

Composing Composers

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Abstract

Suppose you believe on independent grounds that Verdi is Italian, Bizet is French, and Satie is French. To your surprise, you then learn that all three composers are compatriots. What should you believe? This case—Composers—has generated significant discussion. Some argue you should be *cautious* and become ambivalent as to whether all three composers are French or all three are Italian. Surprisingly, if that's right, Composers *wreaks epistemological anarchy*: a wide variety of epistemological principles turn out to be false. Those resistant to this anarchy instead argue you should be *bold* and conclude that all three composers are French. I endorse the anarchy. But I do so here in a unique way. Existing approaches to Composers side exclusively with either the cautious or bold reaction, ruling the other out as irrational. This is undesirable, as both reactions seem reasonable. I outline a new way to model—or should I say, 'compose'—Composers that captures this permissive element of the case.

Keywords

Rational Belief; Belief Revision; Composers; Epistemic Permissivism; Probability; Question Sensitivity

1 Introduction

Stalnaker (1994) outlines a fascinating case about belief revision: Composers.¹ This case concerns how your beliefs about the nationality of three composers should change on learning new information. What makes Composers so interesting is that, while it can seem perfectly rational to update these beliefs following a ‘cautious’ policy, if such a cautious approach is indeed rational, the consequences are dramatic: a wide range of influential theories and plausible principles about rational belief must all be false. In this sense, Composers threatens to *wreak epistemological anarchy*. Meanwhile, on a competing view the rational response in Composers is to update your beliefs according to a ‘bold’ policy. This view threatens no such anarchy. Much therefore turns on which of these policies are rational.

So far, existing approaches to Composers side exclusively with either the cautious or the bold policy, ruling the other out as irrational. However, this is undesirable: both the cautious and the bold reaction seem reasonable, and which one you’re inclined to prefer plausibly depends on how epistemically bold or cautious you are. Here, I’ll defend a new approach to Composers, building on a theory I proposed in (Pearson 2025), that vindicates this permissive judgement about the case. Of course, since on my view the cautious policy *is* rational (albeit not uniquely so), I endorse the ensuing epistemological anarchy. I’ll argue that this consequence is, on the whole, tolerable.

§2 introduces Composers, the cautious policy, and the resulting anarchy. §3 outlines the bold policy and, after offering some novel considerations that following it is the uniquely rational response, ultimately defends the view that the choice between the cautious and bold policies is permissive. §4 examines the incomparability models proposed by Lin (2019), arguing they cannot account for more complex variants of Composers. §5 presents my alternative approach, which allows for permissibility in Composers in a way that extends to these more complex variants. §6 defends the resulting anarchy and concludes.

¹Stalnaker cites a case about counterfactuals from Ginsberg (1986) as inspiration. Ginsberg, in turn, takes inspiration from a classic example from Quine (1950). However, note that Ginsberg’s examples are structurally analogous to earlier examples from Pollock (1981, p. 254).

2 Cautious Composers

Here's the case:

Composers. You justifiably believe (at time t_0) that Verdi is Italian, Bizet is French and Satie is French. These three beliefs are formed on equally strong, independent bases. You know for certain, for each composer, that they are either French or Italian. At t_1 , you learn that Verdi and Bizet are compatriots. At t_2 , you learn that all three composers are compatriots. (Stalnaker 1994, p. 19)

How should your beliefs change at t_1 and then t_2 ? It's uncontroversial what you should believe at t_1 . Contrary to what you believed at t_0 , you learn that Verdi and Bizet are compatriots. Since your initial bases for thinking that Verdi is Italian and Bizet is French were equally strong, you should suspend judgement on whether they are both Italian or both French. Your belief that Satie is French, formed on an independent basis, should remain intact.

But what about t_2 ? It is here that controversy arises. One common reaction is as follows.² At t_2 , you learn that all three composers are compatriots: they are either all Italian or all French. Can you believe they are all Italian? No. Initially you believed that Verdi is Italian and that Bizet and Satie are French, so to conclude they are all Italian would be to draw the odd conclusion that you were wrong about both Bizet and Satie but not Verdi. But you are also not in a position to conclude they are all French. While this situation is perhaps more likely than the one in which they are all Italian—it entails only that you were wrong about one composer (Verdi) rather than about two (Bizet and Satie)—it nevertheless seems that the possibility you were right about Verdi but wrong about both Bizet and Satie is one you should leave open. You should therefore suspend judgement at t_2 on whether they are all Italian or all French.

