

## Realism vs. Surrealism

### Abstract

Realism and surrealism claim, respectively, that a scientific theory is successful because it is true, and because the world operates as if it is true. Lyons (2003) criticizes realism and argues that surrealism is superior to realism. I reply that Lyons's criticisms against realism fail. I also attempt to establish the following two claims: 1. Realism and surrealism lead to a useful prescription and a useless prescription, respectively, on how to make an unsuccessful theory successful. 2. Realism and surrealism give the credit for the success of a theory to an appropriate factor and to an inappropriate factor, respectively. Finally, I point out that surrealism is vulnerable to my pessimistic induction (2014a) against antirealism.

### Keywords

As-If-True, Empirical Adequacy, Pessimistic Induction, Realism, Success, Surrealism, Truth

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### 1. Introduction

Scientific realism claims that a scientific theory is successful because it is approximately true (Putnam, 1975; Psillos, 1999). (From this point on, I will drop the qualifier 'approximately.') Thus, successful theories, such as the special theory of relativity and the kinetic theory of heat, are true. Realism competes with several antirealist alternatives in the literature. One of them asserts that a theory is successful because the world operates as if it is true. This proposal is termed 'surrealism' (surrogate for realism) by Jarrett Leplin (1987). On the surrealist account, the world behaves as if the special theory of relativity and the kinetic theory of heat are true. Timothy D. Lyons (2003) embraces surrealism and raises creative criticisms against realism in his attempt to demonstrate the superiority of surrealism over realism. This paper aims to diffuse his criticisms and to show that surrealism is not a viable rival to realism.

I proceed as follows: In Section 2, I explicate what it is for a theory to be successful and specify some salient conditions for a theory to be successful. This section clears the ground for subsequent sections. In Section 3, I expound surrealism and some commentators' responses to it. In Section 4, I defend realism from Lyons's criticisms, utilizing what I said about the conditions for success in Section 2. In Section 5, I attempt to establish the following two claims: 1. Realism and surrealism lead to a useful prescription and a useless prescription, respectively, on how to make an unsuccessful theory successful. 2. Realism and surrealism give the credit for the success of a theory to an appropriate factor and to an inappropriate factor, respectively. Finally, I point out that surrealism is vulnerable to my pessimistic induction (Park, 2014a) against antirealism.

### 2. Success

In this section, I explicate what it means to say that a theory is successful, and what conditions are required for a theory to be successful. Once we are clear about the concept of success, it will be easy to grasp what surrealism says in Section 3, to see what went wrong

with Lyons's criticisms against realism in Section 4, and to follow my critical discussions of surrealism in Section 5. Thus, this section paves the way for subsequent sections.

A theory is successful, "if it passes a battery of standard tests" (Laudan, 1981: 23). Thus, to say that a theory is successful is to say that *some* of its observational consequences *turned out* to be true, i.e., we know that they are true. We know, for example, that some observational consequences of the special theory of relativity and the kinetic theory of heat are true. Many conditions must be satisfied to ascertain that some observational consequences of a theory are true. Let me go over the most notable ones one by one.

The first condition, which I call the auxiliary condition, is that a theory must be connected with relevant auxiliary assumptions. As Pierre Duhem (1905/1954) famously claimed, what confronts the tribunal of experience is not a single theory but a group of theories. An observational consequence is not derivable from a theory alone. The theory should be supplied with auxiliaries to generate observational consequences. Thus, auxiliaries are a necessary condition for a theory to be successful.

The second condition, which I call the semantic condition, is that at least *some* observational consequences must be true. Even if a theory is conjoined with relevant auxiliaries and as a result issues observational consequences, it cannot make true predictions, if all of its observational consequences are false. Such a theory only makes false predictions, and hence it is unsuccessful. Thus, what a theory needs in order to be successful is not mere observational consequences but *true* observational consequences.

The third condition, which I call the technological condition, is that we must have relevant technologies. In the early 20<sup>th</sup> century, for example, scientists used telescopes to ascertain the prediction of the general theory of relativity that light bends near the sun. Without telescopes, the theory could not have been successful. This example goes well with the definition of success that a theory is successful when some of its observational consequences turned out to be true. Good evidence for the truth of some observational consequences is required for a theory to be successful. We can gather such evidence with the use of technologies.

