Chapter 12
Skepticism About Induction

Abstract Another way of challenging our scientific knowledge is to challenge our knowledge of all unobserved cases and our ability to make justified predictions about what will happen on the basis of previous observations. The skeptic about induction claims that while we might observe many, many instances of As that are Bs this does not allow us to know that the next A we observe will be a B (or even reasonably believe that it will be or is likely to be a B). This sort of inductive skepticism poses a major threat to our scientific knowledge as well as our commonsense knowledge of the world around us. After all, we depend on this sort of inference (from observed cases to what we expect to observe in the future) every day. This chapter argues that again the skeptical challenge can be overcome by carefully understanding the sort of explanationist account of evidential support which has been developed in earlier chapters.

As we saw in the previous chapter, one way to challenge our scientific knowledge involves challenging all of our knowledge of the world around us. Another sweeping skeptical challenge comes by way of attacking our practices of inductive reasoning. This sort of reasoning is ubiquitous in our everyday lives and in science. Roughly, this is the sort of reasoning that we employ when we infer what will happen on the basis of previous observations. Our justification for thinking that the sun will rise tomorrow, that water will boil when heated to a sufficiently high temperature, that a pet goldfish will not survive without being fed regularly, and so on depends upon inductive reasoning. Although this sort of reasoning is "at the heart of science and is crucial to common-sense reasoning", it has long been a target of skeptical attack (Feldman 2003, p. 130). Of course, a successful skeptical attack on our inductive reasoning would undermine a vast swath of our knowledge, including our scientific knowledge.

Skepticism about induction is a significant philosophical problem—one that cannot be easily set aside. On the one hand, as we will see, the sort of argument that is marshaled in support of inductive skepticism seems to employ pretty uncontroversial premises. On the other hand, the great strides which science has made in helping us to learn about our universe makes it clear that the sort of reasoning at the core of scientific practice cannot be rotten. Yet, the premises of arguments for inductive skepticism seem true, and they seem to lead to the clearly

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unacceptable conclusion that our practices of inductive reasoning do not give us justified beliefs or knowledge. As C.D. Broad (1952, pp. 142–143) put it, it appears that inductive reasoning is "the glory of science and the scandal of philosophy." So, we face yet another significant threat to our scientific knowledge.

Despite the fact that the challenge posed by inductive skepticism is a difficult one which cannot be easily put to rest, we will see that there are promising ways of dealing with this scandal. In this chapter we will explore the nature of this challenge and one of the more promising responses to inductive skepticism. Again, the response to this skeptical challenge we will examine is an outflowing of the explanatory account we have been developing in the previous chapters. We shall see that while it is not easy to dismiss the threat of inductive skepticism, we should not despair. Our scientific knowledge remains untarnished.

12.1 Examples of Inductive Reasoning

Before assessing the threat to our scientific knowledge and our knowledge more generally posed by skepticism about induction, it will be helpful to briefly clarify some of the more common varieties of inductive inference. The most widely discussed pattern of this sort of reasoning is when we infer something about the next instance on the basis of previous observations (Feldman 2003). Here is an example:

1. There have been many observations of emeralds in a variety of circumstances and conditions.
2. All of the observed emeralds have been green.
3. Therefore, the next emerald to be observed will be green.

It is also common to reason from observations to general conclusions like in the following example:

1. There have been many observations of emeralds in a variety of circumstances and conditions.
2. All of the observed emeralds have been green.
3. Therefore, all emeralds are green.

Both of the above examples of inductive reasoning are ones in which all of the observations are the same in important ways. In both of these examples *all* of the observed emeralds have been green. Of course, not all of our inductive reasoning proceeds from perfectly uniform sampling. Often we find that only a portion of our observations has the characteristic we are interested in. For instance, if controlled studies have been performed to determine the effectiveness of a particular drug in treating an illness, and it has been found that 75 % of those given the drug recover from the illness, we tend to reasonably conclude that (roughly) 75 % of the untreated people with the illness would recover after receiving the drug. More precisely, we reason in the following way:

1. There have been many observations of the effects of drug X on illness Y in a variety of circumstances and conditions.
2. 75 % of all patients suffering from illness Y have recovered after being given drug X.
3. Therefore, 75 % of patients suffering from illness Y will recover after given drug X.

Certainly, there are complications when it comes to inductive reasoning. If illness Y is something like a cold, say, that is known to end after a particular duration, then we may not infer that drug X leads to recovery 75 % of the time. The reason we do not infer the conclusion in this case is that we have a better explanation of the patients' recoveries—namely, the cold has run its course. Similarly, if we have good reason to think that our observations of objects of kind *A* are skewed in some way, perhaps because the observations have only come from one particular lab and cannot be replicated in other labs, then despite the fact that all of the observed *A*s have had a particular property we may not reasonably infer that they all do or that the next *A* will have that property. As we will see below, this fact about inductive reasoning can be readily explained by the sort of account of inductive reasoning our response to inductive skepticism builds upon. We can set aside these sorts of worries for now. It is enough to recognize that we often justifiedly reason in the ways described above.

