# Why Subjectivism?

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**Abstract**. In response to two trenchant objections, radical subjective Bayesianism has been widely rejected. In this paper, I seek, if not to rehabilitate subjectivism, at least to show its critic what is attractive about the position. I argue that what is at stake in the subjectivism/anti-subjectivism debate is not, as is commonly thought, which norms of rationality are true, but rather, the conception of rationality that we adopt: there is an alternative approach to the widespread telic approach to rationality, which I call the poric approach, on which subjectivism is an attractive position. I then argue that the poric approach—and therefore subjectivism—cannot be easily dismissed.

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One would be hard-pressed to find a self-proclaimed radical subjective Bayesian (henceforth, *subjectivist*) today, and with good reason: the view suffers from serious problems. Critics of the position point out that, to the extent that it mandates particular forms of omniscience, it is too demanding; and to the extent that it mandates no more than that, it is not demanding enough. In light of these problems, subjectivism has been widely rejected.

In this paper, I seek, if not to rehabilitate subjectivism, at least to show its critic what is attractive about the position. But my strategy won't be to engage with the anti-subjectivist head-on. Rather, I highlight that many anti-subjectivists take a particular *telic* approach to rationality—one which might in principle be rejected. I then propose an alternative *poric* approach that one might adopt in its stead, and show not only that the serious problems with subjectivism lose their traction on this new account; but also that a strong argument for subjectivism emerges out of it. The dispute between subjectivism and anti-subjectivism is best seen, I conclude, as a dispute between telism and porism. And the dispute between telism and porism is not easy to resolve: there are some strong reasons for thinking that contemporary Bayesians do and should adopt a poric approach at least some of the time, and therefore that they should take subjectivism seriously.

The plan for the paper is as follows. I begin with a presentation of subjectivism and the two usual objections thereto (§1). I present the telic and the poric approaches, and show that the former is widely presupposed (§2). Then, I propose a poric argument for subjectivism (§3), and I show that

the two usual objections fail if it is accepted (§4–5). I conclude by examining the prospects for the telism/porism dispute (§6).

## 1.

The consideration at the heart of Bayesian epistemology is that beliefs come in degrees: agents may be more or less confident in the truth of any particular proposition.[1] The agent's degree of belief in a proposition is called their *credence* in that proposition, and their total epistemic state can be represented by a credence function $p : \mathcal{A} \to [0, 1]$, which assigns a credence to each element in the set $\mathcal{A}$ of all propositions the agent entertains. The formal structure of $\mathcal{A}$ is as follows. We begin with a non-empty set $\Omega$. We then construct $\mathcal{A}$ to be a Boolean algebra of $\Omega$, which is to say that it is a set of subsets of $\Omega$, such that $\Omega, \emptyset \in \mathcal{A}$, and $\mathcal{A}$ is closed under union and negation. I leave the question of how to precisely interpret these mathematical objects for later on. However I want to draw the attention of the reader to the distinction between the propositions we might call *trivial* ($\Omega$ and $\emptyset$), and those we might call *non-trivial* ($A_1, A_2, ...$). This distinction will turn out to be important.
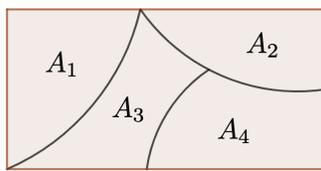


Much of Bayesian philosophical scholarship is organised around the question of which characteristic attributes, if any, rational credences have. Subjectivism is a particular view on the matter:

**Subjectivism**. There are two, and only two, characteristic attributes of rational credences:

*Probabilism*. A rational credence function $p$ is a probability function, that is, such that:
(a) *Trivial Omniscience*. $p(\Omega) = 1$ and $p(\emptyset) = 0$.
(b.) *Additivity*. $p(A_i \vee A_j) = p(A_i) + p(A_j)$ for all inconsistent propositions $A_i, A_j$.

*Conditionalisation*. A rational credence function $p$ upon having learnt evidential proposition $A_i^E$, and given previous credence function $p^-$, is such that:
(a) *Evidential Omniscience*. $p(A_i^E) = 1$ and $p(\neg A_i^E) = 0$.
(b) *Rigidity*. $p(A_j|A_i^E) = p^-(A_j|A_i^E)$ for all propositions $A_j$.

This way of presenting subjectivism highlights the fact that each of the assertions that compose it are made of one sub-assertion **(a)** we might call *substantive*, which concerns particular credences in particular propositions; and of another sub-assertion **(b)** we might call *formal*, which concerns the coherence of the entire credence function(s).[2] These can be organised in the table below.

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[1]  I use the term *Bayesian* in a broad way to pick out any theory or theorist concerned with agents' credences.
[2]  I call these sub-assertions *substantive* and *formal* because I think that these labels capture nicely the way in

|  | **Probabilism** | **Conditionalisation** |
|---|---|---|
| **(a) Substantive** | Trivial Omniscience | Evidential Omniscience |
| **(b) Formal** | Additivity | Rigidity |

In this paper, I shall be concerned solely with the substantive assertions of subjectivism, for two reasons. The first is that, as we shall see, they are the ones at stake in the dispute between subjectivists and their opponents. The second is that formal assertions require an altogether different treatment, different enough that it can be neatly treated separately. As a result, I leave the question of formal assertions for future work.

In light of this restriction, we can consider a restatement of subjectivism.

**Subjectivism**. A rational agent has two and only two characteristic attributes:

*Trivial omniscience.* $p(\Omega) = 1$ and $p(\emptyset) = 0$.

*Evidential omniscience.* $p(A_i^E) = 1$ and $p(\neg A_i^E) = 0$, for all evidential propositions $A_i^E$.

And this restricted claim may be restated in a different form once again:

**Subjectivism**.

*Necessity claim.* Rational agents are trivially and evidentially omniscient.

*Sufficiency claim.* Rational agents have no characteristic attributes beyond trivial and evidential omniscience.

Before getting to the evaluation of subjectivism, let us clarify the two types of omniscience mentioned. This clarification will require an interpretation of the distinction between trivial $(\Omega, \emptyset)$ and non-trivial $(A_i)$ propositions, and of the distinction between evidential $(A_i^E)$ and non-evidential $(A_i^{\neg E})$ propositions. Let us begin with the former. On what we might call the *orthodox* interpretations of the Bayesian formalism, the trivial/non-trivial distinction is interpreted such that (at least) all logical truths and falsehoods—tautologies and contradictions—are represented by trivial elements of the algebra.[3] Correspondingly, probabilism entails (at least) that rational agents have credence 1 in all logical truths and credence 0 in all logical falsehoods. Moreover, the evidential/non-evidential distinction is interpreted externalistically, such that an agent's evidential propositions express facts about the external world, and not merely their impressions of it.[4] So, conditionalisation entails that rational agents have credence 1 in those facts about the external world that constitute their evidence. In what follows, I will adopt this orthodox interpretation of the distinctions and, therefore, of both types of omniscience.

We are now in a position to see why subjectivism is so widely rejected: there are what seem to be decisive arguments against both the necessity and the sufficiency claims. Let us begin with the necessity

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which they differ, but nothing of substance hangs on this. If the reader rejects this characterisation of the distinction, they will (I hope) still accept the restriction of my concern to one of the disjuncts.

