford, 2018: 79).

What exactly are the stable and unstable components of a theory? Different selectivists answer this question differently. For Poincaré (1905/1952) and Worrall (1989), the stable components are mathematical structures and the unstable components are non-structural claims of a theory. So their position is termed structural realism in the literature. For Kitcher (1993: Chapters 4 and 5) and Psillos (1999: Chapter 6), the stable components are working posits and the unstable components are idle posits. As you can see, different selectivists disagree about which components are stable or unstable, but they agree that stable components are trustworthy whereas unstable components are not, and that most present theories will be replaced by future theories.

Selectivism has been influential in the scientific realism debate. Many philosophers, including Anjan Chakravartty (2008), Patrick Enfield (2008), David Harker (2008), Stathis Psillos (2009), Juha Saatsi (2009), and Peter Vickers (2017), have employed it to refute P. Kyle Stanford's (2006: 19–20) pessimistic induction over scientists, which holds that since past scientists could not conceive of alternatives to supersede past theories, present scientists cannot conceive of alternatives that will supersede present theories either. Stanford contends that past theories were "profoundly mistaken in their most fundamental claims about nature" (2006: 8). His contention appears to clash with the selectivist observation that some theoretical contents of past theories were carried over to present theories.

It is worth emphasizing three things about selectivism. First, it holds that past theories were approximately true[3] because their stable theoretical contents are enshrined in present theories (Psillos, 1999: 127). It is invoked to refute the premise of the pessimistic induction that past theories were not even approximately true. Second, it is intended to apply to both past and present theories. Thus, only stable theoretical contents of present theories are warranted. Third, selectivists' case studies are about scientific episodes that occurred before but not during the twentieth century.

Although selectivists are regarded as critics of pessimists in the literature, we must take note of the important similarity between them. Both parties endorse what David Hume (1978: 89) calls the uniformity principle: the future resembles the past. They believe that scientific revolutions will occur in the future as they did in the past, and therefore, present theories will be replaced by unconceived alternatives (Park, 2017b: 98−99, 2017c: 65, 2018: 60−61, Stanford, 2018: 79). The only difference between selectivists and pessimists is that selectivists take it to be important, while pessimists do not, that some theoretical contents of old theories were preserved in new theories. Thus, selectivism either collapses into pessimism or remains distinct from pessimism, only depending on whether preserved theoretical contents are rich and thick enough. I explore this issue in the next section.

3.2. Thick or Thin?

Juha Saatsi says that selectivist attempts to pin down common theoretical contents between past and present theories "have arguably resulted in a characterization of realist commitments so vague and ill-defined" (2015: 8). In the similar vein, Stanford claims that the dispute between pessimists and selectivists "is simply a difference of style or taste in applying the expression 'approximately true' rather than a substantive disagreement between them" (2015: 876). In other words, selectivists have, while pessimists do not, the taste of attributing the realist predicate 'approximately true' to past theories. Stanford (2015) adheres to his previous

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[3] For the notion of approximate truth, see Anjan Chakravartty (2017), Illka Niiniluoto (1987), and Graham Oddie (2016).

position (2006: 8) that past theories were fundamentally mistaken about the world and were radically distinct from present theories, and hence that preserved theoretical contents are too slender and meager to warrant the attribution of 'approximately true' to past theories.

This paper takes seriously Saatsi's criticism and Stanford's criticism against selectivism. So it uses the name 'selectivism' as opposed to 'selective realism,' although the latter is widely used in the literature to refer to the position defended by philosophers, such as Poincaré, Worrall, Kitcher, and Psillos. In my view, only a position that is assertive enough with respect to unobservables deserves the appellation 'realism.' If a position is slender and thin with respect to unobservables, 'antirealism' is the right nomenclature.

Why is selectivism susceptible to Stanford's objection that there is only a terminological difference between pessimism and selectivism? My answer is that it is disputable whether the portion of the stable content of any given distant past theory is above a threshold or not. If the stable content had taken up most of the entire content, Stanford would readily agree with selectivists that the distant past theory was approximately true, and selectivists would undoubtedly deserve the appellation 'realists.' It is questionable, however, whether the stable content took up most of the entire content because the distant past theory was displaced by a recent past theory. Thus, it is ultimately because of scientific revolutions that the dispute arises between selectivists and Stanford regarding whether distant past theories were approximately true.