The fourth condition, which I call the worldly condition, is that the world should behave in a certain manner. A theory cannot be successful, if the world behaves strangely, or if the world suddenly changes the way it behaves. Imagine, for example, that when a stone is thrown upwards, it does not fall down but rather flies up into space. In such circumstances, Newton's law of gravity cannot be successful. Thus, the cooperation of the world is vital for a theory to be successful.

The conditions for success are so many that it is impossible to enumerate all of them. Scientists must have the will or passion to confirm their theories. If they are lethargic and listless, their theories do not have a chance of success, even if all the previously mentioned conditions for success are met. There must be enough funding for scientists; without sufficient financial resources, all the aforementioned conditions will not bring about success. There must be enough natural resources, such as oxygen and water, in scientists' laboratories. Otherwise, they would die of suffocation and dehydration, and as a result their theories would not have the chance to pass empirical tests. I leave it to the reader to imagine what other conditions for success there may be.

### **3. Surrealism**

Are we justified in believing that a successful theory is true? (I thank a referee for sharpening my point in this paragraph.) The realist and the surrealist have different answers to this question. The realist (Putnam, 1975; Psillos, 1999) says yes, claiming that the success of a theory would be a miracle, if it is false. For example, the general theory of relativity predicted

the existence of black holes. It could not have made such a prediction unless it was true. In contrast, the surrealist (Lyons, 2003) says no, contending that the success of the general theory of relativity can be explained without the belief that it is true. I explicate what surrealism says in this section.

Philosophers formulate surrealism differently. Andre Kukla says that the “observable world behaves as if our theories are true” (1998: 22). Moti Mizrahi states that the “observable world behaves as if our mature scientific theories are true” (2012: 133). Similarly, Lyons says that the “mechanisms postulated by the theory and its auxiliaries would, if actual, bring about all relevant phenomena thus far observed and some yet to be observed at time  $t$ ; and these phenomena are brought about by actual mechanisms in the world” (2003: 900). These different formulations basically express the same idea that a theory is successful because the world behaves as if it is true.

The surrealist explanation serves the antirealist purpose of explaining the success of a theory without believing that it is true. Truth figures in the surrealist explanans that the world operates as if a theory is true. The explanans, however, does not entail that the theory is true. It rather entails that it is empirically adequate, i.e., that all of its observational consequences are true. After all, to say that the world operates as if a theory is true is to say that observable events occur as the theory says they do. To say so involves the belief that the theory is empirically adequate, but not the belief that it is true.

What do commentators say about the content of surrealism? Some philosophers claim that there is only a verbal difference between the following two antirealist proposals:

- (1) A theory is successful because the world operates as if it is true.
- (2) A theory is successful because it is empirically adequate.

For instance, Alan Musgrave claims that to say that  $T$  is successful because the world operates as if  $T$  is true “is just a fancy way of saying that  $T$  is observationally or empirically adequate” (1988: 243). Kyle Stanford also doubts that the appeal to as-if-true “is really any more than verbally distinct from the constructive empiricist’s appeal to empirical adequacy” (2000: 268). Thus, surrealism is merely a verbal variant of the suggestion that a theory is successful because it is empirically adequate.

The commentators are right that surrealism entails that a successful theory is empirically adequate. In my view, however, there is a substantial difference between (1) and (2). They invoke different factors to explain the success of a theory. While (1) invokes the world, (2) invokes empirical adequacy, a semantic property. In other words, while (1) suggests that the way *the world* operates is responsible for the success of the theory, (2) suggests that *empirical adequacy* is responsible for the success of the theory. The difference between (1) and (2) becomes clearer, once they are paraphrased, respectively, as follows:

- (1)’ Some observational consequences of a theory turned out to be true because observable events occur as the theory says they do.
- (2)’ Some observational consequences of a theory turned out to be true because all of its observational consequences are true.

Note that (1)’ and (2)’ invoke observable events and the truth of observational consequences, respectively, to explain the success of a theory. In any event, the world and empirical adequacy should not be conflated with each other.

Is it legitimate to invoke the world to explain the success of a theory? The answer is yes from the perspective of the causal theory of explanation according to which “the

explanation of a phenomenon essentially involves *locating and identifying its cause or causes*” (Salmon, 1978: 689). Surrealism invokes a cause, viz., observable events, to explain the success of a theory, implying that a theory cannot be successful, unless observable events occur as it says they do. As we saw in Section 2, numerous factors jointly produce the success of a theory. Surrealism picks out the worldly condition, the fourth condition, to explain the success of a theory. Recall that the cooperation of the world is a necessary condition for a theory to be successful. Thus, the surrealist explanation is respectable like other causal explanations.

