# THE PROBLEM OF INDUCTION:

# AN EPISTEMOLOGICAL AND METHODOLOGICAL RESPONSE

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## SUMMARY

My dissertation concerns the problem of induction, or rather, two related *problems* of induction. The first is what I call the *negative problem of induction*. This is the problem of rebutting the skeptical argument, first articulated by Hume, which purports to show that inductive inferences cannot in principle result in epistemically justified beliefs. A solution to this problem, i.e., a *negative justification* of induction, merely shows that the skeptical conclusion can be plausibly denied, specifically, that it is *possible* that induction results in epistemically justified beliefs. It does not show that this is *probable*, or that it is *reasonable* to rely on induction as a source of epistemically justified beliefs. This is the second or *positive problem of induction*. In this dissertation I develop solutions to both of these problems. In what follows, I briefly summarize each chapter and then say a few words about the philosophical significance of my results.

Chapter 1: The Problem of Induction

A successful response to the negative problem of induction must show either (a) that the skeptical argument is invalid, or (b) that it is unsound, i.e., that it relies on some premise that we can plausibly reject. In chapter one I outline the skeptical argument in such a way that it is both valid and, apparently at least, sound. I do not think it *is* sound, but it is important to pose a problem as forcefully as possible before attempting to solve it, lest one succeed only in knocking down a straw man. Indeed, if the skeptical argument did not seem at least *prima facie* sound to a great many people, including many of the learned, then there wouldn't be a philosophical *problem* of induction, for if any of the premises were obviously false then we could avoid the

skeptical result simply by rejecting that premise. The very fact that so many have grappled with the problem over the past centuries, and the fact that there is still no consensus on how to solve the problem,[1] should caution us against cavalier dismissals. If anyone thinks the skeptical problem easy to solve, odds are they haven't fully appreciated its force. In outline, here's the problem:

(SA1) 1. All inductive inferences require as a premise a contingent auxiliary assumption (AA).
2. A belief is inferentially justified only if belief in the premises is justified.
3. Therefore, a belief is inductively justified only if belief in the AA is justified. (1,2)
4. There is no way of justifying belief in the AA.
   a. All justification of belief is either inferential or noninferential.
   b. Belief in the AA cannot be noninferentially justified.
   c. Inferential justification is either deductive or inductive.
   d. Belief in the AA cannot be justified by deduction.
   e. Belief in the AA cannot be justified by induction.
   f. Therefore, the AA cannot be inferentially justified. (c,d,e)
   g. Therefore, the AA cannot be justified. (a,b,f)
5. Therefore, beliefs arrived at via inductive inferences are unjustified. (3,4)

Because SA1 is valid, if we are to resist the skeptical conclusion we must reject an independent premise. That means either (1), (2), or (4), but (2) is not controversial,[2] and in the subargument for (4), premises (a) and (c) are true by definition of terms, leaving us (1), (4.b), (4.d), and (4.e) as candidates for rejection. I argue, however, that each of these premises is at least *prima facie* plausible and that, therefore, it is not obvious where the fault in the argument lies.

With respect to premise (1) I argue that Hume is right in thinking that inductive inferences presuppose a contingent auxiliary assumption (AA), for if we don't make that assumption the premises are not even *relevant* to the conclusion. Against Hume, however, I

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[1] This is apparent from an examination of the literature, e.g., Salmon 1966, Skyrms 1975, Rescher 1980, and Howson 2000.

[2] Cf. BonJour 1986, p. 117: "it is obviously a necessary condition for inferential justification that the beliefs appealed to as premises be themselves *already* justified in some fashion."

argue that this assumption must be case-specific. Vague generalizations like Mill's Uniformity Principle do not suffice because we need an AA that indicates the relevance of the particular evidence in hand to the particular conclusion. I also argue, contrary to many interpreters, that the skeptical argument does not require these AA's to be *universal* generalizations, but only enough to underwrite the *probable* truth of the conclusion given the premises. This defuses a common objection that Hume simply begs the question by assuming that inductions need to be turned into valid deductions.

As for premise (4.b), I argue that on traditional foundationalist assumptions, the AA's on which induction depends do not qualify as candidates for properly basic beliefs, for they are neither self-evident, evident to the senses, nor incorrigible.