[3] The orthodox forms of Bayesianism function with what we might call a *modal* interpretation of the trivial/non-trivial distinction; where the modal domain varies—for some, it is logical modality that is relevant, for others it is metaphysical modality, etc. See Hájek (2012, ms); Easwaran (2014); Mahtani (2021).

[4] For an overview of the internalist/externalist debate about evidence, see Fratantonio (forthcoming).

claim. This claim is naturally read as mandating trivial and evidential omniscience. And in order to follow such a mandate, the argument goes, one must be in a position to recognise trivial and evidential propositions as such. But real human agents are not in a position to do this. Indeed, not only are there infinitely many logical truths, some of which very complex, but many are not determinable even in principle. So many human agents, when faced with a logical proposition, are not in a position to tell that they are. Furthermore, real human agents are not always in a position to recognise what evidence (externalistically conceived) they possess. For instance, an agent may not be able to tell whether the proposition expressing that they have hands is an evidential proposition for them. So many human agents, when faced with an evidential proposition, are not in a position to tell that they are. And if agents cannot always recognise trivial and evidential propositions as such, they cannot be omniscient in the ways mandated by subjectivism: this is the over-demandingness objection.

> *Over-demandingness objection.*
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> **1**. Rational agents are trivially and evidentially omniscient. (Necessity claim)
> **2**. Real agents must be able to follow norms of rationality.
> **3**. Real agents cannot be trivially and evidentially omniscient.
> **4**. So, the necessity claim is false.

In light of this objection, most have rejected the necessity claim interpreted orthodoxly.

And they have also rejected the sufficiency claim. In fact, this claim has been the target of the vast majority of anti-subjectivist criticism, to the point that the subjectivist/anti-subjectivist debate is often presented in those terms only. What the sufficiency claim seems to assert is that there is no substantive requirement of rationality beyond trivial and evidential omniscience; or in other words, that as long as agents are omniscient in those ways, they are rational. But surely that cannot be, the argument goes. Surely someone who has an extremely high credence that the sun will not rise tomorrow is irrational: to the extent that they ought to have accurate credences that are conducive to practical success, they are falling short. So, subjectivism is not sufficiently restrictive: this is the under-demandingness objection.

> *Under-demandingness objection.*
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> **1**. Rational agents have no characteristic attributes beyond trivial and evidential omniscience. (Sufficiency claim)
> **2**. Some further attributes are conducive to the alethic-practical aims of inquiry.
> **3**. So, the sufficiency claim is false.

This objection has turned out to be particularly potent in deterring people from subjectivism. Indeed, not only are there, to my knowledge, no contemporary defences of the sufficiency claim in print, but there are also reasons to believe that even the writers most strongly associated with subjectivism—Ramsey, de Finetti, and Jeffrey—rejected it. Thus Ramsey writes that probabilism "is obviously not enough; we want our [credences] to be consistent not merely with one another but also with the facts"

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(1926, 191). Jeffrey writes that, as far as the assignment of credences is concerned, his view is "often faulted as uncritical [...]; 'anything goes'. But the adoption of [credences] is a subject-matter dependent *techne*, an art of judgment [...]. Although [the expert agent] is far from knowing how [her mechanism for assigning credences] works, she can know *that* it works, pretty well" (1991, 11–12).[5] And even de Finetti recommends various "evaluations" of credence functions, including "degree of competence or care in forecasts [and] adaptation [...] to standard patterns of statistical theory and practice" (1970, 141).[6] For these three writers, being rational is more involved than subjectivism states: the sufficiency claim is false.

Given the strength of both the over- and under-demandingness objections, it comes as no surprise that subjectivism enjoys a low level of popularity. Thus, although subjectivism tends to be viewed as the default position in Bayesianism, this is not because it is widely accepted. Rather, I submit, it is because it is taken to be simple; and so it is discussed, not in the sense of being engaged with, but in the sense of being used to define putatively more plausible positions by contrast. My aim in this paper is to counter this trend, and to provide an argument *for* subjectivism. I will present a way of thinking about epistemology on which subjectivism is an appealing answer to the question of what characteristic attributes rational credence functions have. I will then show that the over-demandingness and the under-demandingness objections fail to have any grip on this way of thinking. Finally, I will take seriously the thought that it is in some sense bad if subjectivism is true, but will suggest that, in light of my argument, the prospects for escape are bleak.

## 2.

The two claims at the heart of the subjectivism/anti-subjectivism debate—the necessity and sufficiency claims—are both instances of a broader type: they are claims about the attributes of rational credences. And the interpretation of such claims will depend on the purpose and general philosophical outlook with which one makes them.

Often, contemporary Bayesians wonder about the rationality of credences in the context of decision-making; either individual practical rationality, or policy-making.[7] The (individual or policy-making) agent seeks to take the best decision possible, and for this reason needs the best (most rational, most accurate, most reliable) credences on the basis of which to take it. Other times, Bayesians wonder about the rationality of credences in the context of scientific research.[8] There, the scientist seeks an epistemic attitude towards the phenomenon at hand that is as adequate (rational, accurate, reliable) as possible. So in both of these closely related traditions, Bayesians are concerned with agents whose credences are supposed to play some alethic-practical function, and which can do that more or less well. Thus

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[5] So it turns out that Jeffrey rejects both the necessity and the sufficiency claim!

[6] For a history and critical discussion of the early subjectivists' commitments, see Galavotti (2011, 2016, 2018).

[7] Some prominent contemporary book-length works of Bayesian epistemology working explicitly in this framing include: Bradley (2017), Staffel (2019), Pettigrew (2016a, 2020a), Steele and Stefánsson (2021).

[8] For book-length examples, see for instance Howson and Urbach (2006) and Sprenger and Hartmann (2019).

the methodology of Bayesians working in this kind of way tends to work as follows. They compose a model of the agent whose decision is under study, which is intended to capture the epistemically relevant features of this agent.[9] According to orthodox forms of Bayesianism, this can be done by a single credence function. They then ask: what shape should this credence function have, given the function it is supposed to play? This characterisation of contemporary Bayesian methodology begins to give us an insight into what the appraisal or evaluation of credences might be on this approach. Credences are models of the epistemic states of particular (practical-rational, policy-making, scientific) agents, who are imagined to be at least possibly real people. These credences serve alethic-practical functions, and they can do so more or less well. Thus the question of which credences are rational, for these Bayesians, is the following one: which credences would be the best ones for this particular agent to have, given the function credences have? On this approach, the rationality of credences is a matter of their being related in the right way to the end, aim, or goal of inquiry. Thus we can call this approach *telic*.[10]

This telic approach to inquiry can be contrasted with another. On this other approach, we begin not with a particular agent in a particular alethic-practical situation, but with a more generic question about the capacities of human subjects to determine things about the world. The overarching question is that of how much subjects can come to ascertain or determine or find out. These terms have an absolute rather than degreed connotation however, and this is at odds with the Bayesian approach. Thus I urge the reader to understand them as including graded attitudes, and thus the question as possibly yielding answers such as: the subject can be somewhat confident, or very confident in a particular proposition; or can determine that the right credence to have in such a proposition is $1/2$, etc. To proceed with the question of which credences are rational on this approach, one studies the

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[9] Roussos (forthcoming).