The surrealist explanation competes with the realist explanation, as we noted earlier. Which one should we choose? Lyons chooses the former over the latter, raising incisive criticisms against the latter. I critically respond to them in the next section.

## **4. Responses to Lyons’s Criticisms**

### **4.1. Auxiliaries and Technologies**

Realism holds that a theory is successful because it is true. Lyons (2003) objects that truth does not even make success likely because relevant auxiliaries and technologies are required for a theory to be successful:

The stipulation “T is true” in itself entails no restriction that any auxiliaries are conjoined to T; the true theory therefore need not lead to any empirical predictions. (Lyons, 2003: 895)

Even if the true theory does bring about empirical predictions, it need not necessarily bring about empirical predictions that have been or can be tested given current technology. (Lyons, 2003: 895)

These observations led Lyons to deny that “the truth of a theory implies its success” (Lyons, 2003: 894) and to assert that “T’s truth does not even make it *likely* that T will succeed empirically” (Lyons, 2003: 895). Thus, truth is a poor explanatory property for success.

A few critical comments are in order. First, the observation that success requires auxiliaries and technologies is similar to the observation that success requires psychological, financial, and natural resources for scientists, i.e., to the observation that a theory cannot be successful, unless scientists have the passion to perform experiments, unless they have transportation to their laboratories, or unless have enough oxygen in their laboratories. All these observations about success are correct, but none of them undermines realism because realism does not deny in the first place that the conditions for success are needed for a theory to be successful.

Second, the surrealist needs auxiliaries as much as the realist, given that his explanans collapses without auxiliaries. The surrealist explanans that the world operates as if a theory is true presupposes that the theory is conjoined with auxiliaries. Unless a theory is combined with auxiliaries, it has no bearing on observables, and hence the surrealist cannot say that observable events occur as it says they do, i.e., that the world behaves as if it is true. The absence of auxiliaries means that the surrealist explanans evaporates, and that a question does not even arise as to whether the surrealist explanans, a nonexistent factor, makes success likely or not.

Third, suppose for the sake of argument that realism is undercut by Lyons’s criticism that the realist explanans does not make the explanandum likely. In my view, surrealism suffers equally under his criticism. As noted in Section 2, *numerous* conditions are required for a theory to be successful. The surrealist picks out the worldly condition as an explanatory factor for the success of a theory. A problem with the surrealist choice is that even if the world operates as if a theory is true, the theory cannot be successful, if we do not have

technologies to determine whether the world behaves so, if scientists do not have enough oxygen in their laboratories, if the distance between the earth and the sun changes dramatically, and so forth. Thus, the surrealist explanans does not make the explanandum likely either.

#### **4.2. Greater Degree**

Lyons contends that empirical adequacy generates success to a greater degree than truth does. His contention stems from the observation that false auxiliaries can give rise to false predictions:

As hinted at above, the degree of implication enjoyed by empirical adequacy in regard to success is actually greater than truth. If any auxiliary statements were to “throw off” the observable predictions derived from a given theory in such a way as to render those predictions false, that theory would simply not be EA. (Lyons, 2003: 895-896)

Lyons’s point is that the observational consequences of a true theory are not necessarily true because the auxiliaries might be false. In contrast, the observational consequences of an empirically adequate theory are necessarily true by the definition of empirical adequacy. In other words, an empirically adequate theory has necessarily met the auxiliary condition, but a true theory has not. (I thank a referee for this point.) Therefore, as-if-true is a better explanans than truth.

Let me make a couple of critical comments. First, suppose for the sake of argument that the surrealist explanans is better than the realist explanans because relevant auxiliaries are embedded into the surrealist explanans. A problem is that the surrealist does not have a better epistemic access to the truth of auxiliaries than the realist. It is neither the case that the surrealist has God’s eyes nor the case that the surrealist has more experimental evidence for auxiliaries than the realist. The surrealist is no more entitled to avail himself of auxiliaries than the realist. So when the surrealist explains the success of a theory, the realist can ask the surrealist, “Where did you get auxiliaries?” The surrealist must answer this question because the absence of auxiliaries means the evaporation of the surrealist explanans, as we have seen in the previous section. In whatever way the surrealist may have acquired auxiliaries, the realist can acquire them too. In short, the surrealist cannot say that surrealism is better than realism on the grounds that auxiliaries are built into his explanans, but not into the realist’s explanans.

