

# A TALE OF TWO EPISTEMOLOGIES?

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**Abstract:** So-called “traditional epistemology” and “Bayesian epistemology” share a word, but it may often seem that the enterprises hardly share a subject matter. They differ in their central concepts. They differ in their main concerns. They differ in their main theoretical moves. And they often differ in their methodology.

However, in the last decade or so, there have been a number of attempts to build bridges between the two epistemologies. Indeed, many would say that there is just one branch of philosophy here—epistemology. There is a common subject matter after all.

In this paper, we begin by playing the role of a “bad cop,” emphasizing many apparent points of disconnection, and even conflict, between the approaches to epistemology. We then switch role, playing a “good cop” who insists that the approaches are engaged in common projects after all. We look at various ways in which the gaps between them have been bridged, and we consider the prospects for bridging them further. We conclude that this is an exciting time for epistemology, as the two traditions can learn, and have started learning, from each other.

## 1 Introduction

So-called “traditional epistemology” and “Bayesian epistemology” share a word, but it may often seem that the enterprises hardly share a subject matter.

They differ in their central concepts. Traditional epistemology puts “knowledge” and “belief” at center stage, while Bayesian epistemology deals especially with “credences.” They differ in their main concerns. While traditional epistemology typically focuses on what we *humans* know and believe, or not, Bayesian epistemology’s poster child is an *ideally rational agent*. Traditional epistemologists’ preoccupations have included topics such as the sources and limits of knowledge, skepticism, Gettierology, internalism versus externalism, and so on; meanwhile, Bayesian epistemologists have busied themselves with constraints on rational credences, how

credences should be revised, whether they may be imprecise, and their role in decision-making. The two epistemologies differ in their main theoretical moves. Traditional epistemologists offer various forms of foundationalism, reliabilism, contextualism, subject-sensitive invariantism, virtue epistemology, naturalized epistemology, and feminist epistemology, while Bayesian epistemologists offer symmetry constraints, connections between credences and objective chances, connections between credences and future credences, convergence theorems, and so on. And the two camps often differ in their methodology. Traditional epistemology is typically conducted less formally than Bayesian epistemology—less mathematics, fewer symbols, fewer proofs.

However, in the last decade or so, there have been a number of attempts to build bridges between the two epistemologies. Indeed, many would say that there is just one branch of philosophy here—*epistemology*. There is a common subject matter after all.

In this paper, we will begin by playing the role of a “bad cop,” emphasizing many apparent points of disconnection, and even conflict, between the approaches to epistemology. If one focuses on them, one might think that traditional epistemology and Bayesian epistemology are as disparate as, say, metaphysics and ethics. We will then switch role, playing a “good cop” who insists that the approaches are engaged in common projects after all. We will look at various ways in which the gaps between them have been bridged, and we will consider the prospects for bridging them further. We will see that this is an exciting time for epistemology, as the two traditions can learn, and have started learning, from each other.

## 2 “Traditional” versus “Bayesian Epistemology”

First, let us get some caveats out of the way. We are well aware that “traditional epistemology” and “Bayesian epistemology” are each broad churches. I. J. Good (1971) counted 46,656 varieties of Bayesianism in his census, and many further varieties have sprung up since he wrote. There are fewer varieties of traditional epistemology; yet under the same rubric we find, for example, virtue epistemology and epistemic logic, which are hardly the most natural bedfellows. That said, there are a number of generalizations we can safely make that capture various trends on one side or the other. We will often qualify them with hedge words like “typically” or “mostly,” when doing so is not too tedious. But even when we don’t, take them as read.

Moreover, we will conduct our discussion at a rather high level of generality. This is not the place to detain ourselves with fine points of scholarship, or subtle distinctions between this or that philosopher’s view. It should be easy enough to recognize our attributions to one side or the other.

Until fairly recently, a rather large number of philosophers, and even some philosophy *departments*, did not recognize Bayesian “epistemology” as worthy of the name. And even today, you will find quite a few departments whose “epistemology” courses make no mention of the Bayesian approach. We might say that they are playing bad cops. And to be fair, there’s a lot to be said on their behalf. So let us turn to various ways in which the two epistemologies seem to have bifurcated.

### 3 Disparities in Central Concepts

#### 3.1 Psychological Reality Versus Idealization and Mutual Suspicion

“Belief” and “knowledge” are attitudes entirely familiar to folk psychology. Small children are completely comfortable with them. “Credence,” on the other hand, is a semi-technical notion, coined by Bayesians. Moreover, they struggle to analyze or explicate it (see [Eriksson and Hájek 2007](#)). Relatedly, traditional epistemologists—and children for that matter—think that we literally have beliefs and knowledge. This is not merely a *façon de parler*, or a useful model, or an idealization. However, many Bayesians don’t think that we literally have credences; rather, they are theoretical posits of an idealized model. To be sure, people have varying degrees of confidence in things. However, credences are supposed to be perfectly precise real numbers, whereas it seems our degrees of confidence are not. Some anti-Bayesians question the point of the idealization—if we want to play that game, why not idealize to an omniscient agent? Other anti-Bayesians maintain that we do not even understand the model. Meanwhile, some Bayesians claim not to understand talk of “belief.” Traditional epistemologists cannot understand this lack of understanding—if small children get it, how can it be so hard? Score a point to the bad cop.

So there is a divergence over claims about the psychological reality of the central concepts on each side. To be sure, some Bayesians relax their idealization, allowing imprecise credences. But this only highlights the discrepancy between the two epistemologies—for there is no comparable relaxation on the traditional side. Talk of “imprecise belief” or “imprecise knowledge” would make no sense.<sup>1</sup> Another point to the bad cop.

Proponents of each approach have accused the other side of trafficking in an inadequate or otiose notion. Regarding belief, Richard Jeffrey (1970) famously wrote, “I am inclined to think Ramsey sucked the marrow out of the ordinary notion [of belief]” (172), replacing it with the graded notion of subjective probability. Notice, though, Jeffrey’s tell-tale use of the words “I am inclined *to think*.” That sounds like an ungraded notion, synonymous with “*to believe*.” He was also skeptical, as it were, of the notion of *knowledge*, saying that “[t]he obvious move is to deny that the notion of

<sup>1</sup> Don’t confuse this with talk of imprecision in the *content* of an instance of belief of knowledge, which of course is perfectly parallel to imprecision in the *content* of a credence.

knowledge has the importance generally attributed to it” (Jeffrey 1992, 30). Yet he also was prepared to appeal to the notion.<sup>2</sup> This is entirely understandable: even a concept emptied of its marrow, or one whose importance is overrated, can still serve us—perhaps when we talk loosely, or to make a point succinctly. But it does remind us that no matter how firm one’s Bayesian commitments are, it is hard to renounce the traditional parlance altogether.