There are other examples of inductive reasoning, but for our purposes this gives us a sufficient grasp of what is targeted by the inductive skeptic. It is now time to turn our attention to examining the nature of this skeptical challenge.

12.2 The Challenge of Inductive Skepticism

Like many philosophical problems the challenge of inductive skepticism arises from questioning something that we often take for granted. Our commonsense reasoning and scientific practices take it for granted that inductive reasoning provides us with knowledge (or at the very least with justified beliefs). But, this is something which might be questioned. P.F. Strawson (1952, p. 249) characterizes the challenge of inductive skepticism as the challenge of answering the following question: "Why should we suppose that the accumulation of instances of *A*s which are *B*s, however various the conditions in which they are observed, gives any good reason for expecting the next *A* we encounter to be a *B*?" The challenge begins with this sort of question, but as a question it does not yet provide any reason to doubt our knowledge, scientific or otherwise. The reason that this sort of question poses a threat to our knowledge is that one can argue that the answer to Strawson's question is "we should not suppose this at all!"

The challenge of inductive skepticism in its modern form is often attributed to the work of David Hume.[1] Although the argument first appears in Hume's *A Treatise of Human Nature* (1739–1740/1978), it is given a particular clear expression in his *Enquiries Concerning Human Understanding* (1748/1975, pp. 35–36):

> Concerning matter of fact and existence . . . there are no demonstrative arguments . . . it implies no contradiction that the course of nature may change . . . All of our experimental conclusions proceed upon the supposition that the future will be conformable to the past. To endeavor, therefore, the proof of this last supposition by probable arguments, or arguments regarding existence, must be evidently going in a circle, and taking that for granted, which is the very point in question.

In essence, Hume claims that all of our inductive reasoning relies upon the assumption that the future will be like the past. He then goes on to point out that such an assumption cannot be established demonstratively—we cannot derive this assumption from self-evidently true principles via deductive inference. Unfortunately, Hume claims that this assumption cannot be established by using our experiences and inductive reasoning ("probable arguments") either because any such argument must itself rely on the very assumption that we are trying to establish as reasonable—such arguments must rely upon the assumption that the future will resemble the past. So, he claims the assumption is groundless.

Let us make the skeptical challenge to inductive reasoning a bit more precise before turning our attention to how we can overcome this challenge. The first thing we need to do is to recognize that Hume construes the relevant principle too narrowly. It is not just that the future will resemble the past, but instead, the relevant principle is "unobserved instances are like observed instances". After all, it could be that we are making inductive inferences not from past to future, but about things that are all in the past. For example, suppose you have observed random drawings without replacement from an urn of marbles. All 10,000 draws have produced a red marble. You have drawn a marble without looking at it. You infer from the marbles you have observed that the other marble is red too. Notice in this case you are not inferring that the marble *will be red*; you are inferring that *it is red*. Your drawing of the marble is in the past. Although for the discussion that follows the distinction between the principle that "the future will resemble the past" and the broader principle (because it includes the claim that the future will resemble the past) "unobserved instances are like observed instances" will not make much of a difference, it is useful to keep this in mind so as to avoid confusion.

With our clarified understanding of Hume's argument in hand we are ready to formulate the skeptical argument against induction more precisely:

HUME'S ARGUMENT

1. Inductive reasoning is justified only if the principle that unobserved instances are like observed instances (ULO) can be justified.

[1] Weintraub (1995) offers a nice discussion of how Hume's argument is a refinement of an ancient skeptical argument put forward by Sextus Empiricus.

2. If ULO can be justified, then ULO can be justified by either demonstrative argument or by inductive reasoning.
3. ULO cannot be justified by demonstrative argument.
4. ULO cannot be justified by inductive reasoning.
5. Therefore, ULO cannot be justified.
6. Therefore, inductive reasoning is not justified.

(1) is simply expressing the fact that inductive reasoning seems to rely on the assumption that unobserved cases are like observed cases (ULO). (2) is supported by the idea that if we justify a principle (provide good reasons in support of relying upon the principle) we only have two options—we can provide reasons that come from self-evident truths along with deductive reasoning (demonstrative arguments) alone or we can provide reasons by way of experience and inductive reasoning. The thought here is that we either support principles like ULO through the use of reasoning alone or we do so at least in part on the basis of experience. Hume supports (3) by pointing out that there is nothing contradictory in thinking ULO is false. Since the denial of ULO is not a contradiction, it is plausible that ULO could be false. So, Hume concludes that ULO cannot be established via demonstrative argument because its truth is not a matter which can be determined by reason alone. With respect to (4) Hume claims that supporting ULO with inductive reasoning "must be evidently going in a circle, and taking that for granted, which is the very point in question", so he claims that ULO cannot be justified by inductive reasoning. In light of these considerations, it seems that ULO cannot be justified (5). However, if ULO cannot be justified, it seems that inductive reasoning cannot be justified because it relies upon ULO. Thus, HUME'S ARGUMENT yields the skeptical conclusion that inductive reasoning is not justified (6). As we noted above, if this conclusion is true, then our scientific knowledge, as well as an enormous portion of our everyday knowledge, is undermined. Inductive skepticism is a significant threat indeed.