[10] Despite the similarity of the label, this does not correspond to but is broader than what Berker (2013) calls *epistemic teleology*. He defines the view, which is more widely known as *epistemic consequentialism* (Jenkins, 2007; Littlejohn, 2012), thus: "there are certain epistemic *ends* or *goals* that it is epistemically good for us to promote, and the question of what we *should* believe is determined by how well our believing conduces toward the fulfilling of those goals, or the furthering of those ends" (340, emphasis original). It is clear that epistemic consequentialism is a telic position. However, there also exist telic positions besides epistemic consequentialism. Indeed, epistemic consequentialists make two assumptions beyond telism. The first concerns the nature of the aim of epistemic attitudes: epistemic consequentialists assume that this aim is truth or accuracy. But if, as many Bayesians do, we take seriously the fact that credences are also that which rationalises action, we might consider pragmatic goodness to be an aim of credence, too—as indeed the proponents of Dutch Book and decision theoretic arguments do (see immediately below). And the second concerns the nature of the relationship to the aim of inquiry. As Berker notes, "what is distinctive about [epistemic consequentialism] is not just its taking value to be fundamental but moreover its attitude toward the nature of value and how we should respond to it. According to the [epistemic consequentialist], the proper response to value is to bring it about, and the proper response to disvalue is to stop it from being brought about: in short, for the [consequentialist] all value is 'to be promoted' and all disvalue is 'to be prevented'" (343). But it is possible to imagine a position whereby justification is a matter of relating to the aim of inquiry (a telic position), but where this relation is not one of conduciveness or promoting. For instance, Sylvan (2018, 2020) argues that justification is a matter of *respecting* the truth. Thus epistemic consequentialism is one among several possible telic views.

ways in which subjects might come to ascertain things; that is, their means of inquiry. And one asks: Which such means do human subjects have, and how much do they afford us epistemically?[11] On this approach, the question of which credences are rational takes on a different interpretation. For to ask it is to ask: which epistemic state is warranted by our means of inquiry?—Which epistemic state can be arrived at, achieved on the basis of these means?—How much can the subject ascertain? Thus on this approach, the justification of credences is a matter of their being sufficiently warranted by the subject's means of inquiry. To reflect the prominence of epistemic means on this approach, I propose to call it *poric*, after the Greek πόρος, which refers to the means to one's ends.[12]

I have contrasted two approaches to epistemology, and thereby two ways of making sense of rationality:

> *The poric account.* An epistemic state is rational just in case it is warranted by the agent's means of inquiry.

> *The telic account.* An epistemic state is rational just in case it is related in the right way to the aim of inquiry.

Very different statements about the rationality of epistemic states are naturally made on each approach. For instance, on the poric approach, one might say: credence 1 in a particular proposition is rational because the agent has observed that this proposition is true. But on a telic approach, one might say: credence 1 in a particular proposition is rational because the agent would be guaranteed to lose money if they adopted a different credence. This hopefully gives the reader the beginning of a sense of each approach. But my sketches of them have only been cursory, lacking particularly in the details; and I have said nothing yet about the relation they bear to each other. The the next three sections will function, among other things, as an illustration and precisification of the two approaches, and their relation will be a core topic of §6.

Still, the characterisation of the telic approach given above already allows us to see that it is presupposed by all the major answers to the question of which credences are rational. The most popular types of arguments in Bayesian epistemology are given in the table below,[13] together with the applications of these argument-types to defences of probabilism and conditionalisation.

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[11] This approach has affinities with the "sources of knowledge" framing in the traditional epistemology literature. See Audi (2002) for an overview.

[12] The word also refers to a passageway, especially a passage over a body of water, such as a bridge; and derivatively, to a journey or crossing.

[13] For an overview and critical discussion of: Dutch Book arguments, see Pettigrew (2020b); accuracy dominance and expected accuracy arguments, see Pettigrew (2016a) and Pettigrew (2019); arguments for conditionalisation, see Pettigrew (2020c).

|  | **Probabilism** | **Conditionalisation** |
|---|---|---|
| **Dutch Book** | Ramsey (1926), de Finetti (1937) | Teller (1973), Lewis (1999) |
| **Accuracy Dominance** | Joyce (1998) | Briggs and Pettigrew (2020) |
| **Expected Accuracy** | Leitgeb and Pettigrew (2010a,b) | Greaves and Wallace (2006) |
| **Decision Theoretic** | Ramsey (1926), Savage (1954) | Savage (1954) |

These arguments share a common structure: **(1)** Take a putative criterion of rationality X. **(2)** Show that, if an agent's credences violate X, there is an alternative credence function that the agent could have had, which satisfies X, and which better fulfils some aim of inquiry. **(3)** Conclude that X is a characteristic attribute of rational credences.

For illustrative purposes, here is a brief characterisation of step **(2)** for each of the four arguments mentioned, applied to probabilism.

> *Dutch Book Argument.* Show that, if an agent fails to conform to probabilism, they will accept a series of bets such that they are guaranteed to lose money, no matter how the bets are resolved.
>
> *Accuracy Dominance Argument.* Show that, if an agent fails to conform to probabilism, there will be an alternative probabilistic credence function which is guaranteed to be more accurate, no matter how the world turns out to be.
>
> *Expected Accuracy Argument.* Show that, if an agent fails to conform to probabilism, they will fail to minimise the expected inaccuracy of their credences.
>
> *Decision Theoretic Argument.* Show that an agent's preferences over a set of outcomes satisfy particular constraints Y if and only if that agent can be represented as—among other things—having probabilistic credences; and then show that, if the agent does not satisfy constraints Y, things will go badly for them in some practical sense.[14]

This presentation of the arguments allows us to see just how widespread the telic approach is in contemporary Bayesian epistemology. For the step from **(2)** to **(3)** encodes an adherence to telism: all these arguments try to establish the criteria of rationality in question by showing that things would go badly for the agent—alethically or practically—were the agent to flout them.

Let us now circle back to the argument of this paper. As I announced earlier, I am going to argue that subjectivism is an appealing position on the poric approach (§3). I will then show that the over- and under-demandingness objections rely on telic assumptions (§4–5). But I will argue that the poric and the telic are not engaged in a verbal dispute, and that the telic cannot dismiss porist

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[14] For instance, all major representation theorems are such that among constraints $Y$ is the constraint that preferences be *acyclical*; that is, not such that $a \prec b \prec c \prec a$, where $\prec$ represents the preference relation and $a, b, c$ are outcomes. The reason given for such a constraint is the *money pump argument*, which goes like this: if $a \prec b$, the agent will pay to swap $a$ for $b$; if $b \prec c$, the agent will pay to swap $b$ for $c$; if $c \prec a$, the agent will pay to swap $c$ for $a$; and so on—the agent can be made to give out money indefinitely.

insights (§6). This poses a dual problem for the status quo. Firstly, if subjectivism is indeed false on the telic approach (that is, if widespread arguments to this effect are sound), and if we cannot do away with the poric approach on which it's true, we might be faced with the pressure to to abandon telism altogether. And secondly, we will have to grapple with the fact that subjectivism is, in many ways, a terrible predicament.