Going in the other direction, a number of traditional epistemologists are skeptical about credences (see Harman 1986, Pollock 2006, and Holton 2014). Horgan (2017) goes so far as to say that “‘Bayesian formal epistemology’ is relevantly similar to past disciplines like alchemy and phlogiston theory: it is not about any real phenomena.” (His target is what we are calling Bayesian epistemology.) Bayesians, however, might insist that if phlogiston theory had been half as successful as Bayesianism, we would still be teaching courses about it.

### 3.2 Representational Attitudes—Or Not

Arguably, belief and knowledge represent the world as being a certain way;<sup>3</sup> arguably, credences don’t. When you believe that St. Louis is in Missouri, you regard something to be the case. You thereby represent the world as being the St.-Louis-is-in-Missouri way. You similarly do so when you know that it is. However, when you assign a credence of 0.7 to it raining in St. Louis tomorrow, you do not do so—you do not thereby represent the world as being the 0.7-way with respect to rain in St. Louis tomorrow.<sup>4</sup> Expressivism seems tempting for credences in a way that it is not for beliefs.

The representational nature of belief is reflected in an ambiguity in the word “belief.” “Joe’s belief that  $p$ ” is ambiguous between two senses. It can denote (1) the content of one of Joe’s beliefs or (2) the attitude that Joe has toward the proposition that  $p$ . For example:

- (1) Joe’s belief that  $p$  is true. It is the content of that belief that is said to be true.

<sup>2</sup> For example: “Of course you need not have an exact judgmental probability for life on Mars, or for intelligent life there. Still, we *know* that any probabilities anyone might think acceptable for those two hypotheses ought to satisfy certain rules” (Jeffrey 2004, 2; our emphasis).

<sup>3</sup> However, the lottery and preface paradoxes put some pressure on this representational story about belief, since they involve inconsistent beliefs.

<sup>4</sup> To be sure, you may *believe* that there is a 0.7 chance of rain, and hence assign a credence of 0.7 (via the Principal Principle—more on that shortly); then you represent the world as being the 0.7-way with respect to rain. But you do so in virtue of your belief. And you may arrive at the 0.7 credence without any such belief—for example, by assigning 0.7 credence to the hypothesis that the chance of rain is 1, and 0.3 to its being 0. Then, the 0.7 credence is not itself a representation of how the world is; indeed, by your lights, the world is definitely *not* the 0.7-way.

- (2) Joe's belief that  $p$  is justified. It is a doxastic attitude of Joe's toward a certain proposition that is said to be justified.<sup>5</sup>

Curiously, in the phrase "justified true belief" that rolls so easily off the traditional epistemologist's tongue, there seems to be no single sense of belief (content versus attitude) that makes both of the adjectives appropriate.<sup>6</sup>

There is no such ambiguity in credence, nor could there be. "Degree of belief" refers unequivocally to an attitude, not the content of an attitude. When one has credence 0.7 in the proposition that  $p$ , one has a particular attitude toward  $p$ , and that's that.

### 3.3 Knowledge and Bayesianism

Turning to knowledge: knowledge is often said to be "justified, true belief" that meets some fourth "anti-luck" condition, such as safety or sensitivity. Bayesians seem to be unconcerned with these notions, at least at first blush.

- *Justification*: Bayesian epistemologists hardly speak of justification; rather, they are concerned primarily with *rationality*. To be sure, Bayesians do talk about *confirmation*, and Bayesian confirmation theory can be taken as a theory of degrees of evidential support, which sounds like a theory of degrees of justification, assuming something in line with evidentialism about justification.<sup>7</sup> But if Bayesian confirmation theorists think so and want to contribute to the literature on justification, they need to defend some version of evidentialism about justification, and reject its rivals such as reliabilism about justification. Very few have done so.
- *Truth*: At first, truth seems to play little or no role for Bayesian epistemologists, again concentrating on the orthogonal notion of rationality. To be sure, the notion of *accuracy* provides a connection: the accuracy of a credence is defined in terms of its distance from the truth. (See Joyce 1998; 2009.) But in a way this only brings out the disparity more: an intermediate credence can be more or less accurate, but it cannot be *true* (simpliciter), the way a belief can be true. This brings us to belief.
- *Belief*: There are obstacles to understanding belief in purely Bayesian terms. For example, various objections have been leveled at the simple Lockean Thesis that belief is credence above a threshold: among them, the thought that rational beliefs are closed under conjunction, while credence above a threshold is not; the seeming arbitrariness of where the threshold should be set; and the discomforting discontinuity that allegedly occurs at that threshold.

<sup>5</sup> Incidentally, the counterpart words in Mandarin for "belief" and "high confidence" behave the same way.

<sup>6</sup> Thanks here to Michael Titelbaum.

<sup>7</sup> Thanks here to Michael Titelbaum.

(Setting the threshold at 0.9, for example: Is there really such a significant difference in kind between a credence of 0.899 and one of 0.901?)

- *Anti-luck condition*: there has been far less interest in this on the Bayesian side of the tracks. Consider an important candidate for such a condition on your belief that  $p$ , *safety*: if you were to believe that  $p$ , it would not be false. Or consider sensitivity: if  $p$  were false, you would not believe it. Bayesians mostly seem not to be concerned with counterpart notions.

To summarize, traditional epistemology and Bayesian epistemology seem to cleave along at least two lines: psychological realism as opposed to idealization, and with their central concepts, belief as opposed to credence, justification/knowledge as opposed to rationality.

## 4 Disparities in Central Concerns and Viewpoints

The disparities in the central concepts of the two approaches to epistemology flow naturally to disparities in their central concerns.

### 4.1 The Sources of Knowledge

Traditional epistemologists are much exercised by the sources of knowledge: perception, testimony, introspection, reasoning, memory, and what have you. Importantly, they are all sources of knowledge *for us*. Bayesians hardly mention them. Instead, they typically take for granted that an agent receives some “evidence,” and conditionalizes on it, but they rarely interrogate its origins. It is a black box, which they typically symbolize “ $E$ ”; it might denote the contents of perception, testimony, or what have you, or it might not. They care rather more about evidential relations—notably, confirmation and disconfirmation. Meanwhile, to the extent that Bayesians mention an agent’s reasoning and memory at all, it is typically to assume that they are perfect.<sup>8</sup> That’s just part of the usual idealization.

The sources of knowledge lead us swiftly to . . .