Second, false auxiliaries have an equally detrimental effect on realism and surrealism. (I thank a referee for this point.) Strictly speaking, the realist explanans is not merely the truth of a theory but the truth of the conjunction of the theory and its auxiliaries. So the full realist explanation is that a theory is successful because the conjunction of the theory and its auxiliaries is true. The surrealist explanans is also not merely the truth of the theory but the truth of the conjunction. So the full surrealist explanation is that a theory is successful because the world operates as if the conjunction of the theory and its auxiliaries is true. Now, what if auxiliaries are false? Both the realist explanans and the surrealist explanans collapse. After all, if auxiliaries are false, the conjunction is false too. So the realist can no longer say that the theory is successful because the conjunction is true. The surrealist cannot say either that the theory is successful because the world operates as if the conjunction is true. Therefore, seeking the implication of false auxiliaries does not help Lyons’s thesis that surrealism is superior to realism.

#### **4.3. History of Science**

After arguing that truth does not make success likely, Lyons (2003: 898-899) anticipates a move the realist might make. The realist might argue that a true theory is likely to be successful once it is supplied with true auxiliaries. Lyons retorts that the history of science is replete with successful but false theories, such as the caloric theory of heat, the phlogiston theory of combustion, Fresnel's wave theory of light, Maxwell's ether theory, and Dalton's atomic theory:

Seeking to address my earlier concern – attempting to render success likely – the realist may have been tempted to strengthen her explanation to “*T and its auxiliaries are true.*” However, in this section we see the futility of such a move: the quantity of counterinstances – successful theories that could not have this property, thus those the realist could not explain – would increase dramatically. (Lyons, 2003: 899n)

Lyons's point is that successful past theories are all counterexamples to the realist suggestion that the conjunction of a theory and its auxiliaries is successful because the conjunction is true. The counterexamples deter the realist from invoking the truth of a theory and its auxiliaries to explain the success of the theory.

How would the realist reply to this criticism? The conjunction of a past theory and its auxiliaries produced observational consequences, and the observational consequences were ascertained to be true, i.e., the conjunction was successful. How could this conjunction be successful? The realist answers that the conjunction was successful because it was *approximately* true. Stathis Psillos (1999: 113) argues that the caloric theory of heat, a successful past theory, is approximately true because its working components are true, although its idle components are false, in the present light. He would say that the conjunction of a past theory and its false auxiliaries is not completely false, so it can be successful. Thus, the realist retreats to the modest position that a successful theory is approximately true.

#### **4.4. Approximate Truth**

Is the modest realist proposal tenable that a theory is successful because it is approximately true? Lyons objects that the realist explanans, approximate truth, does not necessitate success even in the presence of true auxiliaries:

We've seen above that a true theory need not be successful, and the same points apply no less to approximate truth. In fact, changing the explanans to approximate truth, the situation is considerably worse. A theory that is approximately true, even when it is connected only to true auxiliaries, need not be successful. (Lyons, 2003: 899)

The idea is that an approximately true theory describes unobservables incorrectly to some extent. Because of this inherent defect, some of its observational consequences might be false. It follows that an approximately true theory might not be successful even in the presence of true auxiliaries.

This criticism against realism applies no less to surrealism. The history of science is a wasteland of successful but false theories, such as the Ptolemaic theory and the caloric theory of heat. The past theories are all counterexamples to the surrealist proposal that a theory is successful because the world operates as if it is true. It is wrong to say, for example, that the Ptolemaic theory was successful because the world operated as if it were true. Galileo observed the phase of Venus with his telescope, thereby refuting the Ptolemaic theory. Thus, not all observable events occurred as the Ptolemaic theory said they did, i.e., the world operated not as if it were true but as if it were false. To generalize, the history of science

suggests that some observable events did not agree with what successful past theories said about the world, i.e., that the world operated as if successful past theories were false.