I argue that premise (4.d) is true in virtue of the nature of deduction as a non-ampliative mode of inference. In this vein, I have two subarguments:

(4.d.i)
1. Deduction can only draw out what is already in the premises.
2. Therefore, any deductive proof of the AA must assume premises that have at least as much content as the AA.
3. Therefore, the problem of justifying those premises must be at least as great as that of justifying the AA in the first place.
4. Therefore, deductive proofs of the AA at best postpone the problem and may also make it worse.

(4.d.ii)
1. The AA has to take us beyond the evidence because it serves to connect that evidence with an inductive conclusion that transcends the evidence.
2. Therefore, any deductive proof of the AA will require us to assume premises that go beyond the evidence.
3. Since deduction can never take us beyond the evidence, the truth of those premises cannot be established by deduction.
4. Therefore, deductive proofs of the AA are in principle *incomplete*.

Because the AA is contingently true if true at all, it is a substantive assumption about the world that by nature of its role has to go beyond the inductive evidence. Since deduction cannot validly

take us beyond the premises, therefore, it cannot in principle justify the AA without assuming premises that are at least as much in need of justification.

Finally, we come to premise (4.e). And here again it does not seem that we can supply a workable inductive justification of the AA.

(4.e.i)
1. All inductive inferences require as a premise a contingent auxiliary assumption (AA).
2. Therefore, any inductive justification of the AA must also presuppose an AA (AA').
3. AA' must either be the same as AA or different.
4. If AA' is the same as AA, then the argument is viciously circular; AA is being assumed in the course of proving AA.
5. If AA' is different from AA, then AA' itself stands in need of justification by a prior inductive inference that must also presuppose an AA (AA"). (1)
6. And so on. There results an infinite regress, unless the same AA recurs, at which point the argument becomes viciously circular.
7. Therefore, the AA cannot be justified by induction.

If premise (1) is correct, as already argued, then every inductive inference requires an AA, including any inductive arguments for the AA. But, as the argument above shows, this leads us into either vicious circularity or an infinite regress, neither of which is capable of providing the needed justification.

In sum, it seems that all the premises of SA1 are at least *prima facie* plausible.

## Chapter 2: Some Responses to the Problem

In the second chapter I critically examine several responses to the problem of induction. In classifying the responses I follow the handy catalog prepared by Nicholas Rescher.[3] He groups them under four main categories, which can be defined by the following 2×2 matrix:

| Induction . . . | Doesn't need to be justified | Needs to be justified |
|---|---|---|

[3] Rescher 1980, p. 187.

| | | |
|---|---|---|
| Can't be justified | I | |
| Can be justified | II | III |

The grayed out section represents the skeptical position. The other sections represent various ways of responding to the skeptical position. I critically examine representative examples in each of these categories and argue that neither the view that induction doesn't need to be justified (I-II) nor the major attempts so far to justify it (II-III) are adequate.

The main example of a type I response is the position of Karl Popper, who agrees that induction can't be justified, but isn't bothered by that because he doesn't think we need it anyway. The logic of science, he says, is strictly deductive. I point out several problems with this proposal, among which are that is does not square with the actual practice of science,[4] and that Popper's falsificationist methodology can work only if it tacitly smuggles induction in the back door.[5] So contrary to Popper, induction is not dispensable.

The main category II response is to invoke a reliabilist conception of justification.[6] In its simplest form, reliabilism is the view that epistemic justification is purely a function of the *de facto* reliability of the cognitive faculties and processes that give rise to our beliefs. Specifically, reliabilists argue that a person is inductively justified in a belief if the belief is formed via induction, the person is justified in believing the premises, and *in fact* induction reliably produces true beliefs given true premises.[7] Accordingly, if induction is in fact reliable, and reliability is sufficient for justification, we can justifiably infer inductively from "Most A's have been found to be B's" to "Most A's are B's" without invoking *as premises* any contingent

[4] Newton-Smith 1981, pp. 72-75.
[5] Newton-Smith 1981, pp. 61-63.
[6] See, for example, Goldman 1986, Van Cleve 1984, Papineau 1993, and Greco 2000a.
[7] Van Cleve, 1984, pp. 556, 559.