### 4.2 The Limits of Knowledge

Williamson’s magnum opus in epistemology is entitled *Knowledge and Its Limits*. Imagine a Bayesian writing a book entitled *Credence and Its Limits*. The “limits” part of the book would be comparatively short. That’s true even of *Rational Credence and Its Limits*, which might be the more natural counterpart to Williamson’s book. To be sure, it seems that a rational agent

<sup>8</sup> But not always. Regarding memory loss, witness the large literature on the Sleeping Beauty problem, and some more general treatments, such as [Titelbaum 2013](#). Regarding reasoning, [Staffel \(2013\)](#) takes seriously both our limitations *and* the fact that much of our reasoning involves degrees of belief rather than outright beliefs.

cannot assign credences to all propositions, for cardinality reasons (for example, those akin to Kaplan's paradox<sup>9</sup>). But even restricting ourselves to a privileged set of propositions—perhaps those that are eligible to be the contents of thought<sup>10</sup>—a rational agent need not assign credences to all of them. Said more technically, the algebra in the probability space that represents her credences need not include all of them. But that is not so much because there are *limits* to which propositions she may assign credences—credence gaps or “blindspots” that must remain as such. While an agent may not be able to assign credences to everything at once, they may be indefinitely extensible: for any given proposition, her credence assignments may be extended to include it.<sup>11</sup> Or to the extent that there are such limits, they are rather more *recherché* than many of the putative limits of knowledge—perhaps non-measurable sets, and self-referential propositions such as “*p* and I assign low credence to *p*.”<sup>12</sup>

In any case, notice that if such propositions are credence gaps, they are immediately knowledge gaps. The limits of credence become limits of knowledge, but knowledge supposedly has many further limits.

Williamson's limits of knowledge stem from various related cognitive limitations—for example, one's mental states not being “luminous,” one's knowing things only within certain limits of precision, and the associated failures of the “KK” principle. And traditional epistemologists mostly take seriously the limitations of *human* agents, or at least agents very much like us. Again, Bayesian epistemology typically has no truck with these limitations.

### 4.3 Skepticism

This brings us to one of the most important—perhaps *the* most important concern—of traditional epistemology: skepticism. Various forms of skepticism are thought to be deeply unsettling. The spectre of skepticism about our knowledge of the external world still hangs over traditional epistemology—Descartes's evil demon, brains-in-vats, and all that. But Bayesians seem to be far less preoccupied by it. This is partly because, again, skepticism is supposed to be a problem *for us*, with the sources of knowledge that we take ourselves to have. Moreover, it is hard even to

<sup>9</sup> See Lewis 1986a for a statement of and response to this paradox.

<sup>10</sup> See Lewis 1986a.

<sup>11</sup> We are grateful to Yoav Isaacs for this point.

<sup>12</sup> Note that the book that we are imagining is not entitled *High Credence and Its Limits*. Of course there are some propositions that cannot rationally be assigned high credence—for example, contradictions. There are also more subtle ones—perhaps self-referential propositions again, such as “*p* and I have no credence in *p*” (see Egan and Elga 2005; Caie 2013; Cresto 2015 for further candidates) and “this sentence is improbable” (see Campbell-Moore 2015). But the issue here, rather, is whether there are certain propositions to which one cannot rationally assign a credence *at all*, low or high.

state skepticism about our knowledge of the external world in Bayesian terms, given its lack of engagement with knowledge.

Bayesians have been more engaged with another skeptical problem—the problem of induction. But that just pushes the problem back to Bayesianism’s perennial problem of the priors, which we think has not been solved. There seems to be no parallel to *that* on the traditional side of the tracks. Nor do we think that appeals to convergence theorems help. Hume challenged us to justify our belief *now* that the sun will rise tomorrow—not at the limit of an infinite enquiry, when the sun surely will *not* rise, having been extinguished long beforehand.

Moreover, a popular constraint on priors—so-called *regularity*—does more to exacerbate skeptical problems than to solve them.<sup>13</sup> A probability function is regular if it assigns probability 0 only to contradictions/impossibilities. So, far from ruling out evil demon and brain-in-vat hypotheses, regular credences dignify them with positive probability. Yet without any constraints on priors (beyond their obeying the probability calculus), Bayesianism is more friend than foe to skepticism, in stark contrast to the dominant attitude in traditional epistemology. After all, you can stay perfectly probabilistically coherent while assigning high credence to being the victim of an evil demon, or a brain in a vat. Subjective Bayesianism’s extreme permissiveness is anathema to the traditional epistemologist’s sensibilities. To be sure, objective Bayesianism is less permissive regarding priors, but it is hard to see how their favoured constraints—notably, the principle of indifference and its generalization to maximum entropy—could make any headway on Cartesian or brain-in-vat skepticism. In any event, we have not seen that case made.

#### 4.4 Gettierology

Gettier especially energized the industry of pointing out the failure of the “JTB” analysis of knowledge, and the quest to find the elusive “fourth condition.” It has been quite an industry. As we write these words, his classic paper has been cited around 3,000 times according to Google Scholar, but that substantially understates its influence. One need only drop Gettier’s name in a philosophical discussion, and we immediately understand the reference, with no need for citation.

Bayesian epistemology has hardly had any interest in Gettier cases. (Sarah Moss [2013] is a notable exception—so there’s one citation!) Still less has there been the huge industry of post-Gettier epicycles. This is related to our point earlier that the conditions for knowledge, especially the anti-luck condition, either are hard to formulate in Bayesian terms or have been given scant attention by Bayesians.

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<sup>13</sup> Thanks here to Yoaav Isaacs.

#### 4.5 The Roles of Knowledge and Belief

Knowledge and belief are supposed to play particular roles for which there seems to be no parallel on the Bayesian side. For example, according to Williamson (2000) and his followers, knowledge is the norm of *assertion*. However, those steeped in Bayesian epistemology rarely raise this issue. They might say—perhaps facetiously—that the norm of the speech act of assertion is the same norm that applies to any act: *maximize* expected utility! But usually they don't say anything at all here.

Or Hawthorne and Stanley (2008) offer the norm of practical rationality: “Treat the proposition that  $p$  as a reason for acting only if you know that  $p$ .” Bayesian epistemologists will reply—and not at all facetiously—that you should treat the proposition that  $p$  as a reason for acting only if doing so maximizes expected utility. Various philosophers have said related things about belief. For example, Williamson (2000): “one believes  $p$  outright when one is willing to use  $p$  as a premise in practical reasoning” (99). Fantl and McGrath (2010): if you believe that  $p$ , “then you are prepared to put  $p$  to work as a basis for what you do, believe, etc.” (143). Ross and Schroeder (2014): “believing that  $p$  defeasibly disposes the believer to treat  $p$  as true in her reasoning” (267–268). But recapping a point above, Bayesian epistemologists have said relatively little about our reasoning.