12.3 Responding to the Challenge of Inductive Skepticism

As might be expected from the fact that there are four premises in HUME'S ARGUMENT for inductive skepticism (5 and 6 are conclusions), there are four broad ways to respond to the challenge of inductive skepticism. Each way of responding to the threat of inductive skepticism involves denying one of premises (1)–(4). One might deny premise (1), but doing so seems extremely implausible. It does seem that inductive reasoning rests on ULO or something very similar. After all, if we had no good reason to think that ULO is true, then it is hard to see how we could be justified in relying on inductive reasoning. Consequently, it seems that there are really only three broad responses to this challenge which may be tenable. Let us briefly take a look at some of the more prominent versions of these broad responses before turning to the explanatory response.

First of all, one might deny (2) of HUME'S ARGUMENT on the grounds that there is an additional way ULO might be justified. Some philosophers argue that we can justify inductive reasoning pragmatically.[2] The thrust of this pragmatic justification of induction involves showing that if any method of reasoning about the world will be successful, then our inductive practices will be. Such a response is considered a pragmatic justification because it does not actually involve arguing that our inductive practices are successful or epistemically justified. Instead, this response argues that our inductive reasoning practices are the best we can do. So, supporters of this view argue that there is a way to justify induction which does not rely upon demonstrative arguments or providing inductive arguments in support of inductive reasoning.

The second broad approach to responding to this challenge is to deny (3) of HUME'S ARGUMENT. Typically, this is done by arguing that induction can be justified without any appeal to experience, but instead, it can be justified through considerations of pure reasoning alone. One popular way of doing this is to argue that we can simply tell by rationally reflecting on our methods of reasoning that inductive reasoning is justified.[3] Often the thought here is that when we are discussing something as fundamental as inductive reasoning we will have no recourse but to appeal to our intuitions about what is rational, and these intuitions support thinking that inductive reasoning is rational. We will discuss this issue a bit more fully when discussing the explanatory response.

The third sort of broad approach one might take in responding to the challenge of inductive skepticism is to deny (4) of HUME'S ARGUMENT and maintain that we can justify inductive reasoning via inductive reasoning.[4] Roughly, the idea here is that we can justify ULO by noting that when we have used inductive reasoning before it has led us to correct (justified) conclusions, and then arguing that since our observed cases of inductive reasoning have been successful, the unobserved cases are/will be too. Essentially, this response seeks to show that it is possible to defend the rationality of inductive reasoning by using that very sort of reasoning. This sort of response is circular in some sense, but supporters maintain that the kind of circularity involved is not vicious. We will examine this idea further in sections that follow.

There is much more that can be, and has been, said both for and against each of these approaches to responding to the challenge of inductive skepticism. For our purposes, however, simply noting some of these primary ways of responding to HUME'S ARGUMENT is enough. Accordingly, we will not delve into the debates over the acceptability of these various responses. Some of the details of these responses will be fleshed out further when discussing the explanatory response, but

[2] See Reichenbach (1938, 1949), Salmon (1957, 1974), and Skyrms (1975).

[3] See Carnap (1968), Kyburg (1956, 1965), Lycan (1988), Psillos (1999), and Strawson (1952) for this sort of view.

[4] Prominent defenders of this sort of response to the challenge of inductive skepticism include Black (1954, 1958, 1963), Braithwaite (1953), Papineau (1993), and Van Cleve (1984).

these details can wait until this response has been explained. Briefly explaining these methods of responding to the challenge of inductive skepticism as we have here is worthwhile for at least two reasons. First, doing so helps us to get clear on some of the variation in the ways in which we might seek to respond to this skeptical challenge. Second, even if one were unsatisfied with the explanatory response that we will develop in this chapter, we can see that there are still many other avenues for addressing the challenge of inductive skepticism which might be explored. It remains an open possibility that our scientific knowledge can be defended from this skeptical threat in a variety of distinct ways.

12.4 The Explanatory Response

The first step to developing the explanatory response to inductive skepticism is to get clear on how we should understand the nature of inductive reasoning. It is plausible that the inductive argument forms which we considered in Sect. 12.1, and all other plausible instances of inductive reasoning, should be understood in terms of inference to the best explanation. Recall, from Chap. 10 that inferences to the best explanation are roughly of this form:

$F_1, F_2, \ldots, F_n$ are facts in need of explanation.
Hypothesis H explains the F_i.
No available competing hypotheses would explain the F_i as well as H does.

Therefore, H is true

Admittedly, at first glance the arguments we examined above do not seem to fit this form. Initial appearances notwithstanding, the best way to understand inductive reasoning, when it is appropriate, is as inference to the best explanation/explanatory reasoning. Consider, why is it reasonable to infer that all emeralds are green on the basis of having observed only green emeralds? The reason is that the best explanation of our observations all being the way they are is that there is something about emeralds which makes them all green. Hence, the claim that all emeralds are green is part of the best explanation of our evidence. This answer to why it is reasonable to infer this conclusion is a natural consequence of the account of evidential support we developed in Chap. 10— *Explanationism*. According to *Explanationism*, we have justification for accepting propositions that are part of the best explanation of our evidence or that are better explained by the best explanation of our evidence than their denials.