**3.**

Why then might one be taken by subjectivism? It is, I contend, an appealing answer to the question of which credences are rational, on the poric approach—or so I seek to show in this section. I begin by making two (contentious!) assumptions, which I will discuss and defend in §4 and §5 respectively:

>   *Dualism.* Agents have two means of inquiry: reason, and observation.

>   *Idealisation.* Agents have their means of inquiry perfectly.

According to the dualism assumption, agents have two distinct ways of inquiring into the world: they have reason, on the one hand, and observation (or experience, or sense-perception) on the other. And according to the idealisation assumption, they have these means of inquiry perfectly. What does that mean? Philosophers have long discussed how successful our means of inquiry might be. For instance, epistemologists of perception have discussed whether and how observation could be a source of rational beliefs about the external world; that is, whether and how our capacity to observe could warrant the belief that, for instance, the book I am holding is red, rather than just the belief that the book seems red to me.[15] Similarly, epistemologists of the *a priori* have debated whether and how reason could be a source of rational belief about non-empirical realms, such as the logical realm, the mathematical realm, the moral realm, and so on.[16] The idealisation assumption is designed to circumvent these challenges. It states (boldly!) that they have been answered, such that Bayesian agents are in a position to determine that the book really is red on the basis of observation, and that 2+2 really does equal 4 on the basis of reason.

Taken together, the dualism and idealisation assumptions entail that Bayesian agents have two properties. Firstly, they are *perfect reasoners*. They are always in a position to recognise any proposition that can in principle be settled by reason, that is, any proposition decidable *a priori*, and always in a position to be certain of such propositions. This may include logical propositions, mathematical propositions, metaphysical propositions, moral propositions, and so on, depending on one's views on those realms of thought. And secondly, they are *perfect observers*. They are always in a position to recognise any proposition that can be settled on the basis of their observations, and always in a position to be certain of these propositions. So, for agents with such properties, propositions come in three kinds. The first kind are the propositions determinable *a priori*, those whose truth-value their

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[15] This is a popular way of reading Cartesian doubts (Descartes, 1641). See Lyons (2017) for an overview of the contemporary literature on the epistemology of perception.

[16] See Russell (2014) for an overview of the literature.

capacity to reason suffices to settle. This leaves the propositions not decidable by reason alone, that is, the propositions determinable *a posteriori*, or empirical propositions. A further distinction between those is salient to our agent. On the one hand, there are the propositions they are in a position to settle on the basis of their observations; we can call those the propositions *about the observed.* And on the other, there are the propositions that their capacity to observe does not suffice to settle; we can call those the propositions *about the unobserved.*

The next step is to represent this agent with the help of the Bayesian formalism. How can we represent the *a priori*/*a posteriori* distinction? A very natural option is to use the trivial/non-trivial distinction. So, all propositions determinable *a priori* are represented by $\Omega$ or $\emptyset$ (depending on whether they are true or false), and all the propositions not so determinable are represented by the non-trivial elements $A_i$. Among those, we can further distinguish between $A_i^E$, the propositions about the observed, and $A_i^{\neg E}$, the other propositions, about the unobserved. We now find ourselves with an interpretation of the Bayesian algebra of entertained propositions. This interpretation has, I think, a distinctly Bayesian flavour. The $A_i$s are propositions that the agent might come to learn through empirical inquiry: propositions that might constitute, or come to constitute evidence—that might become $A_i^E$s. By contrast, the trivial propositions $\Omega$ and $\emptyset$ are those whose truth-value cannot be determined by looking in the world. Note that on this interpretation, trivial omniscience is not mere logical omniscience: it is omniscience about all *a priori* matters.

Now, onto the argument for subjectivism. Remember, subjectivism is the conjunction of the necessity claim, which says that rational agents are trivially and evidentially omniscient, and the sufficiency claim, which says that they have no further characteristic attributes.

**1**. Agents have the capacity the observe and the capacity to reason. (Dualism assumption)

**2**. Agents are always in a position to be certain of the truth-value of *a priori* propositions. (Idealisation assumption, 1.)

**3**. The *a priori* propositions are $\Omega$ and $\emptyset$. (Modelling assumption.)

**4**. Agents are always in a position to be certain that $\Omega$ is true and $\emptyset$ is false. (2, 3.)

**5**. Rational credences are such that $p(\Omega) = 1$ and $p(\emptyset) = 0$. (Porism, 4.)

**6**. Agents are always in a position to be certain of the truth-value of propositions about the observed. (Idealisation assumption, 1.)

**7**. The propositions about the observed are the $A_i^E$s. (Modelling assumption.)

**8**. Agents are always in a position to be certain that $A_i^E$ is true and $\neg A_i^E$ is false, for all $A_i^E$s. (6, 7.)

**9**. Rational credences are such that $p(A_i^E) = 1$ and $p(\neg A_i^E) = 0$, for all $A_i^E$s. (Porism, 8.)

**10**. *Necessity claim.* Rational agents are trivially and evidentially omniscient. (5, 9.)

**11**. Agents have no means of inquiry beyond reason and observation. (Dualism assumption.)

**12**. *Sufficiency claim.* Rational agents have no further characteristic attributes. (Porism, 11.)

**13**. *Subjectivism.* (10, 12.)

So why be a subjectivist? Because trivial and evidential omniscience, but nothing else, is warranted by Bayesian agents' means of inquiry. These agents' perfect capacities to reason and to observe warrant certainty in the *a priori* propositions, and in the propositions about the observed. But these capacities do not warrant any particular epistemic attitude towards the third kind of propositions under consideration: the propositions about the unobserved. As such, there is nothing that agents ought to believe about them.

We have made some progress towards subjectivism: we have an argument in favour of the position. But it remains to be shown that its proponent (along the poric lines above) can avoid the under- and over-demandingness objections, help themselves to the dualism and idealisation assumptions, and therefore embrace the necessity and the sufficiency claims. I will begin with the sufficiency claim, under-demandingness objection, and dualism assumption in §4; and move to the necessity claim, over-demandingness objection, and idealisation assumption in §5. In both cases, I will do the following. I will show that the telic should interpret the relevant claim in such a way that it is susceptible to the relevant objection. Then, I will argue that the poric is in a very different situation: their interpretation of the claim entails not only that the related objection is not pertinent to them, but also that they should accept the assumption on which the truth of the claim turns. It follows then that the widespread rejection of subjectivism makes sense in telic but not poric terms. This, given the widespread adoption of telism, both explains why the under- and over-demandingness objections have been so successful in persuading Bayesians away from subjectivism, and provides an impetus to take the position more seriously: to the extent that porism is attractive, we will need to reckon with subjectivism (§6).

**4**.

Let us begin with the sufficiency claim.

*Sufficiency claim.* Rational agents have no attributes beyond trivial and evidential omniscience.