#### 4.6 Internalism versus Externalism

Traditional epistemologists lock horns over whether justification is determined solely by factors said to be *internal* to an agent, immediately accessible to her in some suitable sense. Bayesian epistemologists rarely talk about this, perhaps because they are almost universally internalists about rationality (to the extent that they think in those terms at all).

#### 4.7 “Knowing How” versus “Knowing That,” “Knowing Wh\_”

Recently on the traditional side there has been a revival of a discussion, going back to Ryle, about “knowing how”—in particular, is it just a kind of “knowing that,” or is it something else? Stanley and Williamson (2001) are proponents of the former view. There is nothing analogous on the Bayesian side—there is no such thing as “credence how.” Nor is there anything analogous to “knowing who,” “knowing what,” “knowing when,” and other “knowing wh\_’s,” the targets of Schaffer (2007).<sup>14</sup>

<sup>14</sup> Curiously, some of the counterpart “believe wh\_’s” are strained. “You know who the president is” sounds fine, but “you believe who the president is” does not. Likewise, “believe when,” “believe what,” and “believe whether” are discordant. And yet “certain when” and “certain what” are felicitous again. Even more curiously, “certain whether” seems infelicitous, yet “not certain whether” is fine:

☉ You are certain whether it will rain tomorrow.

☉ You are not certain whether it will rain tomorrow.

So much for central concerns in traditional epistemology that lack counterparts, or comparable attention, or corresponding treatment in Bayesian epistemology. Going the other way, Bayesian epistemologists have various concerns that find no parallels in traditional epistemology.

#### 4.8 Synchronic Norms on Credences

Bayesians regard probabilistic coherence to be the synchronic norm on credences, arguably the analogue of deductive consistency as a synchronic norm on beliefs. But we quickly find a divergence again. For example, does probabilistic coherence require merely finite additivity, or also countable additivity?<sup>15</sup>

#### 4.9 Arguments for Probabilism

Various arguments for probabilism have no traditional parallel—notably the Dutch book, calibration, and representation theorem arguments. One can't even *state* them without the degreed notion of credence.

#### 4.10 Accuracy

Accuracy arguments come closest to reflecting traditional epistemologists' interest in truth. But they have it easy: a belief is either true or not. How do we measure the accuracy of a credence, and then that of an entire credence function? By a proper scoring rule? By the Brier score? By some other measure? That's not so easy.

#### 4.11 Diachronic Norms on Credences

What are the diachronic norms on credences? We have conditionalization (or perhaps Jeffrey conditionalization) as the Bayesian staple. On the traditional side, the AGM model for belief revision is well known, although it has less of a hegemonic claim. (We suspect that comparatively few traditional epistemologists could even tell you exactly what the model is.) AGM theorists decompose the process of belief revision into two steps: (1) if newly acquired information is incompatible with the set of one's beliefs, retract some beliefs to ensure compatibility; (2) add to one's stock of beliefs the new information and their logical consequences. But Bayesians never talk about retracting or adding credences.

And without getting formal, the traditional side has seen some distinctly anti-Bayesian revision policies, starting with Descartes's claim to radically

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<sup>15</sup> Traditional epistemologists may be interested in an infinitary issue: Should the propositions that one believes be  $\omega$ -consistent? But this is no parallel to the Bayesians' interest in countable additivity as a putative norm on one's (probabilistic) attitudes to pairwise inconsistent propositions

suspend all his beliefs that are not clear and distinct. (See also [Harman 1986](#).)

#### 4.12 Imprecise Credences

Are imprecise credences rationally permitted, and perhaps even rationally required? This is one of the “hottest” topics in Bayesian epistemology these days. However, we noted earlier that one cannot make sense of imprecision in the attitudes of knowledge and belief. (One *can* make sense of the *absence* of those attitudes for various propositions, but that is something else.)

#### 4.13 Rational Decision-Making

How do credences enter into rational decision-making? Is the correct decision theory evidential, causal, or something else? (Still another “hot” topic on the Bayesian side!) Here we come to one of the most important differences between the two traditions. Decision theory is intimately intertwined with Bayesian epistemology, in a way that is strikingly absent in traditional epistemology. To be sure, we have mentioned Hawthorne and Stanley’s norm about reasons for acting; but we find on the traditional side nothing like the decision rule of “maximize expected utility,” a prescription for what one should do in every decision situation.

The differences run deeper still. At their heart, arguably, is the primacy, or otherwise, accorded to *preferences*, and derivatively from that, the action-guiding role of doxastic states. Traditional epistemology pays little heed to preferences; Bayesianism gives them a fundamental status and derives credences from them via representation theorems. And while the Bayesian’s favored term of approbation, “rational,” clearly applies to preferences, the traditionalist’s favored terms do not; it is a category mistake to call preferences “true,” and even calling them “justified” is a bit of a stretch.

### 5 Disparities in Theoretical Moves

The disparities in central concerns of the two approaches to epistemology flow naturally to disparities in their theoretical moves. On the traditional side, we have various forms of foundationalism, reliabilism, contextualism, subject-sensitive invariantism, virtue epistemology, naturalized epistemology, feminist epistemology, and so on.

Meanwhile, Bayesian epistemologists offer symmetry constraints (à la the Principle of Indifference), connections between credences and objective chances (à la the Principal Principle), connections between credences and future credences (à la the Reflection Principle), convergence theorems, and so on. To take just one of these, consider Bayesian epistemology’s preoccupation with objective chance—the literature on the Principal Principle and

its variants is huge (starting with Lewis 1980; see also Lewis 1986b). But from the traditionalist's vantage point, this may seem to be a rather odd fixation—why so much attention to *this* *recherché* kind of information? After all, we so rarely have it!<sup>16</sup>

## 6 Disparities in Methodology

A salient difference in methodology between the two camps is the extent to which they employ formal methods. Traditional epistemology is typically conducted discursively, in English prose (or that of other natural languages). Bayesianism, by contrast, is the bastion of *formal* epistemology. Bayesianism often imports results from mathematics, statistics, and logic. Traditional epistemology rarely does, and when it does, it is usually solely logic. Bayesians also employ causal graphs and results about them; we are not aware of traditional epistemologists doing so. More generally, Bayesian epistemology is inspired by science and practised in science; the same cannot be said of traditional epistemology to nearly the same extent.

Such is the case made by the “bad cop.” What about the “good cop”?