3.3. The Pessimistic Induction over Selectivists
Imagine that pessimists and selectivists debated the status of their present theories, such as the oxygen theory, evolutionary theory, the kinetic theory, the germ theory, the Big Bang theory, the special theory of relativity, and the theory of plate tectonics in the early twentieth century. According to the pessimists, scientific revolutions would occur in the future as they did in the past, and as a result, most of their present theories would end up in the graveyard of theories, just as most of their past theories did, including the Ptolemaic theory, the caloric theory, the miasma theory, and the ether theory. The selectivists agreed with the pessimists, but added that *some* theoretical contents of most of their present theories would be retained, similarly to some theoretical contents of most of their past theories.

In retrospect, we can see from the vantage point of the early twenty-first century that both the pessimists and the selectivists were wrong about their present theories. It is a historical fact that most of their present theories have not yet been abandoned, as pointed out by Fahrbach (2011a: 148), Park (2011: 79), and Mizrahi (2013: 3220, 2015, 2016). Thus, the selectivists conceded too much to the pessimists, i.e., they were overly cautious about their present theories. They believed that only *some* theoretical contents of most of their present theories were true, though they could have believed that *most* theoretical contents of most of their present theories were true. Even if they had believed the latter, they would have been right, given that most of their present theories had not yet been overturned. In sum, the selectivists of the early twentieth century would have believed less when they could have believed more.

What is wrong with selectivists being overly cautious about a theory? As suggested earlier, pessimists might covet selectivism. If only some theoretical contents of a theory are true, then it is controversial whether the theory is approximately true. In contrast, if most of its theoretical contents are true, it is not controversial whether it is approximately true. Thus, if you want to believe that a theory is approximately true, you should believe that most of its theoretical contents are true. However, selectivists believe that only some theoretical contents of present theories are true in accordance with their tenet that present theories will be

surpassed by future theories. Hence, they have the burden of fighting pessimists who maintain that selectivism is theirs.

From the mistake of the selectivists of the early twentieth century, we can construct a pessimistic induction against selectivists. It maintains that since the selectivists of the early twentieth century were inordinately cautious about their present theories, those of the early twenty-first century, such as Worrall, Kitcher, and Psillos, are also inordinately cautious about their present theories. To go further, future selectivists will similarly be inordinately cautious about their present theories. This reasoning might be called the pessimistic induction over selectivists.

The pessimistic induction over selectivists is in accordance with the uniformity principle that selectivists endorse. As noted earlier, they believe, as pessimists do, that the future resembles the past, so present theories will be supplanted by future theories, just as past theories were supplanted by present theories. Optimists differ from selectivists only with respect to which part of the history of science should be invoked to make a prediction about the future development of science. Optimists utilize, while selectivists do not, the historical fact that most recent past theories have been stable.

An influential form of selectivism today is structuralism. James Ladyman states that "[s]tructural realism is considered by many realists and antirealists alike as the most defensible form of scientific realism" (2014). In my view, the realists and the antirealists might be right that structuralism is a defensible position. It is not clear, however, whether it is a defensible form of realism or antirealism, although the name 'structural realism' suggests that it is a form of realism. It is devised under the assumption that present theories will be displaced by alternatives, just as past theories were displaced by alternatives. That assumption, however, is problematic, and structuralists are vulnerable to the pessimistic induction over selectivists sketched in this section. So 'structuralism' is a better term than 'structural realism.'

4. Optimistic Realism
4.1. Content
The mistake of selectivists sketched in the previous section motivates a new realist position that I term optimistic realism. According to this position, *most* present theories will be stable, they will at best go through minor revisions in the future development of science, and they will be (approximately) true in light of future theories.

Optimistic realism and selectivism are substantially distinct positions. They hold, respectively, that scientific revolutions will drive out *some* and *most* present theories. In addition, they hold, respectively, that *most* and *some* theoretical content of a stable present theory will be preserved in a future theory. In sum, optimistic realism is more assertive than selectivism with respect to the portion of the population of present theories that will remain stable, and with respect to the portion of the theoretical content of a present theory that will remain stable.