AA's.[8] Reliabilism thus rejects premise (1) of (SA1). Moreover, we can establish the reliability of induction inductively *without vicious circularity*:

> Most of the inductive inferences I have drawn in the past from true premises have had true conclusions.
> Hence, the majority of *all* inductive inferences with true premises have true conclusions.[9]

Thus, we don't need to be justified in believing that induction is reliable, but we can be.[10] While the above inductive argument for the reliability of induction employs an inductive inference rule (the so-called 'straight rule') to argue for the reliability of that very inference rule, such 'rule-circularity,' it is argued, is not vicious.[11] If it were, then we couldn't justify induction *or even deduction*. But we tolerate deductive proofs of deduction, so why not extend the same courtesy to induction?

I argue several points in response to this proposal. First, the claim that we couldn't justify deduction if rule-circularity were vicious is false. In the deductive case we can prove the validity of any given inference rule *without invoking the rule in question.*[12] Second, I argue that deduction and induction are not parallel cases, for inductive inference rules, unlike deductive ones, are invariably contingent. Third, the reliabilist rejection of premise (1) of SA1 is in fact correct, for AA's do not function *as premises*. Nevertheless, the skeptical argument can be easily reworked to avoid the problem by couching it in terms of inference rules rather than auxiliary

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[8] Greco 2000a, pp. 172-173.
[9] Van Cleve 1984, p. 557.
[10] Van Cleve 1984, p. 559.
[11] Van Cleve 1984, 558-560; Papineau 1993, 157-158. Van Cleve distinguishes 'rule-circularity' from 'premise-circularity'. Only the latter, he argues, is viciously circular.
[12] Howson 2000, pp. 27-29.

assumptions. Fourth, we can prove via Goodman's so-called 'new riddle of induction' that the straight rule is in fact unreliable,[13] unless additional substantive assumptions are invoked.

Category III responses target premise (4) of the skeptical argument. The responses are numerous and varied: (a) *categorical apriorism* (early Peirce, Stove, D. C. Williams) is the view that inductive inference *must work* based on strictly theoretical grounds; (b) *conditional apriorism* (late Peirce, Reichenbach) maintains that *if* anything can work, then induction can; (c) *probabilism* (middle Peirce, Carnap, Bayesianism) holds that the mathematical theory of probability can provide us with unambiguous assessments of the likelihoods of hypotheses in relation to a given body of evidence; (d) *inductivism* (Braithwaite, Black) says that induction can be justified inductively; and (e) *uniformitarianism* (Mill, Russell, Keynes) is the view that induction can be justified by postulating some broad metaphysical principle like the Uniformity of Nature. Without going into details, I argue that each response fails for the same basic reason: Every attempt to show that inductive inferences can yield epistemically justified beliefs must invoke substantive assumptions—assumptions that, it seems, would have to be inductively justified. Howson sums it up nicely:

> Let P be the conjunction of all factual statements known to be true. Suppose that the inference from P to a statement Q describing some event not known to be true is not deductive. . . . It follows immediately from the definition of deductive validity that in some subset W of all the possible worlds . . . P is true and Q is false. . . . [W]hat further information could be appealed to which would make it more likely that our world is not in W? . . . [T]he only information we have about this world that is known to be true is already in P. . . . All we know is that in our world Q may be true or it may be false. . . . Hence any principle claiming to justify the inference from P to the truth *or even the probable truth* of Q must beg the question.[14]

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[13] Howson 2000, pp. 30-31.
[14] Howson 2000, pp. 11-12.

This negative result may not be conclusive, however. In a classic work on problem solving, Polya remarks that when the direct approach to solving a problem doesn't work, one should try to come at it from a different angle.[15] Perhaps our conception of the problem tacitly conceals some erroneous assumptions. Accordingly, we should examine the terms of the problem. Thus in chapter three I take a step back to examine the nature of inference and the nature of epistemic justification.

Chapter 3: Inference in Perspective

In chapter three I examine the nature of inference and propose the following definition:

> (D3) An inference is a cognitive event in which one passes from a set of believed or supposed propositions (the premises) to belief in a proposition (the conclusion) because from one's cognitive perspective it consciously and clearly appears that the latter must be or is likely to be true if the former is.