In the face of this objection, the surrealist might dilute his position, maintaining that a theory is successful because the world operates as if it is *approximately* true, or because the world operates *approximately* as if it is true. This modest version of surrealism allows for the possibility that some observable events do not agree with what a successful theory says about the world. Consequently, the modest version of surrealism is compatible with the history of science.

The preceding surrealist move, however, falls prey to Lyons's objection. The new surrealist explanans that the world operates approximately as if a theory is true allows for the possibility that some observable events occur contrary to what a theory says about the world, and hence for the possibility that the theory is not successful. The new surrealist explanans does not necessitate success even in the presence of true auxiliaries. Thus, Lyons's criticism against the modest version of realism backfires on the modest version of surrealism.

Lyons's criticism is, however, valuable in that it prods us to ponder how approximate truth relates to success. I (2014b: 108) suggested that an approximately true theory is either empirically adequate or approximately empirically adequate. A theory is approximately empirically adequate, if and only if most of its observational consequences are true. It follows that an approximately true theory is *likely* to be successful. To use an analogy, if all or most swans are white, some swans randomly picked from the population of swans are likely to be white. Thus, the realist explanation implements the inductive-statistical model of explanation in which an explanandum probably follows from an explanans. So does the surrealist explanation. The surrealist explanation, however, is inferior to the realist explanation, as will become clear in the next section.

## **5. Criticisms against Surrealism**

### **5.1. Useful and Useless Prescriptions**

We encounter all sorts of problems in our daily life. When a problem occurs, we look for the cause of the problem. Once we have identified the cause, we take an action to get rid of the cause. Suppose, for example, that you bought a car. Unfortunately, the ignition plugs were bad, and as a result the car stopped in the middle of the road. Two questions naturally arise. Why did the car stop? What should you do to make it run again? These two questions are not isolated from but connected with each other. An appropriate answer and an inappropriate answer to the first question lead, respectively, to an appropriate answer and an inappropriate answer to the second question.

There can be different explanations of why the car stopped and hence different prescriptions on how to make it go again. Consider the following two explanations: 1. The car stopped because the ignition plugs were bad. 2. The car stopped because there was gravity between the car and the earth. Both explanations are legitimate from the perspective of the causal theory of explanation, given that they both invoke causes that contributed to the problem. They, however, blame different factors. The first one blames (the manufacturer of) the ignition plugs, whereas the second one blames the world, for the problem. Accordingly, the first one leads to the solution to the problem, while the second one does not. The prescription to replace the ignition plugs with new ones would solve the problem, but the prescription to eliminate gravity between the car and the earth would not. In this sense, the first explanation leads to a useful prescription, but the second one to a useless prescription.

Analogously, suppose that scientists devised a theory, and that it failed empirical tests, even though they had relevant auxiliaries, technologies, funding, and so on. For example, some scientists proposed the cold fusion theory in the late 1980s according to which a nuclear

reaction can occur at room temperature. Unfortunately, other scientists could not duplicate their experiment, and the theory was quickly discredited. The theory was unsuccessful. Two questions arise. Why was the theory unsuccessful? What should the scientists have done to solve the problem? The realist and the surrealist give different explanations of why the theory was unsuccessful, and hence they give different prescriptions on what the scientists should have done to solve the problem.

The realist claims that the cold fusion theory was unsuccessful because it was false. This explanation indicates that the cause of the failure of the theory lied in the theory, and that the scientists were to blame for the failure of the theory. So they should have fixed the theory or replaced it with a new one. The realist's prescription on how to solve the problem is right. This useful prescription originates from the explanation that a theory is unsuccessful because it is false. In general, picking out an appropriate cause leads to a useful prescription.

In contrast, the surrealist asserts that the cold fusion theory was unsuccessful because the world did not operate as if it was true. This explanation indicates that the cause of the failure lied in the world, and that the world was to blame for the failure of the theory. So the scientists should have fixed the world to solve the problem, i.e., the scientists should have changed the way the world behaved to ensure that observable events occurred as the theory said they did. The surrealist's prescription is useless. This useless prescription stems from the explanation that a theory is unsuccessful because the world does not operate as if the theory is true. In general, picking out an inappropriate cause leads to a useless prescription.