The telic interprets this claim thus: no credal profile that satisfies trivial and evidential omniscience fulfils the aims of inquiry better than any other. Or in other words, all agents who are trivially and evidentially omniscient will fare equally well in relation to the alethic-practical goals of inquiry. But, many Bayesians have sought to show, some credal profiles *are* alethically and/or practically better than others. So, rationality makes demands beyond merely trivial and evidential omniscience. This is the under-demandingness objection:

*Under-demandingness objection.*

    **1**. Rational agents have no attributes beyond trivial and evidential omniscience. (Sufficiency claim)

    **2**. Some further attributes are conducive to the alethic-practical aims of inquiry.

**3**. So, the sufficiency claim is false.

There are three particularly popular ways in which Bayesians have sought to establish premise **2** of the under-demandingness objection. The first instantiation of the objection we can call *Moorean*.[17] It posits as highly plausible that an agent with e.g. a middling credence in an unknown coin's coming up heads is more rational—has credences more accurate and conducive to practical success—than an agent with a very different credal profile. Whatever philosophical consideration might push us away from endorsing this common-sense claim is surely less plausible than the claim itself. Or in the terms of the under-determination objection, premise **2** is simply more plausible than whatever grounds we have for premise **1**.[18] The second instantiation of the argument we can call *calibrationist*, for its positing of an additional aim for credences: that of being calibrated with frequencies (van Fraassen, 1983). The posit entails premise **2**: assuming that a coin lands heads with a frequency of $1/2$, there is a particular credence that best fulfils the calibration aim. And finally, the third instantiation of the under-determination objection we can call *risk-based*. It comes in two versions. Williamson (2010) argues that an agent with an extremely high credence that an unknown coin will land heads is, because of the constitutive relationship between credences and action, disposed to act in very risky ways; and that doing so goes against what it would be best for them to do. And Pettigrew (2016a,b) argues that an agent with a very high credence that an unknown coin will land heads takes an undue epistemic risk—they risk being very inaccurate.

At least one of these three versions of the under-determination objection, let us concede for now, is sound. And these versions are, as we have already seen, all telic in structure: they seek to establish (by appeal to the priority of common-sense, to the authority of frequencies, to the judiciousness of risk-aversion) that some credences are more conducive than others to the aims of inquiry. It follows that the telic Bayesian has good reason to reject the sufficiency claim: there are (substantive) norms of rationality beyond trivial and evidential omniscience. The under-demandingness objection, however, has no sway over the poric Bayesian. For the poric interprets the sufficiency claim as the claim that no particular credences are warranted beyond trivial and evidential omniscience. Again: porically interpreted, the sufficiency claim states that the agent's means of inquiry provide no reason to have any particular trivially and evidentially omniscient credal profile; that the agent can ascertain nothing about the non-trivial and non-evidential, the empirical unobserved. Interpreted this way, the sufficiency claim is a sceptical claim, of a familiar kind: it is an *inductive-sceptical* claim. And on this interpretation, it is no longer susceptible to the under-demandingness objection. For even if premise **2** can be established, it can be relevant to the sufficiency claim only in case the latter is telically interpreted.

The poric does not therefore fall prey to the under-demandingness objection. But it remains an open question whether they should endorse the sufficiency claim. Given the interpretation they make of

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[17] Moore (1939); Lycan (2001).

[18] This, I think, is how to interpret Jeffrey's claim cited above, that "although [the expert agent] is far from knowing how [her mechanism for assigning credences] works, she can know that it works, pretty well" (1991, 11–12).

it, this will depend on the agent's inquisitive capacities. Every Bayesian will agree that the agent has at least the capacity to observe and the capacity to reason: they can acquire evidence and ascertain some trivial propositions. But neither observation alone nor reason alone tells the agent anything about unobserved propositions. So, if the *dualism assumption*—the assumption that agents have exactly two means of inquiry—is true, then the under-demandingness objection has no grip on the poric Bayesian, and the sufficiency claim holds.

This prompts the evaluation of the dualism assumption. One might reject it in two ways. The first is to argue that there exist *additional* means of inquiry beyond observation and reason. An obvious candidate for such is testimony. Its orthodox treatment in the Bayesian literature is known as *supra-Bayesianism*.[19] On this view, possible testimonial reports feature among the propositions entertained by the agent, and upon receiving a particular report, the agent conditionalises on it. This amounts to treating testimony as a kind of evidence, acquired by observation: the observation of others' credences. So, on orthodoxy, testimony does not stand in tension with the dualism assumption. But even if one rejects supra-Bayesianism and treats testimony as an independent means of inquiry, one is unlikely to get very far. For if Bayesian epistemology applies to everyone—as it surely does if it applies to anyone—what we can come to know by testimony is limited to what others can come to know by observation. And many—most!—of the propositions of interest to an agent are unobserved not only by themselves, but by all agents. Indeed, many of the things that matter for an agent to know concern the future. This holds of course in the banal sense that agents' attachments reach into the future. But it holds also in the more fundamental sense that one's very capacity to act—to exert agency, to intentionally interact with the world—depends on assumptions about the (future) time at which the action will take place, that the world will be such that the action's effects would be such-and-such, etc. Thus the addition of testimony to an agent's means of inquiry might slightly narrow the scope of the sceptical claim, but it will leave in place the gap to the future. And what additional means of inquiry do agents have, which could directly bridge that gap?

This brings us to the second way to reject the dualism assumption: by arguing that observation and reason are not strictly separate means of inquiry, but can also be employed in combination to yield an *ampliative inference*. This is the path most taken to address inductive scepticism. The probabilistic version of this view is classically associated with Keynes, who writes: "Given the body of direct knowledge which constitutes our ultimate premises, [probability] theory tells us what further rational beliefs, certain or probable, can be derived by valid argument from our direct knowledge. This involves purely logical relations between the propositions which embody our direct knowledge and the propositions about which we seek indirect knowledge" (1921, 3). On such a view, observation yields certainty of the evidential propositions, and reason of the logical-probabilistic relation between the evidential propositions and the non-evidential ones. So taken together, observation and reason can warrant a particular degree of belief in a non-evidential proposition. The sufficiency claim is thereby false: our

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[19] The label comes from Keeney and Raiffa (1976). For a critique and alternative proposal, see Roussos (2021).

means of inquiry warrant particular credences about the empirical unobserved; they allow us to form rational credences beyond the trivial and the evidential realm.[20]

If this Keynesian strategy were to work—if agents could meld observation and reason to draw ampliative inferences about the unobserved—the poric would be forced to reject subjectivism. But this kind of strategy has been very unpopular in the history of Bayesian epistemology, all the way to Ramsey. He writes that the "fundamental criticism of Mr Keynes' views . . . is the obvious one that there really do not seem to be any such things as the probability relations he describes. . . . I do not perceive them, and if I am to be persuaded that they exist it must be by argument; moreover I shrewdly suspect that others do not perceive them either, because they are able to come to so very little agreement as to which of them relates any two propositions" (1926, 161). This problem was Ramsey's prompt for "attempt[ing] to treat the subject from a rather different point of view" (166); the "different point of view" being, we saw in §2, the telic one at the root of most subsequent Bayesian theorising. This leaves the poric in an undesirable predicament. Their commitment to the sufficiency claim hangs on the dualism assumption—on whether there are means of inquiry by which we can come to ascertain propositions about the unobserved. If there are, the sufficiency claim—and therefore subjectivism—is false. But the view is widespread that this is a hopeless enterprise: that if we are considering the means that agents have to ascertain propositions about the unobserved, we are not going to find them. The poric, qua subjectivist, is an inductive sceptic.