## 7 Looking for Bridges

Despite what has been presented above, there are bridges between the two epistemologies—existing bridges, bridges under construction, or bridges that need to be built. But where to find these bridges? A good way to proceed is to start with the common ground between the two sides. Both epistemologies are concerned with epistemic evaluations of doxastic states. So epistemologists in either party care about this issue:

What would make doxastic states “good” in one sense or another?

It is just that one party is concerned with a qualitative kind of doxastic state (belief), and the other with a quantitative kind (credence)—whether or not one of those two kinds is reducible to the other:

Traditional Epistemology	Bayesian Epistemology
What would make beliefs “good” in one sense or another?	What would make credences “good” in one sense or another?

Then we may proceed to refine this pair of issues in many different ways—as many as the senses in which beliefs or credences can be good. For example:

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<sup>16</sup> To be sure, the Principal Principle is a constraint on *conditional* credences. We need not *have* the information that the chance of some proposition is a particular value; it is just the condition of a conditional credence. But then the traditionalist may find odd the fixation on this *recherché* kind of condition. When was the last time you formed a conditional belief whose condition was a claim about a chance?

## Traditional Epistemology

Q1. What would make one's belief in  $p$  justified?

## Bayesian Epistemology

Q1'. What would make one's credence in  $p$  justified?

Next, we may look at how one of these two issues is addressed on its own side, and examine how the counterpart issue is addressed, or fails to be addressed, on the other side. As mentioned before, Q1 is a central issue in traditional epistemology, while Q1' has been largely ignored in Bayesian epistemology until very recently. But we can, and should, think about how the progress made on Q1 can be carried over to Q1'. The pair Q1 and Q1' will be just the first pair to be examined. To anticipate, we will choose (among many) ten ways in which beliefs or credences can be good, and discuss the corresponding ten pairs of issues:

## Traditional Epistemology

Q1. What would make one's belief in  $p$  justified?

Q2. Do beliefs aim at truth?

Q3. What would make a system of beliefs rational?

Q4. What would make one's belief in  $p$  rational?

Q5. What would make one's belief in  $p$  knowledge?

Q6. Which ways of changing beliefs in response to new information/evidence are rational?

Q7. Can we give a cogent argument that our belief in the existence of the external world is knowledge, justified, or rational?

Q8. Can we give a cogent argument that our beliefs in some general, scientific hypotheses are knowledge, justified, or rational?

## Bayesian Epistemology

Q1'. What would make one's credence in  $p$  justified?

Q2'. Do credences aim at accuracy?

Q3'. What would make a system of credences rational?

Q4'. What would make one's credence in  $p$  rational?

Q5'. What would make one's credence in  $p$  knowledge-like?

Q6'. Which ways of changing credences in response to new information/evidence are rational?

Q7'. Can we give a cogent argument that our (high) credence in the existence of the external world is knowledge-like, justified, or rational?

Q8'. Can we give a cogent argument that our (high) credences in some general, scientific hypotheses are knowledge-like, justified, or rational?

- Q9. Do some external or pragmatic factors partly determine what counts as justified belief, rational belief, or knowledge?
- Q10. What is the role of beliefs in rational decision-making?
- Q9'. Do some external or pragmatic factors partly determine what counts as justified credence, rational credence, or knowledge-like credence?
- Q10'. What is the role of credences in rational decision-making?

## 7.1 Justification

Question Q1—“what would make one’s belief in  $p$  justified?”—has occupied a central place in traditional epistemology, and there has been a huge literature on it. The counterpart question Q1’—“what would make one’s credence in  $p$  justified?”—is seldom discussed in Bayesian epistemology, recalling our point that Bayesians speak little about justification. That is a striking asymmetry. The good cop has some work to do.

This asymmetry might appear puzzling at first glance, for Bayesians are typically very interested in rationality, and it seems that rationality and justification must be closely connected in one way or another; perhaps they are even synonymous. For example, it sounds very odd to say of someone’s belief or credence in  $p$  that it is *justified and irrational*, whether or not this oddity is to be explained in terms of a simple necessary connection or something more complicated.

This asymmetry admits of a possible—but unfortunately only partial—explanation. Perhaps Bayesians are not so interested in the justification of an individual credence because they are actually not very interested in the rationality of an individual credence. Instead, they are more interested in the rationality of a *system* of credences. They would say that, if someone has credence 60% in  $p$  and credence 30% in not- $p$ , those two credences are jointly irrational (or incoherent). But is it the case that each of her credences in  $p$  and in not- $p$  is irrational? If only one of the two is irrational, which? Bayesians have shown a conspicuous lack of interest in such questions. More on this when we discuss questions Q4 and Q4’.

The above explanation is not entirely satisfactory because it is undeniable that Bayesians are at least interested in the rationality of a system of credences. So there is *prima facie* reason for them to be interested in the justification of a system of credences, given that justification and rationality must be closely related in one way or another.

That said, recently we have [Dunn \(2015\)](#) and [Tang \(2016\)](#) developing theories of justified credences by examining the process-reliabilist theory of justified beliefs and exploring its Bayesian counterpart. So a bridge might be established by examining what has been done on one side and developing a counterpart on the other side.

## 7.2 Truth/Accuracy

There is the issue of whether doxastic states aim at accurate representations of the world. This splits immediately into the following pair of issues:

Traditional Epistemology	Bayesian Epistemology
Q2. Do beliefs aim at truth?	Q2'. Do credences aim at accuracy? (Wait—how do we define degrees of accuracy for credences?)

Both issues have received much attention on their respective sides. Admittedly, the two sides have been developed in asymmetric ways. Traditional epistemologists tend to care about how we should interpret or understand the putative “aim,”<sup>17</sup> while Bayesians tend to care about how the two pillars of Bayesian epistemology—probabilism and conditionalization—could be established on the assumption that credences aim at accuracy (with an appropriate sense of aiming and accuracy).<sup>18</sup> But traditional epistemologists’ discussion about the proper interpretation of “aim” should be carried over to the Bayesian side, as has been happening recently.<sup>19</sup> Furthermore, the attempt to establish epistemic norms from the assumption that doxastic states aim at accurate representations should not be confined to the Bayesian side; in fact, it has recently been carried over to the traditional side ([Easwaran and Fitelson 2015](#)).

## 7.3 Rationality of a System of Doxastic Attitudes

Let us now consider questions concerning rationality.

Traditional Epistemology	Bayesian Epistemology
Q3. What would make a system of beliefs rational?	Q3'. What would make a system of credences rational?

This turns out to be where we find the closest connection between the two epistemologies—the good cop’s chief exhibit. The rationality of a system of credences is perhaps *the* central concern in Bayesian epistemology. Traditional epistemologists are also interested in the counterpart concern, although not taking it as so central. Their interest in the rationality of a system of beliefs is partly due to the Lottery Paradox and the Preface Paradox as potential challenges to the following thesis:

<sup>17</sup> See, for example, [Wedgwood 2002](#).