The surrealist might retort that I have attached too much weight to the linguistic form in which the surrealist explanation is couched. The surrealist explanation does not necessarily lead to the aforesaid useless prescription. Surrealism is compatible with the suggestion that the author of a theory is to blame for the failure of the theory, and that the scientist should fix the theory, not the world, to make it successful. It is wrong to accuse surrealism of having the absurd consequence that the world is to blame for the failure of a theory, and that the scientist should change the way the world behaves. In sum, the surrealist can cheerfully say, "A theory is unsuccessful because the world does not operate as if it is true. But the scientist needs to fix the theory, not the world, to make it successful."

In my view, there is something wrong with the surrealist's remark. The surrealist cites the world as the cause of the failure of a theory, and then suggests out of the blue that the theory should be fixed. There is no connection whatsoever between his explanation of why a theory is unsuccessful and his prescription on how to make it successful. Moreover, his prescription that a theory should be fixed indicates that he believes that there is something wrong with the theory, not with the world. It is puzzling why he cites the world as the cause of the failure of the theory when he believes that the problem lies in the theory.

The surrealist's preceding remark is similar to that of a mechanic who says "The car stopped because of gravity between the car and the earth. But I'll replace the ignition plugs with new ones to make the car run again." Note that after citing gravity as the cause of the failure of the car, the mechanic suggests out of the blue that the ignition plugs should be replaced with new ones. There is no connection whatsoever between his explanation of why the car stopped and his prescription on how to make it go again. Furthermore, his prescription that the ignition plugs should be replaced with new ones indicates that he believes that the car stopped because of the ignition plugs, not because of gravity. It is puzzling why he cites gravity as the cause of the failure of the car when he believes that the ignition plugs are the cause of the failure.

## **5.2. Appropriate and Inappropriate Crediting**



Realism and surrealism attribute the success of a theory to different factors. The realist claims that *the truth* of a theory is the reason for its success, i.e., the theory would not be successful, if it is not true. The surrealist, on the other hand, claims that *the world* is responsible for the success of a theory, i.e., the theory would not be successful, if the world behaves differently. In this section, I aim to expose a problem of attributing the success of a theory to the world.

Let me begin with an analogy. Imagine that the Wright brothers tried various shapes of an airplane in the early 20<sup>th</sup> century. After many trials and errors, the airplane acquired the right shape, and as a result it successfully flew. A question arises. Why did the airplane successfully fly? There can be many different explanations, given that many factors jointly produced the flight of the airplane. Let me consider two explanations: 1. The airplane could fly because it acquired the right shape. 2. The airplane could fly because there was air in the sky. Both explanations are legitimate from the perspective of the causal theory of explanation, given that they both invoke causes that contributed to the flight of the airplane. The airplane could not have flown, if it had not acquired the right shape, or if there had not been air in the sky.

The flight is an impressive performance of the airplane. So a question naturally arises. Who or what deserves the credit for the flight of the airplane? If you attribute the flight to the right shape, you are entitled to say that the Wright brothers deserve the credit. After all, they created the right shape. If, however, you attribute the flight to the air in the sky, you are not entitled to say so. After all, if the air is responsible for the flight of the airplane, then the Wright brothers are not praiseworthy for the flight of the airplane. They would only be so, if they created the air!

Similarly, imagine that a scientist devised a theory. After many trials and errors, the theory became successful. There can be many different explanations of why the theory is successful, given that many factors jointly generate the success of a theory, as we have seen in Section 2. Let me consider the following two explanations: 1. The theory is successful because it is true. 2. The theory is successful because the world operates as if it is true. Both explanations are legitimate from the perspective of the causal theory of explanation. After all, the theory cannot be successful, if it is not true, or if the world does not operate as if it is true.

Success is an impressive performance of a theory. The general theory of relativity, for instance, made the amazing true prediction that light bends near the sun. A question naturally arises. Who or what deserves the credit for the impressive performance? If you attribute the success to the truth of the theory, you are entitled to say that the author of the theory deserves the credit. After all, the author created the theory, making sure that it is true. If, however, you attribute the success to the world, you are not entitled to say so. After all, if the world is responsible for the success of a theory, then the author of the theory is not praiseworthy for the success of the theory. He would only be so, if he created the world!

There is a further problem with surrealism. The Wright brothers would be disappointed with the explanation that their airplane flew thanks to the air in the sky. Such an explanation fails to recognize their creativity and hard work. Analogously, Einstein would be disappointed with the surrealist contention that the general theory of relativity is successful thanks to the way the world operates. Einstein worked hard to think up his theory and to make it successful. The surrealist explanation fails to capture this human contribution to the success of a theory. It recognizes only the worldly contribution.