How does optimistic realism differ from historical optimism introduced in Section 2? While historical optimism is a view about distant and recent past theories, optimistic realism is a view about present theories. Relatedly, while historical optimism is designed to refute the premise of the pessimistic induction that most past theories were thrown out, optimistic realism is designed to specify the epistemic attitude that we should take towards present theories. Despite this difference, however, they can go hand in hand, leading to an optimistic induction, which I unpack in the next section.

4.2. The Optimistic Induction over Optimistic Realists

Imagine that optimistic realists and pessimists debated over the status of their present theories in the early twentieth century. According to the optimistic realists, most of their present theories would be retained and would at best go through minor revisions, in which case they would be (approximately) true in light of future theories. According to the pessimists, by contrast, most of their present theories would be discarded, in which case they would not even be approximately true in light of future theories. We can see from the perspective of the early twenty-first century that the optimistic realists were right about their present theories. This historical observation motivates an optimistic induction that since the optimistic realists of the early twentieth century were right about their present theories, those of the early twenty-first century are also right about their present theories. To go further, future optimistic realists will similarly be right about their present theories. This reasoning might be called the optimistic induction over optimistic realists.

The optimistic induction over optimistic realists is in accordance with the uniformity principle that pessimists and selectivists endorse. Optimistic realists claim that the future resembles the recent past in terms of the frequency of scientific revolutions. The only point of difference between the opposing parties concerns which part of the past should be invoked to theorize about future science, viz., while optimistic realists make use of the recent past, pessimists and selectivists make use of the distant past.

In this section, I constructed the optimistic induction over optimistic realists to support optimistic realism. In Section 3.3, I constructed the pessimistic induction over selectivists to undermine selectivism. The optimistic induction and the pessimistic induction rely on the same historical fact that most recent past theories have been stable. The two inductions, however, are distinct from each other, given that the former is over optimistic realists whereas the latter is over selectivists.

4.3. Advantages

In this section, I present three advantages of optimistic realism over selectivism. First, optimistic realism is immune to Stanford's (2009: 385) criticism against selectivism that no criterion is provided for distinguishing between stable and unstable theoretical contents. In the absence of such criteria, we cannot discern stable theoretical contents of present theories, although we can discern stable theoretical contents of past theories in retrospect. The stable theoretical contents of past theories are those that are also found in present theories. Since present theories are not yet replaced by future theories, we cannot tell which theoretical contents of present theories will be retained in future theories. This criticism against selectivism is inapplicable to optimistic realism, given that optimistic realism is not saddled with the distinction between stable and unstable theoretical contents. Optimistic realists simply believe that most contents of most present theory are true, i.e., most present theories are (approximately) true, without distinguishing between stable and unstable constituents. Thus, they do not have the burden of specifying which theoretical contents are trustworthy and which are not.

Second, optimistic realism is also immune to Stanford's criticism against selectivism that only a terminological difference exists between pessimism and selectivism. Stanford's objection to selectivism is predicated on the observation that most past theories were profoundly mistaken about the world in light of present theories. For example, the phlogiston theory is radically false in light of the oxygen theory. Such an objection to selectivism, however, does not apply to optimistic realism. As we noted in Section 2, most recent past theories coincide with present theories. So it is wrong to say that recent past theories were profoundly mistaken about the world in light of present theories. For example, it is wrong to

say that the oxygen theory is radically false in light of the oxygen theory. Thus, the difference between pessimism and optimistic realism is not merely terminological but substantial.

Third, as noted in Section 2, many philosophers highlight that recent past theories were far more successful than distant past theories. This observation of the difference between distant and recent past theories requires us to treat them differently, i.e., we should assume different epistemic attitudes towards them. Selectivists, however, assume the same epistemic attitude towards them: they believe that only some theoretical components of both distant and recent past theories were trustworthy. In contrast, optimistic realists assume different epistemic attitudes towards them: while they believe that *some* theoretical contents of most distant past theories were true, they believe that *most* theoretical contents of most recent past theories were true. Thus, optimistic realism reflects, while selectivism does not, the empirical superiority of recent past theories over distant past theories.