Because this definition requires having a conscious perspective on the relation between premises and conclusion I call it an *internalist* definition of inference. Many philosophers, however, take for granted an *externalist* definition of inference according to which for a cognitive event to be inferential it is sufficient that it result in the formation of a belief *on the basis of* propositional input, where the basing relation is not thought to require having a conscious perspective on the relation between premise and conclusion.[16] I defend my internalist definition of inference by arguing that it is preferable *for the purpose of dealing with issues of inferential justification*, i.e., the epistemic justification of beliefs arrived at via inference. To substantiate this point, I develop an account of epistemic justification in terms of *adequate grounding* and *epistemic responsibility*

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[15] Polya 1957, pp. xvi-xvii, 108-109.

[16] Fumerton, for example, explicitly rejects an internalist definition of inference: "[E]ngaging in conscious consideration of some set of premises on the way to reaching a conclusion that is consciously thought of as following from those premises is not a necessary condition for the justification supporting that belief to be inferential" (Fumerton 1995, p. 39).

that plausibly captures, I believe, the core intuitions of both internalist and externalist theories of epistemic justification. One's grounding for a belief is the objective probability that the belief is formed and maintained in such a way as to be true. This reflects the externalist intuition that epistemic justification should have a *de facto* connection with truth. And one is epistemically responsible in believing to the extent that he exercises control over his epistemic resources in a manner that, as far as he can tell, is conducive to adequate grounding. This reflects the internalist intuition that epistemic justification is significantly dependent on one's conscious, first-person access to information.

Combining this account of epistemic justification with an internalist definition of inference leads to the following accounts of inferential and noninferential justification:

> The belief that *p* is *inferentially* justified for a person S iff (1) S's grounds[17] for believing *p* are in fact (a) adequate and (b) responsibly obtained, and (2) S has or has had[18] a conscious perspective on the adequacy of his grounds for believing *p*, in which perspective his grounds appear adequate.
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> The belief that *p* is *noninferentially* justified for a person S iff (1) S's grounds for believing *p* are in fact (a) adequate and (b) responsibly obtained, and (2) S has never had a conscious perspective on the adequacy of his grounds for believing *p*.

Because an internalist definition of inference is narrower than the usual externalist definition, it restricts the scope of inferential justification and expands the scope of noninferential justification. This opens additional space for a noninferential justification of the substantive

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[17] Grounds are anything that, in contributing to the formation and maintenance of a belief, contributes to its grounding, i.e., anything that significantly affects the objective probability that the belief is formed and maintained in such a way as to be true. This includes S's evidence for *p*, the reliability of S's cognitive faculties, and the methods or procedures by which S acquired his evidence.

[18] I say "has or has had" a conscious perspective to accommodate beliefs that were formed via an inference, and therefore have inferential justification, but for which we do not currently have a conscious perspective on the adequacy of their grounds. For example, I want to say that my belief in the Pythagorean Theorem is inferentially justified because I have worked through the mathematical proof, even though I do not currently have the proof in mind.

assumptions on which inductive inferences depends. In the light of this, I argue, it becomes plausible to deny premise (4.b) and to maintain instead that the substantive assumptions upon which inductive inference depends *can* be noninferentially justified. The plausible rejection of a key premise of the skeptical argument reveals the argument to be unsound and constitutes, therefore, a solution to the negative problem of induction.

What this solution to the negative problem shows is that it is *possible*, for all we know, that induction result in epistemically justified beliefs. This is definitely an encouraging result in the face of the skeptical challenge, but it does not suffice to underwrite our actual inductive practices. To do that we need to solve the *positive problem of induction*, which is to show that it is reasonable to rely on induction as a source of epistemically justified beliefs. A successful response to this constitutes a *positive justification* of induction. This is what I pursue in chapters four through six.

Chapter 4: Inference and Inquiry

In chapter four I argue that inferences essentially occur within the context of problem-solving inquiry—as inquiry is the search for answers to our questions, inference is a cognitive event whereby we arrive at an answer to a question on the basis of the information at our disposal. An examination of the structure of the problem-solving process reveals a correspondence between three stages of inquiry, three types of question, and three types of inference. Peirce called these types of inference abduction, induction, and deduction, but I call them explanatory, evaluative, and explicative inference, respectively, in order to emphasize the role they play in the process of inquiry. Roughly speaking, explanatory inference reasons from effect to a hypothetical cause, explicative inference reasons from a hypothesis to its consequences, and evaluative inference assesses the truth or falsity of a hypothesis by examining

the truth or falsity of its consequences. I argue that explicative inference is essentially deductive in character, while explanatory and evaluative inference are *distinct* types of inductive inference. A response to the positive problem of induction, therefore, needs to deal with both. Since inferences are essentially embedded within a process of inquiry and are defined by the role they play in that process, the positive problem of induction takes on a decidedly *methodological* character. That is, our reliance on explanatory and evaluative inference is positively justified if we can responsibly trust them to fulfill their role in the process of inquiry.