The case for understanding all good inductive reasoning as explanatory reasoning is clearer when we consider arguments like this one:

1. There have been many observations of the effects of drug X on illness Y in a variety of circumstances and conditions.

2. 75 % of all patients suffering from illness Y have recovered after being given drug X.
3. Therefore, 75 % of patients suffering from illness Y will recover when given drug X.

As we noted above, the conclusion that 75 % of patients suffering from illness Y will recover when given drug X does not seem to follow from the premises when we know that the illness is something like a cold which will go away on its own (without drug X) in the amount of time elapsed before the observation is to be made. What explains the difference between instances where we can reasonably accept the conclusion of this sort of argument and instances where we cannot? In the cases where we can reasonably accept the conclusion the truth of that conclusion is part of the best explanation of our observations, or it is better explained by the best explanation of our evidence than its denial. The best explanation of the fact that 75 % of all patients suffering from illness Y have recovered after being given drug X, when this is all the information we have, is that there is something about drug X (a property governed by a law-like regularity, some mechanism, etc.) which makes it so that 75 % of the patients given drug X will recover. The claim that (roughly) 75 % of patients suffering from illness Y will recover when given drug X is much better explained by the best explanation of our observations than its rival (it is not the case that (roughly) 75 % of patients suffering from illness Y will recover when given drug X) is. So, according to *Explanationism* that conclusion is justified for us.

In a case where we also know that illness Y is something which tends to disappear on its own in the length of time that we have observed patients given drug X things are different. In this case there being something about drug X (a property governed by a law-like regularity, some mechanism, etc.) which makes it so that 75 % of the patients given drug X will recover is not the best explanation of our observations. Instead, we have an equally good rival explanation—illness Y is such that it naturally (without the drug treatment) goes away in the amount of time elapsed prior to our observations. In this case we are not justified in accepting the conclusion of the argument above.

Additionally, once we understand induction as a kind of explanatory reasoning we can explain why certain methods of inductive inference are fallacious (Lycan 1988). It is widely recognized that inductive inferences drawn from an insufficient sample size and those drawn from biased samples do not provide good reason to accept their conclusions. But, why is that? If we understand inductive reasoning as nothing over and above the sorts of inferences we considered in Sect. 12.1 above (with no underlying explanatory connection being necessary), then it seems we do not have an explanation of why it is fallacious to drawn conclusions in these ways. However, construing induction as a kind of explanatory inference explains why these are fallacies.

Consider a simple example of drawing a conclusion from an insufficient sample size. Saundra is trying to determine the color of marbles in an urn. Saundra knows there are a million marbles in the urn and that they can be any color. She draws a single marble and notices that it is red. Saundra infers on the basis of that single

observation that all the marbles are red. In such a case it is clear that Saundra has reasoned poorly. She has committed the fallacy of reasoning from an insufficient sample size. The flaw in Saundra's reasoning is that her conclusion is not the best explanation of why she has the observation that she does. An equally good (or better) explanation is that some, but not all, of the marbles are red. Without understanding induction in terms of explanatory reasoning it is not clear what is wrong with Saundra's inference in this case.

When it comes to reasoning from biased samples things are even clearer. Consider a simple example of this fallacy. Steve wants to know which college football team is the most popular team in the United States. He surveys students at the University of Alabama at Tuscaloosa and finds that almost all of them like the University of Alabama's football team better than any other college football team. On the basis of his data, Steve concludes that the University of Alabama's football team is by far the most popular college football team in the United States. Like Saundra, Steve has reasoned poorly. The flaw in Steve's reasoning is perhaps even clearer than the flaw in Saundra's. The best explanation of Steve's data is not that the University of Alabama's football team is by far the most popular college football team in the United States. A better explanation of Steve's data is that students at a particular university prefer their university's football team to the teams at other universities. In light of considerations about these fallacies, and the other considerations raised above, it is reasonable to conclude that inductive reasoning, when it is justified, is an instance of explanatory reasoning (IBE).[5]

At this point we have seen it is plausible that good cases of inductive reasoning should be understood as an explanatory reasoning and that when inductive reasoning goes wrong it is because it fails to form a good IBE. It is now time to explore how recognizing this fact helps with the challenge of inductive skepticism. Recall P.F. Strawson's (1952, p. 249) expression of this challenge in terms of the following question: "Why should we suppose that the accumulation of instances of *A*s which are *B*s, however various the conditions in which they are observed, gives any good reason for expecting the next *A* we encounter to be a *B*?" We now have a good answer to this question. We have good reason for expecting the next *A* we encounter to be a *B* when our accumulated observations of *A*s that are *B*s are best explained by some regularity connecting *A*-ness to *B*-ness.[6] For example, why is it that we have good reason to think the next unsupported object relatively close to the surface of the earth will be pulled toward the earth? The reason is that the best explanation of our previous observations of unsupported objects relatively close to the surface of the earth being pulled toward the earth is that it is a law of nature, gravity, that

[5]See Harman (1965, 1968, 1973, 1986), Weintraub (2013), and White (2005) for further considerations in support of this claim. Fumerton (1980) demurs, but see Weintraub (2013) for convincing responses to Fumerton's objections.