**5.**

Let us move on to the necessity claim.

*Necessity claim.* Rational agents are trivially and evidentially omniscient.

Since the telic's aim is to guide and/or evaluate the epistemic states of agents,[21] they must interpret this claim as a *norm* of rationality, a prescription to be *followed.* It must mean something like: agents ought to be trivially and evidentially omniscient. Moreover, since it is the epistemic states of potentially *real* agents (individuals, policy makers, scientists) that are to be guided and/or evaluated, a norm of rationality like the necessity claim must be a norm for real—and not idealised—agents. But as we have seen, real agents are not always in a position to follow such a norm. Hence the over-demandingness objection:

*Over-demandingness objection.*

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[20] There is some affinity between this Keynesian view and what is now known as *evidentialism* in the Bayesian context. White for instance insists that credences should "reflect" the evidence (2009, 171); this can be made sense of by imagining that there is a relation knowable to the agent between a body of evidence and a particular credence in a non-evidential proposition.

[21] Bradley seeks to construct a theory which "would provide *guidance* on how bounded agents should represent the uncertainty they face, how they should revise their opinions as a result of experience" (2017, xiii, emphasis added); Pettigrew wants to know "when it is appropriate to *criticize* an individual for their logical ignorance" (2021, 9993, emphasis added).

**1**. Rational agents are trivially and evidentially omniscient. (Necessity claim)

**2**. Real agents must be able to follow norms of rationality.

**3**. Real agents cannot be trivially and evidentially omniscient.

**4**. So, the necessity claim is false.

Because of the wealth of telic arguments for probabilism and conditionalisation, this objection has long bothered telics, often under the name of the *problem of logical omniscience.*[22] They have adopted various strategies to circumvent it,[23] but the view that the necessity claim in its telic, orthodox interpretation—that real human agents ought to be absolutely certain of all logical, metaphysical, or a priori matters, and of all their externalistically-conceived evidence—is universally rejected for its over-demandingness.

But the necessity claim's susceptibility to the over-demandingness objection depends on the assumption that it is a norm of rationality to be followed by real agents. This assumption, we have seen, is required by the telic project. But the poric project is rather different—different enough to require an interpretation of the necessity claim on which it is not affected by the over-demandingness objection. Indeed, since the poric is interested in what an agent's means of inquiry affords them, the claims they make about rationality, such as the necessity claim, are not best interpreted as norms for agents to follow, but rather as statements regarding how much agents are able to ascertain. So, since the necessity claim on the poric approach is not a demand, it cannot be plagued by the problem that what it demands of agents is too much. But another version of the over-demandingness objection looms. For if the porically interpreted necessity claim makes a descriptive claim about that which *real* agents are able to ascertain, it states that the means of inquiry that real agents have suffice to ascertain all logical/metaphysical/a priori propositions, and all externally-conceived propositions. It is then not quite over-*demanding*, but something like over-*estimating*. If the poric is to avoid this objection, they have to take some distance from real agents. Instead, they have to take the relevant agents to be those whose means of inquiry do warrant trivial and evidential certainty—that is, agents with *perfect* epistemic capacities. This is the *idealisation assumption* which featured in the poric argument for subjectivism; and on which, unsurprisingly, the truth of the necessity claim turns.

The evaluation of the idealisation assumption requires a sense of the poric project as a whole. The poric Bayesian is concerned with our means of inquiry—our epistemic capacities—and what they afford us (§2). More specifically, they are concerned with what our means of inquiry afford us in a particular domain—the domain of the empirical unobserved (§3). And furthermore, this concern is

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[22] Hacking (1967), Garber (1983). See Titelbaum (2022) and Lin (2022) for excellent overviews and discussions.

[23] The rejection of trivial omniscience has, because of a widespread reticence to abandoning probabilism, mostly happened by reinterpreting the trivial/non-trivial distinction in such a way as to undermine premise **3**. For example, Hacking (1967) and more recently Pettigrew (2021) have proposed reinterpretations on which trivial omniscience no longer entails logical omniscience. By contrast, the rejection of evidential omniscience has mostly taken place by rejecting conditionalisation. Jeffrey (1965) suggests moving to another updating norm, now known as *Jeffrey conditionalisation*, which preserves rigidity but not evidential omniscience. For other proposals, see Bronfman (2014), Schoenfield (2017), and Gallow (2019, forthcoming).

rather worrisome, for they find themselves in a sceptical predicament: there is nothing, their view entails, that the agent can determine about the empirical unobserved—that is, no particular epistemic state that the agent's means of inquiry warrants about this domain (§4). They reach this conclusion because of the general structure of their meta-epistemology. They begin from the agent's means of inquiry, and delineate domains by reference to that which those means of inquiry can help ascertain. So, the means of observation determines the domain of the observed, such that the domain of the observed is whatever can be found out by observation. Similarly, the means of reason determines the domain of the a priori, such that the domain of the a priori is whatever can be found out by reason. This naturally brings up the question of just how performant these means are; which is the same as to ask how large the resultant domains are. And, for the reasons rehearsed in the previous section, however performant these two means are, however large the conjunction of these domain is, is not enough: it leaves out of our reach a realm that is crucial to our constitution as agents—the empirical unobserved.

This is how to interpret the idealisation assumption on the poric approach. No matter how good our powers of observation are, no matter how successfully we can reason, we will never be able to determine what to believe about the unobserved. Even if we were perfect observers, always in a position to recognise any proposition that can be settled on the basis of our observations, and always in a position to be certain of these propositions, and even if our powers of observation afforded us reach not only of tables and chairs, but also of the microscopic and the distant and the mental; and even if we were perfect reasoners, always in a position to recognise any proposition that can in principle be settled by reason, and always in a position to be certain of such propositions, and even if our powers of reason extended to all of logic and of metaphysics and of god and the soul; even with such perfect means, we would not know whether to have a low or high credence in the sun's rising tomorrow. Thus the idealisation assumption strengthens rather than weakens the poric case for subjectivism: even the perfect observer, the prefect reasoner, would be plagued by inductive scepticism. It follows that the necessity claim—the claim that rational agents are trivially and evidentially omniscient—should be interpreted on this approach, not as a demand on agents or as an estimation of their capacities, but as a *concession*. By stating that agents have their capacities of inquiry perfectly, the poric theorist is conceding more to them than they in fact have. And if even agents who have their means of inquiry perfectly cannot have rational beliefs about the unobserved, agents who have them imperfectly certainly cannot.

**6**.

My primary aim in this paper has been to provide an answer to the titular question: why subjectivism? The answer I have provided is that, on the poric account of rationality, according to which epistemic states are rational to the extent that they are warranted by the agent's means of inquiry, subjectivism is an appealing view. But, alongside this, I have also tried, if not to vindicate, at least to countenance

widespread anti-subjectivist beliefs, by conceding that they might be appealing on the alternative (and widely assumed) telic account of rationality. It follows that the debate between subjectivists and anti-subjectivists is best seen, not as a debate about particular putative norms of rationality, but as a debate about which meta-epistemological approach—telic or poric—to adopt.