Chapters 5 and 6: Explanatory and Evaluative Inference

In chapters five and six I examine explanatory and evaluative inference, respectively, and argue that we are positively justified in relying on them as sources of epistemically justified answers to our questions. My basic strategy is as follows. First, I argue that in order for explanatory inference to get off the ground we have to accept what I call the *correspondence thesis*, that there exists a significant and fundamental correspondence between knower and known, between our cognitional makeup and the intelligible structure of reality. I argue that acceptance of this thesis is epistemically responsible because it is methodologically necessary—any attempt to responsibly pursue adequate grounding for our beliefs has to assume that reality is *knowable*, and knowable *by us*. Second, from the correspondence thesis I derive several important epistemological corollaries, among which are that our cognitive faculties are generally reliable when responsibly deployed and that responsibly obtained appearances are reliable guides to reality. Third, I employ Bayes' Theorem to express the logic of explanatory and evaluative inference in terms of probabilities. Fourth, I use the correspondence thesis and its corollaries to argue that we can make epistemically responsible estimations of those probabilities. It follows that we can responsibly rely on explanatory and evaluative inference as sources of epistemically

justified beliefs. Fifth and finally, I try to specify some general conditions under which both explanatory and evaluative inferences lead to epistemically justified beliefs. Thus concludes my response to the positive problem of induction.

The Philosophical Significance of These Results

As my advisor, John Greco, is fond of pointing out, analysis of skeptical arguments drives positive epistemology.[19] This is evidenced by the history of philosophy, where we see that the epistemological innovations of figures like Descartes, Kant, and Reid were driven in large measure by a concern to meet the challenge of skepticism. And it is evident in contemporary epistemology, where skeptical arguments play an important methodological role by providing test cases for epistemological positions. Given that we do have knowledge or justified belief in most of the cases in which we think we do, any adequate epistemology should be immune to wide-ranging skeptical arguments and should have the resources to show us where such skeptical arguments go wrong. If an epistemological position cannot do that then it is, at the very least, incomplete. And if it should lead to skepticism, then that is a decisive reason for rejecting it.

What makes the skeptical problem of induction an interesting problem is that it starts from assumptions that most everyone either accepts or finds plausible and constructs a valid argument for the utterly incredible conclusion that none of our inductively inferred beliefs amount to knowledge or are even so much as epistemically justified. If we are to reject the conclusion, then we must reject something in the argument. But as the premises seem plausible, it is not clear what we can plausibly reject—hence the problem. The problem, moreover, has

[19] Greco 2000a, p. 4. This claim is a corollary of the more basic truism that *problems drive positive inquiry*, in all areas, not just epistemology.

proven to be highly robust. Many inventive solutions have been proposed, but it seems that most if not all have failed under close scrutiny. Still, failed solutions can succeed indirectly by teaching us more about the problem and how to solve it. In this dissertation I have drawn together several ideas from others who have struggled with this problem. From Peirce and Rescher[20] I learned that methodological factors are relevant for epistemic justification. From Salmon[21] and Howson[22] I learned that Bayes' Theorem is a useful tool for modeling inductive inference. From Greco[23] I learned that any adequate response to skepticism has to adopt at least a partially externalist position on epistemic justification. And from Williams[24] I learned the importance of distinguishing clearly between the grounding and responsibility aspects of epistemic justification. I have combined these lessons, and others, in a way that, it seems to me, successfully rebuts the skeptical argument and exhibits the rationality of inductive reasoning more clearly, in some respects, than has been done before. Whether my proposal ultimately succeeds or not, time will tell. But even if it does not, I think a couple lessons can be learned that make a substantive contribution to the ongoing epistemological discussion.