[6]Some, such as Armstrong (1983) and Foster (1982–1983, 2004), hold that this regularity must be a law of nature. Others, such as White (2005), argue that it is not necessary that the regularities appealed to are natural laws. Fortunately, we do not need to settle this issue here. Either way things turn out the explanatory response to inductive skepticism is still compelling.

objects with mass are drawn toward one another with the less massive object moving more toward the more massive object. Now, we do not have to know the exact regularity which is operative in order to reasonably draw an inference on the basis of our previous observations, it is enough for it simply to be the best explanation of our observations that there is some regularity or other that connects A-ness (like unsupported mass) to B-ness (falling).

Putting this response in terms of HUME'S ARGUMENT from Sect. 12.2, we have good reason to think that premise (4) is false. Once we recognize that inductive reasoning is best understood in terms of explanatory reasoning we can see that there is good inductive (in the broad sense of being non-deductive/non-demonstrative) support for ULO—it is justified for us when the best explanation of why the observed instances have a feature that they do is that there is some regularity which makes it so that they have that feature. When such a regularity is the best explanation for why the observed *A*s are *B* we have good reason to think the unobserved *A*s will be *B* as well. So, we do have a sort of inductive reasoning which can legitimately support ULO. Thus, premise (4) is false, and HUME'S ARGUMENT fails to establish the conclusion that our inductive reasoning is not justified. Therefore, the threat of inductive skepticism is not all that threatening.[7]

12.5 The Challenge Returns?

Although we have seen that appealing to explanatory reasoning provides us with a satisfactory way of overcoming the challenge of inductive skepticism, one might worry that the problem simply returns as a problem for IBE (Weintraub 2013). That is, one might question what reason we have for thinking explanatory reasoning will get us to the truth of things. In other words, rather than questioning why we should think ULO is true, one might instead question why we should think the best explanation of some phenomenon is likely to be true.

This objection has been termed the "Truth Demand" because it demands that in order for IBE to be acceptable we have to have reason for thinking that the features which make one explanation better than another, explanatory virtues, are linked to the truth (Vogel manuscript). The Truth Demand has been pressed in numerous forms. James Beebe (2009, p. 619) says, "the satisfaction of the explanatory criteria cannot provide us with an epistemic reason to believe . . . if those criteria are not themselves truth-linked." Peter Lipton (2004, p. 144) expresses the Truth Demand as follows:

> Why should the explanation that would provide the most understanding if it were true be the explanation that is most likely to be true? Why should we live in the loveliest of all possible worlds? Voltaire's objection is that, while loveliness may be as objective as you like, the

[7]For further considerations in support of this sort of response to inductive skepticism see Armstrong (1983), BonJour (2010), Feldman (2003), Foster (1982–1983, 2004), and Lycan (1988).

> coincidence of loveliness and likeliness is too good to be true. It would be a miracle if using explanatory considerations as a guide to inference were reliably to take us to the truth.

Bas van Fraassen (1980, p. 90) also appears to be pressing the Truth Demand when he says, "some writings on the subject of induction suggest that simpler theories are more likely to be true. But it is surely absurd to think that the world is more likely to be simple than complicated." All of these versions of the Truth Demand present the same challenge to the acceptableness of relying on explanatory reasoning. The Truth Demand challenges the supporter of IBE to give reasons for thinking that explanatory virtues, which make one explanation better than another, are connected to the truth. That is, the Truth Demand is a demand for reasons to think that the best explanation of a given phenomenon is likely to be true.

Jonathan Vogel (manuscript) aptly notes that the various versions of the Truth Demand can be understood as pressing an argument that beliefs licensed by IBE are not justified. Essentially the Truth Demand is the challenge of inductive skepticism, which was overcome above, returning as an attack on explanatory reasoning. Here is Vogel's formulation of the Truth Demand argument:

1. A belief licensed by inference to the best explanation will be justified only if we are justified in believing that such a belief is likely to be true.
2. We are justified in believing that a belief licensed by inference to the best explanation is likely to be true only if we are justified in believing that the world is lovely.
3. We aren't justified in believing that the world is lovely.
4. Therefore, we aren't justified in believing that a belief licensed by inference to the best explanation is likely to be true.
5. Therefore, a belief licensed by inference to the best explanation isn't justified. (manuscript, p. 4)[8]

In light of this, one might worry that we have overcome the challenge of inductive skepticism only to find ourselves facing an analogous challenge for explanatory reasoning.