A natural reaction to this state of affairs would be to rule the telic/poric dispute—and therefore the subjectivist/anti-subjectivist dispute with it—as merely verbal. But I think we should resist this urge. For it is not implausible to read the telic and the poric as attempting to form an answer to a single question. Firstly, note that for both, epistemology is an aim-directed endeavour. This is obvious in the case of the telic, but also holds of the poric. Indeed, the poric mandate to adopt the epistemic states warranted by one's means of inquiry cannot even be formulated without presupposing the existence of an epistemic aim: what is warranted is what can be built *up* from the means—built that is, in the direction of the aim. (There is an interesting question, of course, about what it is that is to be achieved—whether the goal is alethic, or practical, or both—what shape it takes beyond this—but what matters here is a more abstract question about the structure of epistemic endeavours.) And secondly, note that achievement is a matter, not just of where one ends up, but also of what one started with. That the poric presupposes this is obvious, but the telic does too. Indeed the typical telic is not merely instructing agents to conform to the epistemic goal(s): they do not rule for instance that agents ought to have all and only true beliefs. Instead, they insist that agents ought to have the best beliefs that they could have, given their epistemic standing. In sum, the telic and the poric can plausibly be portrayed as trying to answer the same question: that of what agents can epistemically achieve on the basis of their means. And given that they are both trying to answer the same question, but that their responses differ, at most one of them can be right. This is why I think that a diagnosis of verbal dispute would be misguided.

To establish this properly, more work would need to be done to get a better grasp on the way the telic conceives of epistemic achievement. And if it is indeed the case that telism and porism stand in direct tension, this would cast doubt on the soundness of the telic arguments against the sufficiency claim in particular. But regardless, I think it is clear that contemporary Bayesians sometimes do adopt poric ways of thinking, and do take at least some of the the insights expressed therein seriously. As we have seen, the poric approach articulates the inductive question; that of what, if anything, agents can ascertain that is empirical and beyond the reach of their observations. And the sociological link between Bayesian epistemology and induction is very well established: the number of scholarly texts and syllabi attests to it. Furthermore, many Bayesians hold a principle that, I will show, can only be defended porically. This principle states that extremal credences in non-trivial non-evidential propositions—that is, in propositions about the unobserved—are irrational:

*Humility.* $p(A_i) \neq 1$ and $p(A_i) \neq 0$, for all $A_i \in \mathcal{A}$ such that $A_i \neq \Omega, \emptyset$, and $A_i \notin \mathcal{A}^E$.[24]

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[24] Humility is a weakening of a more familiar claim, *regularity*, which states that extremal credences in all non-trivial propositions are irrational. But as Hájek (2012) points out, regularity stands in tension with

Many arguments exist in the literature that would establish humility if successful. They have a common structure: they seek to show that an agent flouting humility would fail with regards to the alethic-practical aims of inquiry. (In other words, they are all telic arguments.) Williamson (2007) states that a non-humble agent would bet their life on the non-trivial non-evidential proposition at hand. Shimony (1955) argues that the agent would be liable to a loss, if the non-trivial non-evidential proposition they are certain of turns out false; but does not stand to gain anything, if it turns out true. Lewis (1980) remarks that this agent knows that they foreclose learning that the proposition is false: given (standard) conditionalisation, a proposition can only come to constitute evidence if it is antecedently assigned a non-zero credence. They all conclude that these agents are irrational.

But Hájek shows that these arguments fail. He writes: "an omniscient God who knows which world is actual, and so concentrates all credence on that world, [has the characteristics highlighted by Williamson, Shimony, and Lewis], and [is] none the worse for that!" (2012, 420).[25] The difference between this non-humble god and the non-humble mere mortal is, of course, that the latter's dual means of inquiry do not allow them to ascertain an empirical unobserved proposition, whereas the former's do. So, any argument that will concede non-humility to the god but not to the mortal must be poric. Indeed it is a poric consideration, along the lines that one should not believe beyond that which our inquiry warrants, that makes humility plausible in the first place. And Bayesian who finds humility plausible thereby adopts, at least in that instance, a poric approach. The difficulty is that porism seems to entail, not only that no extremal epistemic state in propositions about the unobserved is warranted (humility), but that no epistemic state at all, extremal or not, is (subjectivism). That is, it entails a very pessimistic answer—a sceptical answer—to the question of what one can epistemically achieve.

This leaves us in a difficult situation. The poric approach, which seems to have inductive-sceptical consequences, is at least occasionally taken on by Bayesians, for reasons that seem hard to reject. And it appears to clash with the dominant telic approach. This unstable situation—the cohabitation of two ways of thinking, not obviously overlapping, but also clearly not unrelated—might be the result of the complicated intellectual history of Bayesian thought. As must have struck the reader already, the poric approach has distinctly empiricist overtones. Thus Hume introduces his study of induction in the *Enquiry* by stating that "it may . . . be a subject worthy of curiosity, to enquire what is the nature of that evidence, which assures us of any real existence and matter of fact, beyond the present testimony of our senses, or the records of our memory" (IV.1.3). The telic approach by contrast has a pragmatist flavour. Ramsey, in his foundational paper, not only proposes the first telic arguments for probabilism, but offers the following definition of rationality: he maintains that we should interpret the question of whether "it is reasonable for a man to have such and such a degree of belief in a proposition" (193) as that of "What habits in a general sense would it be best for the human mind to have?" (194).[26] The

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conditionalisation, because it entails evidential omniscience. For this reason I proceed with humility rather than regularity.

[25] Hájek makes the point about Shimony's argument, but it extends to the others. This is because, as I argue, the Shimony's argument is susceptible to Hájek's objection in virtue of its telic character.

[26] For a sense of Ramsey's place in the pragmatist tradition, see Misak (2016).

relation between empiricist and pragmatist approaches to rationality is notoriously fraught, and the tension persists, I think, in Bayesian theory today, under the guise of the subjectivism/anti-subjectivism dispute.

**11th August 2022**

## References

Audi, R. (2002). The Sources of Knowledge. In P. K. Moser (Ed.), *The Oxford Handbook of Epistemology*, pp. 71–92. Oxford University Press.

Berker, S. (2013). Epistemic Teleology and the Separateness of Propositions. *Philosophical Review 122*(3), 337–393.

Bradley, R. (2017). *Decision Theory with a Human Face*. Cambridge University Press.

Briggs, R. A. and R. Pettigrew (2020). An Accuracy-Dominance Argument for Conditionalization. *Noûs 54*(1), 162–181.

Bronfman, A. (2014). Conditionalization and Not Knowing That One Knows. *Erkenntnis 79*(4), 871–892.

de Finetti, B. (1937). La Prévision: Ses Lois Logiques, Ses Sources Subjectives. *Annales de l'Institut Henri Poincaré 7*, 1–68.

de Finetti, B. (1970). Logical Foundations and Measurement of Subjective Probability. *Acta Psychologica 34*, 129–145.

Descartes, R. (1641/1993). *Meditations on First Philosophy*. D. A. Cress (Trans.). Hackett Publishing.

Easwaran, K. (2014). Regularity and Hyperreal Credences. *Philosophical Review 123*(1), 1–41.