The surrealist might object that realism and surrealism are on a par regarding the issue of attributing the success of a theory to an inappropriate factor. Realism can also be taken to attribute the success of a theory to the world. Consider the following two realist proposals:

(A) A theory is successful because it is true.

(B) A theory is successful because both observables and unobservables behave as it says they do.

Both (A) and (B) imply that a successful theory is true, so they are both available to the realist. (B), however, gives the credit to the world. Therefore, realism also has the absurd consequence that the world deserves the credit for the success of a theory.

In my view, however, there is a huge difference between (A) and (B). (A) and (B) invoke truth and the world, respectively, to explain the success of a theory. Truth and the world should not be equated with each other. Truth is a property of a belief. It arises when a belief matches up with the world. It is up to both humans and the world whether a theory matches up with the world or not. In contrast, it is not up to humans whether the world operates in a certain manner or not. Thus, (A) implies, but (B) does not, that there is a human contribution to the success of a theory. Thus, it is not only the surrealist but also the realist who can wrongfully give the credit to the world within his framework.

### **5.3. Pessimistic Induction**

Lyons's surrealism (2003: 900) is one of antirealist explanations of the success of science which were proposed to undermine Putnam's claim (1975) that realism provides the best explanation for the success of science. According to the antirealist proposals, science is successful because only successful theories survive (van Fraassen, 1980: 40; Wray, 2007, 2010), because robust methods screen out unsuccessful theories (Laudan, 1984: 101), because successful theories are empirically adequate (Musgrave, 1988: 242; Ladyman, 1999: 186), because the world operates as if successful theories are true (Fine, 1986; Lyons, 2003: 897, Mizrahi, 2012: 133), because successful theories are instrumentally useful (Fine, 1991: 82), because successful theories are true, but we do not have to believe that they are true (Brown, 1994), because successful theories are predictively similar to true theories (Stanford, 2000), and because the world operates approximately as if successful theories are true (Lyons, 2003: 900).

I (2014a) exposed problems with all the preceding antirealist explanations of the success of science except the latest one, which happens to be Lyons's surrealism (2003: 900). I then argued that Lyons's surrealism had problems hitherto unexposed, and that the problems would be exposed later because its several forerunners had problems which did not occur to antirealists. Antirealists are fated to keep proposing problematic antirealist explanations of the success of science in the future. In short, I ran a pessimistic induction against antirealism.

My pessimistic induction against antirealism echoes Stanford's pessimistic induction (Stanford, 2006: 19-20) against realism. Stanford maintains that since successful past theories had alternatives, viz., their present successors, which past scientists could not conceive of, successful present theories also have alternatives which present scientists cannot conceive of. Future scientists will conceive of alternatives hitherto unconceived and replace present theories with future theories. I (2014a: 16-19) argued at length that my pessimistic induction against antirealism and Stanford's pessimistic induction against realism rise or fall together. It requires, however, going off on a tangent to summarize here my replies to the objection that my pessimistic induction and Stanford's pessimistic induction are on different boats.

Two scenarios are possible. The first scenario is that the criticisms I launched against surrealism in Sections 5.1 and 5.2 of this paper successfully refute surrealism. In this case, the criticisms have exposed the very problems that were hidden when Lyons advocated surrealism. The second scenario is that the criticisms fail to refute surrealism. In this case, they fail to expose the hidden problems with surrealism. The surrealist, however, should still confront my pessimistic induction against antirealism.

## 6. Conclusion

The realist attributes the failure and the success of a theory to the author of the theory, recommending that the theory should be fixed in case it is unsuccessful, and giving the credit to the author of the theory in case it is successful. Thus, he recognizes the scientist's contribution to the failure and the success of the theory. In contrast, the surrealist attributes the failure and the success of a theory to the world, recommending that the world should be fixed in case it is unsuccessful, and giving the credit to the world in case it is successful. Thus, he fails to recognize the scientist's contribution to the failure and the success of the theory. Finally, even if these criticisms do not refute surrealism, surrealism is still a problematic doctrine because it has problems hitherto unexposed. The problems will be exposed as a matter of induction, given that its several predecessors had problems which were not apparent initially but were later exposed. Therefore, surrealism is not a promising alternative to realism.

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