12.6 Responding to the Returned Challenge

Fortunately, we have plausible ways of responding to the challenge presented by the Truth Demand too. One way of responding to the Truth Demand involves appealing to rational reflection. As Henry Kyburg Jr. (1974, p. 65) says:

> I think that in some sense our justification of inductive rules must rest on an ineradicable element of inductive intuition—just as I would say that our justification of deductive rules

[8]With respect to an explanation "loveliness" refers to the explanation's possessing explanatory virtues. Hence, the lovelier of two explanations is the explanation which is more explanatorily virtuous, i.e. the better explanation of the two. The claim that "the world is lovely" refers to the idea that explanatory virtues are correlated to the truth in the sense that explanations which are explanatorily virtuous are likely to be true.

> must ultimately rest, in part, on an element of deductive intuition: we *see* that *modus ponens* is truth-preserving—that is simply the same as to reflect on it and fail to see how it can lead us astray. In the same way, we *see* that if all we know about in all the world is that all the A's we've seen have been B's, it is *rational* to *expect* that the next A will be a B.[9]

Kyburg appeals to rational reflection as a way to justify inductive reasoning because he takes inductive reasoning to be a fundamental form of reasoning just as deductive reasoning is. Since inductive reasoning is fundamental, it does not make sense to attempt to justify it in terms of some other more basic forms of reasoning. Thus, rational reflection provides the only non-circular way of justifying inductive reasoning.

As we have discussed above, Kyburg's claim about inductive reasoning being fundamental does not seem correct when we think of inductive reasoning as simply enumerative induction—the sort of inductive reasoning that says there is nothing more to the inferences in Sect. 12.1 than moving directly from observations to conclusions about the unobserved. This is why we could not simply employ Kyburg's method to respond to our initial challenge of inductive skepticism. Yet, we have seen that it *is* reasonable to think that inductive reasoning of that sort can really be reduced to, or subsumed under, explanatory reasoning. It is plausible that explanatory reasoning is a basic form of reasoning.[10]

If explanatory reasoning, like IBE, is a fundamental form of reasoning, it is to be expected that it will be justified in the same way as other fundamental forms of reasoning, that is, by rational reflection. So, mirroring Kyburg, one might claim that we *see* that if H is the best explanation of our evidence, it is *rational* to *expect* H to be true. This is the best that can be expected when one is justifying a fundamental form of reasoning; to ask for justification in terms of some other more fundamental truth relation is to misunderstand what is involved in being a fundamental form of reasoning.

Given the plausible assumption that in order for it to be rational for one to expect H to be true it must be that H is likely to be true given one's evidence, appeal to rational reflection offers a plausible way of meeting the Truth Demand. In other words, one might attempt to satisfy the Truth Demand by claiming that when we reflect on various explanations we see that the one which is the

[9]Carnap (1968), Kyburg (1956), Lycan (1988), and Psillos (1999) all claim that both basic forms of deductive reasoning and basic forms of inductive reasoning are justified by rational reflection. In a similar vein, Goodman (1965, p. 64) claims that all inference rules are justified by a sort of reflective equilibrium, "The process of justification is the delicate one of making mutual adjustments between rules and accepted inferences; and in the agreement achieved lies the only justification needed for either." Of course, Goodman's reflective equilibrium just is an example of employing explanatory reasoning of the sort that we are attempting to defend. White (2005) suggests something similar to Goodman. After arguing that explanatory considerations can be used to sort good and bad non-deductive inferences, White claims that inference to the best explanation may be justified by seeking reflective equilibrium with respect to our judgments concerning instances of non-deductive inference. We will discuss this sort of response below.

[10]For reasons in addition to those we discussed above see Enoch and Schechter (2008) for strong grounds for thinking that explanatory reasoning is a fundamental form of reasoning.

most explanatorily virtuous is likely to be true. Thus, one might attempt to meet the Truth Demand by making the plausible claim that explanatory reasoning is a fundamental form of reasoning, and it is justified through rational reflection.

Of course, one might question what justifies us in using rational reflection as a way of justifying forms of reasoning. According to our account of evidential support, *Explanationism*, this must be because the best explanation of the observations we make through rational reflection is that those observations are true. As a result, it seems that we may end up relying on explanatory reasoning in order to justify explanatory reasoning even if we go via the route of rational reflection. This is not necessarily a bad thing though.

This brings us to our second way of responding to the Truth Demand. We can plausibly maintain that the best explanation for why most of our inferences to the best explanation have been successful is that explanatory reasoning is a justifying form of reasoning. That is to say, we might appeal to explanatory reasoning as a way of justifying the claim that explanatory reasoning gets us to truth. We might express this in the following sort of way:

Argument IBE

1. Most of our observed instances of (good) IBE have true conclusions.
2. The best explanation of (1) is that explanatory virtues are positively correlated to the truth.
3. Therefore, explanatory virtues are positively correlated to the truth.

Of course, there are details concerning *Argument IBE* which could use further development, but for our purposes this sketch of our reasoning in response to the Truth Demand is sufficient.