Fratantonio, G. (forthcoming). Evidential Internalism and Evidential Externalism. In M. Lasonen-Aarnio and C. Littlejohn (Eds.), *The Routledge Handbook for The Philosophy of Evidence*. Routledge.

Galavotti, M. C. (2011). The Modern Epistemic Interpretations of Probability: Logicism and Subjectivism. In S. H. Dov M. Gabbay and J. Woods (Eds.), *Handbook of the History of Logic*, Volume 10, pp. 153–203.

Galavotti, M. C. (2016). The Origins of Probabilistic Epistemology. In A. Hájek and C. Hitchcock (Eds.), *The Oxford Handbook of Probability and Philosophy*. Oxford University Press.

Galavotti, M. C. (2018). Who is Afraid of Subjective Probability? In A. Giordani and C. de Florio (Eds.), *From Arithmetic to Metaphysics: A Path Through Philosophical Logic*, pp. 151–158. De Gruyter.

Gallow, J. D. (2019). Diachronic Dutch Books and Evidential Import. *Philosophy and Phenomenological Research 99*(1), 49–80.

Garber, D. (1983). Old Evidence and Logical Omniscience in Bayesian Confirmation Theory. In J. Earman (Ed.), *Testing Scientific Theories*, pp. 99–132. University of Minnesota Press.

Greaves, H. and D. Wallace (2006). Justifying Conditionalization: Conditionalization Maximizes Expected Epistemic Utility. *Mind 115*(459), 607–632.

Hacking, I. (1967). Slightly More Realistic Personal Probability. *Philosophy of Science 34*(4), 311–325.

Hájek, A. (2012). Is Strict Coherence Coherent? *Dialectica 66*(3), 411–424.

Hájek, A. (ms). Staying Regular.

Howson, C. and P. Urbach (2006). *Scientific Reasoning: The Bayesian Approach*. Open Court.

Hume, D. (1748/1998). *An Enquiry Concerning Human Understanding: A Critical Edition*. P. Millican (Ed.). Oxford University Press.

Jeffrey, R. C. (1965). *The Logic of Decision*. University of Chicago Press.

Jeffrey, R. C. (1991/1992). Radical Probabilism. In *Probability and the Art of Judgment*. Cambridge University Press.

Jenkins, C. (2007). Entitlement and Rationality. *Synthese 157*, 25–45.

Joyce, J. (1998). A Non-Pragmatic Vindication of Probabilism. *Philosophy of Science 65*(4), 575–603.

Keeney, R. L. and H. Raiffa (1976). *Decisions with Multiple Objectives: Preferences and Value Trade-Offs*. Wiley.

Keynes, J. M. (1921). *A Treatise on Probability*. Wildside Press.

Leitgeb, H. and R. Pettigrew (2010a). An Objective Justification of Bayesianism I: Measuring Inaccuracy. *Philosophy of Science 77*(2), 201–235.

Leitgeb, H. and R. Pettigrew (2010b). An Objective Justification of Bayesianism II: The Consequences of Minimizing Inaccuracy. *Philosophy of Science 77*(2), 236–272.

Lewis, D. K. (1980). A Subjectivist's Guide to Objective Chance. In R. C. Jeffrey (Ed.), *Studies in Inductive Logic and Probability*, pp. 83–132. University of California Press.

Lewis, D. K. (1999). Why Conditionalize? In *Papers in Metaphysics and Epistemology*, pp. 403–407. Cambridge University Press.

Lin, H. (2022). Bayesian Epistemology. In E. N. Zalta (Ed.), *Stanford Encyclopedia of Philosophy*.

Littlejohn, C. (2012). *Justification and the Truth-Connection*. Cambridge University Press.

Lycan, W. G. (2001). Moore Against the New Skeptics. *Philosophical Studies 103*, 35–53.

Lyons, J. (2017). Epistemological Problems of Perception. In E. N. Zalta (Ed.), *Stanford Encyclopedia of Philosophy*.

Mahtani, A. (2021). Dutch Book and Accuracy Theorems. *Proceedings of the Aristotelian Society 120*(3), 309–327.

Misak, C. (2016). *Cambridge Pragmatism*. Oxford University Press.

Moore, G. E. (1939). Proof of an External World. *Proceedings of the British Academy 25*, 273–300.

Pettigrew, R. (2016a). *Accuracy and the Laws of Credence*. Oxford University Press.

Pettigrew, R. (2016b). Accuracy, Risk, and the Principle of Indifference. *Philosophy and Phenomenological Research 92*(1), 35–59.

Pettigrew, R. (2019). Epistemic Utility Arguments for Probabilism. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy*.

Pettigrew, R. (2020a). *Choosing for Changing Selves*. Oxford University Press.

Pettigrew, R. (2020b). *Dutch Book Arguments*. Cambridge University Press.

Pettigrew, R. (2020c). What is Conditionalization, and Why Should We Do It? *Philosophical Studies 177*, 3427–3463.

Pettigrew, R. (2021). Logical Ignorance and Logical Learning. *Synthese 198*, 9991–10020.

Ramsey, F. P. (1926/1931). Truth and Probability. In *The Foundations of Mathematics*. Kegan Paul.

Roussos, J. (2021). Expert Deference as a Belief Revision Schema. *Synthese 199*, 3457–3484.

Roussos, J. (forth). Normative Formal Epistemology as Modelling. *British Journal for the Philosophy of Science*.

Russell, B. (2014). *A Priori* Justification and Knowledge. In E. N. Zalta (Ed.), *Stanford Encyclopedia of Philosophy*.

Savage, L. J. (1954). *The Foundations of Statistics*. Wiley.

Schoenfield, M. (2017). Conditionalization Does Not (in General) Maximize Expected Accuracy. *Mind 126*(504), 1155–1187.

Shimony, A. (1955). Coherence and the Axioms of Confirmation. *Journal of Symbolic Logic 1*(20), 1–28.

Sprenger, J. and S. Hartmann (2019). *Bayesian Philosophy of Science*. Oxford University Press.

Staffel, J. (2019). *Unsettled Thoughts: A Theory of Degrees of Rationality*. Oxford University Press.

Steele, K. and H. O. Stefánsson (2021). *Beyond Uncertainty*. Cambridge University Press.

Sylvan, K. (2018). Veritism Unswamped. *Mind 127*(506), 381–435.

Sylvan, K. (2020). An Epistemic Non-Consequentialism. *Philosophical Review 129*(1), 1–51.

Teller, P. (1973). Conditionalization and Observation. *Synthese 26*(2), 218–258.

Titelbaum, M. G. (2022). *Fundamentals of Bayesian Epistemology, Vols 1 and 2*. Oxford University Press.

van Fraassen, B. (1983). Calibration: A Frequency Justification for Personal Probability. In R. Cohen and L. Laudan (Eds.), *Physics, Philosophy, and Psychoanalysis*. Reidel.

White, R. (2009). Evidential Symmetry and Mushy Credence. *Oxford Studies in Epistemology 3*(1), 161–186.

Williamson, J. (2010). *In Defence of Objective Bayesianism*. Oxford University Press.

Williamson, T. (2007). How Probable Is an Infinite Sequence of Heads? *Analysis 67*(3), 173–180.