This reaction endorses the following pattern of belief revision:

CAUTIOUS At t_1 , suspend judgement on whether Verdi and Bizet are both Italian or both French, but continue to believe Satie is French. At

²Endorsed in (Stalnaker 1994) and (Schultheis 2018, Ch. 2) and taken by Lin (2019) and Goodman and Salow (2025) to be intuitively plausible.

t_2 , suspend judgement on whether all three composers are either all Italian or all French.

CAUTIOUS seems like a perfectly ordinary and innocent—perhaps even mundane—reaction to Composers.

Not so. If CAUTIOUS is rational, *epistemological anarchy* ensues! Consider first a central tenet of (Alchourrón, Gärdenfors, and Makinson 1985) and (Leitgeb 2014):³

PRESERVATION If you both rationally believe q and rationally leave p open (i.e. you rationally do not believe not- p), then you would still be rational in believing q were you to learn p as total information.

PRESERVATION cannot be true if CAUTIOUS is rational. If CAUTIOUS is rational, then at t_1 you rationally believe Satie is French and rationally leave it open that both Verdi and Bizet are French. You therefore rationally leave it open that all three composers are French and thereby compatriots. So, upon learning at t_2 that all three *are* compatriots, PRESERVATION recommends, contra CAUTIOUS, maintaining your belief that Satie is French.

It gets worse. Consider the following weakening of PRESERVATION:⁴

ANTICIPATION If it would be rational to stop believing q were you to learn that p as total information, and it would be rational to stop believing q were you to learn not- p as total information, it cannot *now* be rational to believe q .

ANTICIPATION is extremely plausible. Yet, as Ginger Schultheis has observed,⁵ it cannot be right if CAUTIOUS is rational. Consider an alternative case:

³See (Goodman and Salow 2025), (Salow 2025) and (Pearson 2025) for recent discussion. These authors sometimes state PRESERVATION in terms ‘justified’ rather than ‘rational’ belief. This is a mere terminological choice that none of these authors place weight on. For convenience, I’ll stick to the ‘rational’ terminology.

⁴See (Pearson 2025) for in-depth discussion of ANTICIPATION. ANTICIPATION is called ‘Negation Rationality’ by (Kraus, Lehmann, and Magidor 1990) and (Freund and Lehmann 1996). Goodman and Salow (2025) discuss a generalization called ‘TI-’.

⁵See (Goodman and Salow 2025, §4), who credit the observation to Schultheis via personal communication.

Composers*. Exactly the same as Composers at t_0 and t_1 . However, at t_2 , instead of learning that all three are compatriots, you learn that Satie is *not* compatriots with Verdi and Bizet.

In this alternative case at t_2 , either Verdi and Bizet are both Italian and Satie is French—meaning you were wrong only about Bizet—or Verdi and Bizet are both French and Satie is Italian—meaning you were wrong about both Verdi and Satie but not Bizet. This trade-off between possibilities in which you were either wrong about just one composer or exactly two also occurred in the original case. There, the CAUTIOUS judgement was that you shouldn't rule out being wrong about two. So, this should be the CAUTIOUS judgement in Composers*, too. That is, at t_2 , you should leave it open that Verdi and Bizet are both French and Satie is Italian, meaning you should give up your belief that Satie is French.

It follows that, if CAUTIOUS is rational, ANTICIPATION is false. For we've established that, if CAUTIOUS is rational, then you it would be rational to stop believing Satie is French both were you to learn that Satie is compatriots with Verdi and Bizet at t_2 (as in Composers) *and* were you to learn that Satie is not compatriots with Verdi and Bizet at t_2 (as in Composers*). Yet CAUTIOUS recommends believing Satie is French at t_1 , contra ANTICIPATION.