First, discussions of the problem of induction rarely pause to consider the inferential / noninferential distinction. More often then not, it is simply *assumed* that the relevant conception of inference should be what I call an *externalist* one, according to which an inference is, roughly, any cognitive event that takes beliefs as input and generates beliefs as output. As my discussion in chapter three shows, it is far from obvious that this is the conception of inference that we ought to be working with in dealing with this problem. Instead, I argue that an *internalist*

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[20] Rescher 1980.
[21] Salmon 1966.
[22] Howson 2001.
[23] Greco 2000a.
[24] Williams 2001.

definition, according to which inference essentially involves having a conscious perspective on the relation of support between premises and conclusion, is the definition that we ought to work with. Even if I am wrong on that point, it is an issue that to my knowledge has not been seriously raised before and one that, as my solution to Fumerton's dilemma and my rebuttal to Hume show, has significant epistemological and antiskeptical ramifications.

Second, nearly all epistemological discussions of inference in general and inductive inference in particular overlook the pragmatic dimension of inference that Peirce noticed and emphasized,[25] and which I explore in chapter four. I argue there that inferences do not occur in a disinterested logical space, but are essentially embedded within a process of inquiry the aim of which is to solve epistemic problems, and more specifically, to answer questions. When we look at inferences from this angle, I contend, we arrive at a *three-fold* classification of inferences distinguished by the role they play in the process of inquiry in virtue of the type of question that they answer. This is significant for at least a couple reasons. The first is that if inferences have an essentially pragmatic dimension oriented toward the solution of *epistemic* problems, then methodological considerations are relevant to the inferential justification of belief. For in that case the practice of a sound methodology, of good problem-solving technique in the conduct of inquiry, just *is* the epistemically responsible thing to do. The second is that we discover two pragmatically distinct types of induction: explanatory inference and evaluative inference. Because they play different roles in a process of inquiry, different methodological issues arise in each case, which means that a complete solution to the positive problem of induction needs to address both. Most treatments of induction miss this distinction because they approach inference

[25] See Levi 1997 for details.

from a primarily or even exclusively formal perspective, in which case, as I point out, the distinction collapses. But the distinction is nonetheless epistemically relevant and thus highlights the need to look at not only the form of an inference but its function as well. If this is correct, then philosophers need to pay more attention to the pragmatics of inference.

References

BonJour, Laurence. 1986. "The Coherence Theory of Empirical Knowledge." In Moser 1986. Originally published in *Philosophical Studies* 30 (1976): 281-312.

Brunning, J., and P. Forster, eds. 1997. *The Rule of Reason*. Toronto: Univ. of Toronto Press.

French, P., T. Uehling, and H. Wettstein, eds. 1984. *Midwest Studies in Philosophy 9*. Minneapolis: Univ. of Minnesota Press.

Fumerton, Richard. 1995. *Metaepistemology and Skepticism*. Lanham, MD: Rowman & Littlefield.

Goldman, Alvin. 1986. *Epistemology and Cognition*. Cambridge, MA: Harvard Univ. Press.

Greco, John. 2000a. *Putting Skeptics in Their Place: The Nature of Skeptical Arguments and Their Role in Philosophical Inquiry*. Cambridge: Cambridge Univ. Press.

Howson, Colin. 2000. *Hume's Problem: Induction and the Justification of Belief*. Oxford: Clarendon Press.

Levi, Isaac. 1997. "Inference and Logic According to Peirce." In Brunning and Forster 1997, pp. 34–56.

Moser, Paul, ed. 1986. *Empirical Knowledge*. Totowa, NJ: Rowman and Littlefield.

Newton-Smith, W. H. 1981. *The Rationality of Science*. London: Routledge.

Papineau, David. 1993. *Philosophical Naturalism*. Oxford: Blackwell.

Polya, G. 1957. *How to Solve It: A New Aspect of Mathematical Method*. 2nd edition. Princeton, NJ: Princeton Univ. Press.

Rescher, Nicholas. 1980. *Induction*. Pittsburgh: Univ. of Pittsburgh Press.

Salmon, Wesley. 1966. *The Foundations of Scientific Inference*. Pittsburgh: Univ. of Pittsburgh Press.

Skyrms, Brian. 1975. *Choice and Chance*. 2nd edition. Encino, CA: Dickenson Publishing Co.

Van Cleve, James. 1984. "Reliability, Justification, and the Problem of Induction." In French, Uehling, and Wettstein 1984.

Williams, Michael. 2001. *Problems of Knowledge: A Critical Introduction to Epistemology*. Oxford: Oxford Univ. Press.