<sup>18</sup> See, for example, [Joyce 1998; 2009](#) and [Pettigrew 2016](#).

<sup>19</sup> See, for example, [Caie 2013](#), [Greaves 2013](#), [Carr Forthcoming](#), [Konek and Levinstein Forthcoming](#).

**Consistency Thesis of Rational Beliefs:** A system of beliefs is rational only if it is consistent.

The denial of this thesis is one of the solutions to these paradoxes; in fact, Kyburg (1961) devised the Lottery Paradox explicitly to defend the negation of the consistency thesis. But the paradoxes are challenges to developing a theory of rational (or coherent) systems of doxastic attitudes that include *both* beliefs and credences. They urge us to establish bridges between traditional epistemology and Bayesian epistemology. So, thanks to these paradoxes, the present pair of issues is where we can find the closest connection between the two epistemologies.

That said, we do not lack philosophers who want to dismiss this connection by ridding us of one of the two sides. When discussing Levi's (1967) solution to the lottery paradox, Jeffrey (1970) suggests eliminating the belief side altogether, leaving only the credence side, and exempting us from any need to build a bridge. We will revisit this at the tenth pair of issues, below.

#### 7.4 Rationality of an Individual Doxastic Attitude

Rationality can be attributed not just to a system of doxastic attitudes, but also to a single attitude. Hence, we have the following pair of issues:

Traditional Epistemology	Bayesian Epistemology
Q4. What would make one's belief in $p$ rational?	Q4'. What would make one's credence in $p$ rational?

Both sides are under-discussed in the literature, which seems surprising. Let us examine the Bayesian side first, and then turn to the traditional side.

It is surprising that Bayesian epistemologists' interest in the rationality of a system of credences has not inspired a comparable interest in the rationality of an individual credence—indeed, one might think that the rationality of a system depends, at least partly, on the rationality of the individual credences that constitute it.<sup>20</sup> It is remarkably hard to find a clearly formulated thesis in the Bayesian literature of the form: “one's credence in  $p$  is rational iff . . . ” Now, you might think that Bayesians are interested at least in the rationality of one's credence in an individual proposition in certain special circumstances. For example, you might think that Bayesians are interested in whether it is rationally required to have credence  $x$  in  $p$  if one is certain that the chance of  $p$  is  $x$ .<sup>21</sup> But Bayesians seem to be interested in a question about *wide-scope* irrationality: whether it is irrational simultaneously to have credence  $x$  in  $p$  and credence 1

<sup>20</sup> And even if it's the other way round, as a coherentist would have it, still one would expect to see some discussion of the rationality of individual credences.

<sup>21</sup> We thank Michael Titelbaum for bringing this possibility to our attention.

in the proposition that the chance of  $p$  is  $y$ . But when  $x$  and  $y$  are not identical, which of the two credences is irrational? Curiously, Bayesians have shown little interest in this. Moreover, Bayesians' concern with such chance-credence relations is driven by their concern with the Principal Principle, which at most is about the rationality of a very special kind of *conditional* credence: an agent's credence in  $p$  given that the chance of  $p$  is  $x$  (and perhaps given something more). This is not an *unconditional* credence in an individual proposition.<sup>22</sup>

Traditional epistemologists have been attentive to the epistemic virtues of an individual attitude, such as a belief that is justified or that counts as knowledge. But it is not clear why they seem not so attentive to the *rationality* of a belief. We have noted that it is odd to say of someone's belief in  $p$  that it is justified and irrational. If justification implies rationality, knowledge does, too (assuming that knowledge implies justification). So it is puzzling that rational beliefs do not receive the same attention as justified beliefs do from traditional epistemologists. Granted, an externalist about *knowledge* would deny its connection to rationality, if she is an internalist about *rationality*, holding that rationality is determined by factors internal to an agent. (Most Bayesians are at least tacitly internalists about the rationality of a system of credences, as we have indicated earlier.) But the thesis that knowledge implies rationality is debatable, and this only makes the rationality of an individual belief a more interesting topic. There is some literature in traditional epistemology on the connections from rationality to justification or to knowledge, but it is curiously small and recent.<sup>23</sup>

Given that neither side is well developed, it is little wonder that there is no bridge at the moment. Epistemologists on both sides: it's time to get to work!

## 7.5 Knowledge

We have mentioned traditional epistemologists' interest in knowledge. Bayesians do not have this interest to nearly the same extent. This might be because it is hard to find a Bayesian counterpart of knowledge. But let us borrow Moss's (2013) term "knowledge-like":

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<sup>22</sup> What we have just said also applies to Bayesians' interest in peer disagreement and higher-order evidence, except that the propositions to be conditionalized on are not about chances, but about peers' credences or such evidence.

<sup>23</sup> See, for example, Sutton 2005, Cohen and Comesaña Forthcoming, and Williamson Forthcoming. Lasonen-Aarnio (2010) proposes a case of unreasonable knowledge from the viewpoint of externalism about knowledge. In light of the above discussion, we want to ask whether a belief is unreasonable iff it is irrational. But, the more we think about this question, the more we think about the rationality of an individual belief.

Traditional Epistemology	Bayesian Epistemology
Q5. What would make one's belief in $p$ knowledge?	Q5'. What would make one's credence in $p$ knowledge-like? (Wait—what does it mean for a credence to be knowledge-like?)

Moss (2013; [Forthcoming](#)) uses examples from natural language to explain what it means for a credence to be knowledge-like.

A different approach to establishing a bridge here is to examine existing accounts of knowledge in traditional epistemology and to see if we can work out their Bayesian counterparts. Think about the two candidate necessary conditions for knowledge that we mentioned above:

**Safety:** If you were to believe that  $p$ , it would not be false.

**Sensitivity:** If  $p$  were false, you would not believe it.

It is not hard to guess the Bayesian counterparts of these two conditions:

**Safety':** If you were to have high credence in  $p$ , it would not be false.

**Sensitivity':** If  $p$  were false, you would not have high credence in it.

These are meant just to be first stabs, subject to refinements and variations.<sup>24</sup> We might also be inspired by this observation: given the graded nature of those candidate necessary conditions, a credence might be more or less knowledge-like, or even knowledge-like to a certain quantitative degree. A research program might thereby emerge.

This reiterates a point made earlier: a bridge might be established by examining what has been done on one side and developing a counterpart on the other side. (Are there research programs that proceed in the reverse direction, bringing ideas from Bayesian epistemology to traditional epistemology? Yes, as we will see at the question pair Q10 and Q10'.)