5. Objections and Replies
Pessimists might object that we have two reasons for rejecting historical optimism. First, some recent past theories underwent major revisions. For example, the standard model of particle physics was crowned as a universal theory of material systems in the mid-1970s when it was confirmed that the hadrons were composed of fractionally charged quarks. In the 1990s, however, cosmological observations provided convincing evidence that dark matter and energy take up 95% of the materials in the universe, and that they are anomalies to the standard model. Second, quantum mechanics and the general theory of relativity are incompatible with each other, so it is likely that they will be replaced by future theories. Optimistic realism overlooks something most philosophers of science and scientists find especially exciting about science today, viz., the vibrant metaphysical turmoil at its most fundamental levels.

This paper assumes for the sake of argument that the standard model of particle physics was overturned, and that the existence of dark matter and energy is established, although they are invoked to explain the expansion of the universe and the motion of stars in a galaxy, and scientists have not yet obtained independent evidence for their existence. This paper also assumes for the sake of argument that quantum mechanics and the general theory of relativity will be replaced by a radically different theory or theories, although it is debatable whether they will be (Park, 2015: 223). This paper instead points out that the objection that *some* recent past theories were or will be replaced by radically different alternatives is compatible with historical optimism that *most* recent past theories have not yet been and will not be overthrown, and that they have retained and will retain most of their theoretical contents. In order to refute historical optimism, pessimists need to show not that *some* recent past theories were and will be discarded but that *most* recent past theories were and will be overthrown.

It is unlikely that pessimists will be able to show that *most* recent past theories were overthrown. To reiterate, Mizrahi (2013: 3219–3220, 2016) randomly chooses some theories from the population of past theories and demonstrates that most past theories are not yet abandoned. Pessimists should also choose some theories from the population of past theories and demonstrate that most past theories were abandoned. Optimistic realism remains unscathed, even if some fundamental physical theories were or will be overturned. The vibrant metaphysical turmoil is powerless in front of Mizrahi's random sampling, just as Superman is in front of Kryptonite.

Let me now turn to selectivists' possible response to my denial that selectivism is a form of realism.[4] They might admit that they are overly cautious about present theories, but

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[4] I thank a reviewer for this criticism.

insist that selectivism is a form of realism. As Popper argued already in the 1960s, a scientific theory may go through a scientific revolution, and yet it can be approximately true theory. For example, Newtonian mechanics is still approximately true, even if it was replaced by the theory of relativity. It follows that we are entitled to believe that present theories are approximately, although they will be displaced by future theories.

I take Stanford's criticism against selectivism seriously that past and present theories radically differ from each other, so present and future theories will also be radically differ from each other, and it is controversial whether to attribute 'approximate truth' to present theories or not. The fact that Popper attributes it, while pessimists do not, to past theories shows that Popper and pessimists have different tastes on whether to attribute it to past theories or not, and hence to present theories or not. Selectivists are vulnerable to such an objection, in my view, because they believe that present theories will go through scientific revolutions, as past theories did, and that as a result, they will lose their significant parts. Realists would not be subject to the objection, if they believed that scientific revolutions would not occur, so present theories would not lose their significant parts. In the absence of scientific revolutions, rational agents would have no choice but to attribute the realist predicate to present-cum-future theories.

6. Conclusion

Selectivists concede too much to pessimists. Their excessive concession leads to Stanford's criticism that only a terminological difference exists between pessimism and selectivism as well as to the pessimistic induction over selectivists, which states that since the selectivists of the early twentieth century were unduly cautious about their present theories, those of the early twenty-first century are also unduly cautious about their present theories. Optimistic realism is proposed as a realist alternative to selectivism. It is supported by the optimistic induction over optimistic realists, which holds that since the optimistic realists of the early twentieth century were right about their present theories, those of the early twenty-first century are also right about their present theories. The history of science teaches us that realists should choose optimistic realism over selectivism. This paper can be summarized in a simple sentence: selectivism recommends less when we deserve more.

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