At this point one might object that we are doing the very thing which Hume (1748/1975, p. 36) complained occurs when you try to justify induction inductively—we "must be evidently going in a circle, and taking that for granted, which is the very point in question." It is true that there is circularity here, however, it is not vicious. In order to appreciate this point it is important to distinguish two kinds of circularity: *premise* and *rule*.

Premise-circularity occurs when the conclusion of an argument occurs as one of the premises of that argument. Here is a blatant example of this sort of circularity:

1. Explanatory virtues are positively correlated with truth.
2. Therefore, explanatory virtues are positively correlated with truth.

Clearly, this sort of circularity is vicious because its conclusion is the same as its premise. The very thing that is trying to be established is accepted as a premise—the argument gives you no reason to accept the conclusion which you did not have prior to formulating the argument.

Things are different with rule-circularity. Rule-circularity occurs when the rule relied upon in the argument for moving from the premises to the conclusion is the very rule that is supported in the conclusion. This sort of circularity does not

seem to be vicious. The reason for this is that a rule-circular argument can give you reason to accept the conclusion that you did not have prior to formulating the argument. You can gain such reasons because in some cases, those involving fundamental methods of reasoning, you might reasonably employ a method of reasoning without explicitly endorsing that method as you would have to if it were a premise of your argument. This is a very important difference between premise-circular and rule-circular arguments. *Argument IBE* is rule-circular, but not premise-circular.

Quite plausibly, when we reach a fundamental method of reasoning it must be justified in a rule-circular fashion (Matheson 2012). By definition, a fundamental method of reasoning is one which cannot be reduced to or supported by some more fundamental method. After all, if the method in question can be reduced to, or supported by something more fundamental, then the method being reduced/supported is not fundamental. Hence, it is not surprising that explanatory reasoning is justified in a rule-circular fashion. Further, it seems like a perfectly legitimate way to justify this fundamental method of reasoning. After all, there is no more fundamental method of reasoning which we can appeal to in justifying explanatory reasoning—any attempt will end up employing explanatory reasoning, either explicitly or implicitly, at some point.

12.6.1 Residual Concerns

Before we set aside the Truth Demand and consider the challenge it presents to be overcome, there are two concerns that need to be addressed. The first concern is simply the question of why we cannot employ this sort of rule-circular response from the start—when responding to the challenge of inductive skepticism. As we noted above, this is something that several philosophers have attempted to do. Nevertheless, we have seen that the plausibility of this sort of response depends upon whether the principle of reasoning being defended is fundamental. We have considered good reasons for thinking that inductive reasoning, construed as distinct from explanatory reasoning, is not fundamental. Thus, it is doubtful that this sort of response can be successfully employed against the original challenge of inductive skepticism.

The second concern is that if rule-circular reasoning can support explanatory reasoning as it does in *Argument IBE*, then it can just as easily be employed to support clearly false principles of reasoning. The worry here is that it seems reading tea leaves or consulting one's horoscope or employing counter-induction (the rule that since all observed *A*s have been *B*, the next observed *A* will not be *B*) and other clearly poor ways of reasoning can also be defended in a rule-circular fashion. After all, one might point out that it seems the counter-inductivist can argue in the following fashion:

1. The previously observed instances of counter-induction have failed to lead to true conclusions.
2. Therefore, (by counter-induction) the next instance of counter-induction will lead to a true conclusion.[11]

Similar rule-circular defenses of other clearly poor methods of reasoning seem to be easily generated. Consequently, one might claim that it is trivial to point out that a method of reasoning can be supported by employing that very method of reasoning. Thus, one might worry that the sort of self-support which a rule-circular explanatory argument provides in support of explanatory reasoning fails to justify explanatory reasoning.

One thing to note immediately is that it is not a trivial matter that a self-supporting, rule-circular argument can be given for a particular method of reasoning. Consider the simple rule that calls for consulting tea leaves in order to determine how a particular unobserved situation will turn out. It is entirely possible that if one were to read tea leaves in order to determine whether tea leaf reading is a good way to reason, the result would be negative (Matheson 2012). The same applies to consulting the horoscope and numerous other flawed reasoning methods (Weintraub 1995). It is a live possibility that many of these methods of reasoning would fail to provide grounds for a rule-circular argument supporting their own reasonableness. So, it is not a trivial accomplishment that explanatory reasoning is self-supporting in the way that it is (Boghossian 2000).