## 7.6 Revision of Doxastic States

Now turn to the revision of doxastic states:

Traditional Epistemology	Bayesian Epistemology
Q6. Which ways of changing beliefs in response to new information/evidence are rational?	Q6'. Which ways of changing credences in response to new information/evidence are rational?

Both sides are well discussed. The Bayesian side is centered around conditionalization, its add-ons, and/or its alternatives, while the traditional side is centered around the AGM theory of belief revision and its rivals (although belief revision theory was established mostly by, not traditional

<sup>24</sup> Cf. [Roush 2005](#) for how she develops a Bayesian counterpart of sensitivity.

epistemologists, but some formal epistemologists who are more sympathetic than Bayesians to the importance of the concept of beliefs in epistemology).

It is not just that both sides are well discussed. Attempts have been made to unify the two sides. If we are interested in the Lottery Paradox and how one's total system of beliefs *plus* credences can be rational, we should be equally interested in how one can have a coherent system of credence revision procedures *plus* belief revision procedures. Some answers have been proposed (Arló-Costa and Pedersen 2012; Leitgeb 2013; Lin and Kelly 2012). The right answer is by no means trivial, because there is a dynamic version of the Lottery Paradox that arises with just three tickets (Lin and Kelly 2012), while the original paradox arises only with a large number of tickets.

### 7.7 Skepticism

The Cartesian skeptic poses the following challenges to traditional and Bayesian epistemologists, respectively:

Traditional Epistemology	Bayesian Epistemology
Q7. Can we give a cogent argument that our belief in the existence of the external world is knowledge, justified, or rational?	Q7'. Can we give a cogent argument that our (high) credence in the existence of the external world is knowledge-like, justified, or rational?

As the bad cop noted earlier, responding to the Cartesian skeptic is of utmost concern in traditional epistemology, but it seems to have been of little interest to Bayesian epistemology. But note that the situation is reversed when it comes to the challenges from the inductive skeptic:

Traditional Epistemology	Bayesian Epistemology
Q8. Can we give a cogent argument that our beliefs in some general, scientific hypotheses are knowledge, justified, or rational?	Q8'. Can we give a cogent argument that our (high) credences in some general, scientific hypotheses are knowledge-like, justified, or rational?

A good part of Bayesian epistemology has been designed specifically in response to the inductive skeptic. One of the major versions of Bayesian epistemology—objective Bayesianism—was developed by Carnap (1945) as a first step toward a full-fledged response to inductive skepticism. Furthermore, the most significant application of Bayesian epistemology to actual scientific practice is Bayesian statistics, thanks to Savage (1954) and other statisticians, and it is meant to be a theory of how we can come to have rational high credences in some statistical hypotheses. In contrast, although

inductive skepticism does interest some traditional epistemologists, it is less taught in a traditional epistemology class than in a philosophy of science class.

Perhaps traditional epistemologists have in mind a division of labor. If this is justified, perhaps Bayesian epistemologists are equally justified in leaving the topic of Cartesian epistemology largely to traditional epistemology—with a promissory note to work out a Bayesian counterpart of the best response in traditional epistemology to the Cartesian skeptic.

## 7.8 Externalism and Pragmatic Encroachment

What factors should be taken into account when we epistemically evaluate doxastic states? More specifically:

Traditional Epistemology	Bayesian Epistemology
Q9. Do some external or pragmatic factors partly determine what counts as: justified belief, rational belief, or knowledge?	Q9'. Do some external or pragmatic factors partly determine what counts as: justified credence, rational credence, or knowledge-like credence?

The traditional side is well discussed, in the huge literature about externalism, and the rapidly growing literature about pragmatic encroachment.<sup>25</sup> The Bayesian side is far less discussed, but some initial steps have been taken. We already have some pragmatic factors encroaching on Bayesian epistemology: [Armendt \(2008\)](#) discusses whether rational credences depend partly on what is at stake, and [Clarke \(2013\)](#) and [Norby \(2015\)](#) argue that rational credences depend partly on the coarse-grained partitioning of possibilities that reflects what interests the agent. For a recent development of externalism in Bayesian epistemology, we have mentioned [Dunn's \(2015\)](#) and [Tang's \(2016\)](#) works on the process-reliabilist theory of justified credences. In general, we will be able to formulate an externalist theory in Bayesian epistemology whenever we have an externalist theory in traditional epistemology and work out its Bayesian counterpart.

## 7.9 Rational Decision-Making

Last but not the least, there is a meta-epistemological issue. Epistemology is concerned with, among other things, various epistemic evaluations of doxastic states (as exemplified by the above nine pairs of issues). But what is it to be in a doxastic state (rather than a bouletic, desire-like state)? What is it to have a belief in  $p$ ? What is it to have credence  $x$  in  $p$ ? These questions concern the natures of some subject matters of epistemology and, hence, belong to meta-epistemology, although they also belong to

<sup>25</sup> See, for example, [Weatherson 2005](#), [Fantl and McGrath 2010](#), [Ross and Schroeder 2014](#).

philosophy of mind. To clarify the nature of a mental state (if not to define it), we need to sort out its relations to other mental states—and we do not have to be functionalists to think so. This should not be surprising, for most philosophically interesting concepts, properties, attitudes, or states cannot be defined explicitly without circularity, but can be clarified only by stating their mutual relations. Many Bayesians would add that belief guides action and, hence, to clarify the nature of a doxastic state, we need to know at least the action-guiding roles that it could play, such as its normative relations to preferences about available courses of action, and to desires about possible outcomes in the future. That is, the nature of a doxastic state must be clarified at least in terms of the role that it could play in rational decision-making, or so many Bayesians think.<sup>26</sup> And apart from its bearing on doxastic states, rational decision-making is an important topic in its own right.

Hence we have the following issues:

Traditional Epistemology	Bayesian Epistemology
Q10. What is the role of knowledge/beliefs in rational decision-making?	Q10'. What is the role of credences in rational decision-making?

Bayesians have done a great deal on their side. In fact, their answer to Q10', Bayesian decision theory, has become so influential in the social sciences that it is *the* default theory that psychologists and economists seek to improve upon (Koehler and Harvey 2004). In light of this Bayesian success, some Bayesians (e.g., Jeffrey 1970) even challenge traditional epistemologists to work out plausible answers to Q10 and argue that, if they fail to do so, it is evidence that they do not know what they are talking about.

Is there a bridge between these two issues? Most people working on Q10, the traditional side, are almost forced to establish a bridge. Indeed, Bayesian decision theory is so influential that most people working on Q10 find a need to build their answers upon Bayesian decision theory, the default answer to Q10', in one way or another. For example, Harsanyi (1985), Weatherson (2005), Wedgwood (2012), and Ross and Schroeder (2014) all try to explain the nature of beliefs in terms of, among other things, their role in Bayesian decision-making. Although Lin (2013) gives an account of the role of beliefs in everyday, qualitative (and hence non-Bayesian) practical reasoning, he still emphasizes a virtue of qualitative practical reasoning from the Bayesian perspective. Such reasoning sometimes suffices for achieving the kind of ideal that Bayesian decision-making is meant to

<sup>26</sup> Those Bayesians might add that this is so even if we imagine someone who has beliefs but no preferences, like Eriksson and Hájek's monk (2007): the monk's beliefs must still be understood in terms of how they could play a role in rational decision-making *if he had* preferences.

achieve; it can sometimes serve as a manageable means for the Bayesian end.

It is worth mentioning that, although traditional epistemologists are typically not so interested in rational decision-making, there is an exceptional tradition that can be traced back to [Pascal \(1670 \[1948\]\)](#), with followers including [Levi \(1967\)](#) and [Rinard \(2015\)](#). They think that we need decision theory to address one of the most central questions in traditional epistemology: What propositions should one believe? It is also worth mentioning that, although decision theorists are typically not so interested in knowledge, [Isaacs \(2014\)](#) uses a knowledge-based probabilistic epistemology (i.e., one employing probabilities conditional on what an agent knows) to construct a decision theory suitable for deontological ethics.

## 8 Prospects for a More Unified Epistemology

So we have seen something of a *rapprochement*. Some of the primary concerns of traditional epistemology show up, after all, on the Bayesian side—they just appear under somewhat different guises. That said, we think that there is still more *rapproching* to be done. We have presented two approaches to epistemology, seen through the eyes of our two cops. One portrayed a rather dark picture of a disunified field; the other, a much lighter picture of a somewhat unified field, with the potential for yet more unification. Perhaps the overall picture is neither black nor white, but gray?

There are many shades of gray—at least fifty, apparently. We should all agree that the two epistemologies overlap to some degree. But to what degree (as a Bayesian might say)? Let's conclude by briefly reflecting on the extent to which the disparities between them are sociological contingencies, mere accidents of intellectual history.

We have emphasized traditional epistemology's focus on what we humans know and believe, contrasting with Bayesian epistemology's focus on ideally rational agents' credences. One can imagine their respective philosophical trajectories having been reversed—the former concentrating instead on the knowledge and beliefs of ideally rational agents,<sup>27</sup> the latter instead on human degrees of confidence. Then again, one might regard beliefs as computationally tractable doxastic states for cognitively limited agents such as ourselves, whereas credences require the mental capacity of more ideal agents (cf. [Harman 1986](#)). So perhaps it is not such an accident after all that our traditional and Bayesian forefathers took the paths that they did. That said, Bayesians' preoccupation with ideally rational agents does not mean that they do not share with traditionalists their ultimate concern with human beings. Some Bayesians, such as [Titelbaum \(2013\)](#), [Staffel \(2015\)](#), and [De Bona and Staffel \(Forthcoming\)](#), regard the standard

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<sup>27</sup> This is what belief revision theorists and epistemic logicians have done.

version of Bayesianism as a first approximation to a realistic normative theory, and they have been trying to make it more realistic.

Or consider Bayesian epistemology's spotlight on rational preferences and decision-making, contrasting with traditional epistemology's comparative lack of attention to them. Perhaps without towering figures like Ramsey, de Finetti, and Savage (and even Pascal before them) giving priority to the action-guiding role of credences, Bayesian epistemology could have gone rather differently. After all, one could plausibly maintain that the primary role of credences is to codify *uncertainty*—a purely *doxastic* state. To be sure, that uncertainty may be manifested in rational action, but it is arguably more fundamental. And it is also manifested in mental activities that need not have anything to do with action—notably, confirmation, and inductive inference (cf. Christensen 2004). Bayesian epistemology guides and is guided by science, and much science is purely theoretical rather than practical. While Bayesianism has been a very fruitful approach in philosophy of science, it would be strange to characterize the work of Copernicus, Newton, or Einstein in terms of their preferences and decisions.

Going in the other direction, traditional epistemology need not have waited until Williamson (2000), and other authors whom we have cited, for making contact with practical reasoning, nor Lin (2013) for a representation theorem for beliefs. It could have been far more engaged with rational decision-making from the outset. Philosophers of mind have seen the connection between belief and action for decades—indeed, various functionalists have long regarded it to be analytic.

Again, it is historically contingent that Bayesians have hardly opened their “black box,” *E*, of evidence. In fact, it is surprising, given how central a role evidence plays in their theorising. While they are typically highly permissive about priors, they are entirely rigid about their policy for updating on evidence—it's Bayes' rule or bust! Traditional epistemologists, by contrast, have long been investigating what's inside the black box: the deliverances of perception, testimony, introspection, reasoning, memory, and what have you. That work could easily have been done by Bayesians all along.

Their lack of engagement with the internalism/externalism debate is surprising for a related reason. After all, their “black box” is compatible with both internalist and externalist conceptions of evidence.<sup>28</sup> We see no good reason why Bayesians cannot probe the nature of evidence more, and they can draw on the vast literature of their traditionalist brethren. So the divergence in attention between the two epistemologies, to these and other topics associated with evidence, is of more sociological than philosophical interest.

The rationality of an individual credence or belief seems to represent the most interesting situation among our questions. Neither side has worked

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<sup>28</sup> Thanks here to Yoaav Isaacs.

much on this topic, and so there has been little learning from the other side yet. This seems to be another quirk of the way they happened to develop. We might wait for one side to generate a literature that the other side can learn from. But we propose a better development plan: let both sides sit together right away and discuss how they may have a joint project on the rationality of an individual *doxastic* attitude, be it a belief in a proposition, a credence in a proposition, or even a comparative attitude of taking one proposition to be more likely than another proposition.

So it goes. To the extent that the two approaches' research priorities and thematic differences have been somewhat historically contingent, they need not be entrenched. And to be sure, especially in the last decade, we have seen an increasing two-way traffic of philosophers crossing the tracks between the approaches. May this be a sign of things to come.

At the end of the day, despite some differences between so-called "traditional epistemology" and "Bayesian epistemology" that prompted our inner "bad cop," it seems that our "good cop" is on the right track. Perhaps the best way to describe the overall situation is that the one "epistemology" is *complementary* to the other; they are alternative approaches to a shared subject matter after all. It's little wonder, then, that they share the word.

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