Despite the fact that not all methods of reasoning can appeal to self-supporting rule-circular defenses of themselves, it is not enough to allay this concern by noting that explanatory reasoning's self-support is non-trivial. Fortunately, we have already noted a very important difference between explanatory reasoning and these other reasoning methods—explanatory reasoning is fundamental. In addition to the reasons we have adduced above for thinking that explanatory reasoning is fundamental there is a further reason to think explanatory reasoning is special in this way. Consider any of the other flawed methods of reasoning that we mentioned above. How would we determine whether that method is successful or not? Intuitively, in order to judge whether a method of reasoning is successful we would look at the observed instances when that method was employed and see what the results were. In cases where a particular method has been observed to yield true conclusions in the majority of the observed instances of its use we might reasonably conclude that the method is successful. That is to say, we might reasonably conclude that the method will be likely to lead us to true conclusions in future instances of its use. Of course, the means by which we are reasonably

[11] Salmon (1957) argues that if a rule-circular justification can be given for inductive reasoning, then it can be given for counter-induction too. Black (1958) argues that counter-induction cannot be supported in this way because counter-induction is actually internally inconsistent. We will not settle this issue here because there are other reasons for thinking that rule-circular reasoning is a viable way of supporting explanatory reasoning, but not illegitimate forms of reasoning like counter-induction.

concluding that the method is successful is by appealing to explanatory reasoning. We infer that the best explanation of the observed successes of the method is that it is the sort of method which is generally successful. So, we conclude that future uses of the method are likely to lead us to true conclusions too. Thus, in order to determine whether another method of reasoning is a successful method we will have to rely on explanatory reasoning.[12]

We now have a clear rationale for distinguishing between methods of reasoning that can be supported in a rule-circular fashion (such as explanatory reasoning) and those that cannot—the former are basic/fundamental methods of reasoning; the latter are not. If a method of reasoning is not fundamental then, if it can be supported at all, there will be some more basic method which supports it. However, if a reasoning method is fundamental, there is nothing more basic or fundamental which can be appealed to in order to justify it. To expect such a justification of a fundamental method of reasoning is to misunderstand what it means to be *fundamental*. Hence, it is not at all surprising that a rule-circular justification is required for fundamental methods of reasoning like explanatory reasoning. Once a fundamental method is reached there is nowhere else to look for justification than that method itself.[13]

Now, one might worry that while a rule-circular justification of explanatory reasoning is all that we can (or should) hope for because it is a fundamental method of reasoning, this will not satisfy the inductive skeptic. After all, the inductive skeptic doubts that it is reasonable to employ explanatory reasoning in the first place. Accordingly, utilizing the sort of reasoning being questioned by the skeptic will not assuage the skeptic's concerns.

The key to responding to this worry is to recall our distinction in Chap. 5 between justifying and being justified. It is true that a rule-circular defense of explanatory reasoning will not be dialectically satisfying to the skeptic. So, if we employ such a defense, we will fail in *justifying* our use of explanatory reasoning to the skeptic. Nevertheless, this does not mean that our use of explanatory reasoning fails to be *justified* in this rule-circular way (Boghossian 2000; Matheson 2012). It may very well be that if a skeptic does not grant that our most basic methods of reasoning are reasonable, we cannot persuade him otherwise. It is likely that if the skeptic refuses to acknowledge the reasonableness of our fundamental methods of reasoning, we cannot reason with him at all! This should not trouble us though. Without at least some common ground it is not possible to justify anything to the skeptic. That is not a problem for our fundamental methods of reasoning, but instead, it is a problem for the skeptic.

[12] Both Jones (1982) and Strawson (1952) emphasize this point in terms of inductive reasoning. However, as we have seen above, inductive reasoning is itself really a kind of explanatory reasoning.

[13] See Enoch and Schechter (2008), Feldman (2003), Feigl (1950), and Matheson (2012) for further discussion of fundamental methods of reasoning.

12.7 Conclusion

As we have seen, the challenge that inductive skepticism poses for our scientific knowledge has the potential to be quite threatening. Fortunately, we have also seen that the explanatory account that we have been developing throughout earlier chapters offers a compelling way of overcoming this challenge. Although there is much work to be done in spelling out the exact details of the amount of justification conferred upon claims via our inductive reasoning practices, and there are additional challenges to this sort of reasoning, we have reason to be optimistic with respect to our prospects for spelling out these details and meeting these challenges.[14] In light of this, our scientific knowledge seems secure despite challenges from inductive skepticism.

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[14] One of the more famous of these challenges is Goodman's (1965) "New Riddle of Induction". Essentially, Goodman's riddle poses the challenge of explaining why observations support what we typically assume rather than some strange hypothesis. Goodman makes this point by noting that it seems the fact that all observed emeralds are green supports thinking that all emeralds are *grue* (where "grue" means that the object is observed before a particular time and green, or observed after that time and blue) just as well as it supports thinking that all emeralds are green. This is yet another inductive challenge which can be met with explanatory reasoning. Very roughly, the reason that our normal hypotheses are supported by our observations rather than strange grue-like hypotheses is that the former are better explanations of our data than the latter. For more detailed discussion of the New Riddle of Induction and convincing arguments that the solution to the riddle lies in appealing to explanatory reasoning, see Hesse (1969), Lycan (1988), Ward (2012), and White (2005). Interestingly, Boyce (2014) argues that the New Riddle of Induction is logically equivalent to the purported paradox of ravens illuminated by Hempel (1945). Consequently, if Boyce is correct, then explanatory reasoning can solve this paradox as well. Even if they are not logically equivalent, it is plausible that explanatory reasoning offers a solution to Hempel's paradox of ravens too (Lycan 1988).

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