These results cause problems for, not only theories of belief revision that entail PRESERVATION and ANTICIPATION, such as (Alchourrón, Gärdenfors, and Makinson 1985) and (Leitgeb 2014), but also weaker theories that do not necessarily entail them, like (Lin and Kelly 2012) and (Goodman and Salow 2025). For while these theories predict other counterexamples to PRESERVATION and ANTICIPATION, they agree with the predictions these principles make with respect to Composers specifically.⁶

There's more. Schultheis (2018) further observes that CAUTIOUS constitutes a counterexample to the following natural principle connecting

⁶Why is this? Consider Lin and Kelly's theory (roughly similar remarks apply to Goodman and Salow's). They say that that w is more plausible than w' just in case w is sufficiently more probable than w' , and that it's rational to believe p iff p is true throughout the most plausible worlds. So, it's rational to believe Satie is French at t_1 only if the world in which all three composers are French is sufficiently more probable than the world in which they are all Italian. Assume that's so. The problem is that, given plausible auxiliary assumptions about the relevant probability distribution (like those I'll outline in §5), the ratio of probabilities between these two possibilities does not change between t_1 and t_2 . Therefore, the all-French possibility will remain more plausible than the all-Italian possibility at t_2 meaning it remains, contra CAUTIOUS, rational to believe Satie is French.

credence to belief:

LOCKEAN SUPERVENIENCE If two agents A_1 and A_2 have the same rational credence in p , then A_1 can rationally believe p iff A_2 can rationally believe p .

Now, there are already some reasons to deny LOCKEAN SUPERVENIENCE. Buchak (2014) argues that agents with the same credences may differ in what they can rationally believe when those agents possess evidence of different kinds (say testimonial versus purely statistical evidence). Fantl and McGrath (2009) argue this can happen when the practical stakes for the relevant agents differ. Even a simple Lockean—who thinks you can rationally believe p iff p is sufficiently probable—might deny it if they think the threshold for ‘sufficiently probable’ can vary across agents.

However, what is remarkable CAUTIOUS is that it, if rational, constitutes a counterexample to LOCKEAN SUPERVENIENCE *even if* we hold fixed all of these complicating factors. That is, it promises to show that, even when the two agents A_1 and A_2 have the same kind of evidence, are in situations with equivalent practical stakes, and have the same threshold for ‘sufficiently probable’, LOCKEAN SUPERVENIENCE still fails.

To see this, note that the following two facts plausibly should hold about your credences at t_1 :

- (i) At t_1 , you should be 50/50 as to whether Verdi is Italian or French, as you should be as to whether Bizet is Italian or French.
- (ii) At t_1 , your credence that Satie is French should be probabilistically independent from the claim that Verdi/Bizet is Italian/French.

(i) is plausible as we supposed your initial beliefs about their nationalities were formed on equally strong bases; (ii) is plausible as we assumed these beliefs were formed on independent bases. Yet, Schultheis (2018, pp. 36–37) proves that if (i) and (ii) hold, then your credence that Satie is French cannot change on learning, at t_2 , that all three composers are compatriots. Treating you at t_1 and you at t_2 as the two agents A_1 and A_2 , since by CAUTIOUS you nevertheless drop your belief that Satie is French at t_2 , CAUTIOUS is rational only if LOCKEAN SUPERVENIENCE is false—even if restricted in the ways I outlined above.

CAUTIOUS may look innocent. Yet, if it’s rational, epistemological anarchy ensues.

3 Bold Composers

Anarchy isn't for everyone. The anarchy wreaked by CAUTIOUS will incline many towards scepticism, not of the above principles, but rather of CAUTIOUS. For example, you can imagine a hard-nosed Lockean objecting: 'This isn't a genuine counterexample to LOCKEAN SUPERVENIENCE; rather, Schultheis's observations merely serve as a proof that CAUTIOUS is mistaken. Since the probability that Satie is French does not drop after learning all three composers are compatriots, you should continue to believe that Satie is French at t_2 and so believe they're all French.'

This reaction isn't obviously unreasonable.⁷ And if something like it is right, your beliefs in Composers should instead change according to:

BOLD At t_1 , suspend judgement on whether Verdi and Bizet are both Italian or both French, but continue to believe Satie is French (as with CAUTIOUS). However, at t_2 , believe that all three composers are French.

And why not? After all, it is more plausible that you were wrong about just one composer (Verdi) rather than two (Bizet and Satie). So, perhaps the correct response really is to conclude that all three composers are French.

Still, this is all a little 'one philosopher's modus ponens is another's modus tollens'—whenever you have a purported counterexample to a principle, one option is to reject the counterexample rather than the principle. The case for this reply would be strengthened if there was more one could say in support of the claim that the intuitions supporting CAUTIOUS rest on a mistake.

Well, there *is* more one can say. When discussing an unrelated literature, Hart and Titelbaum (2015) consider:⁸

Urn Matching. Urn X contains 50 black balls and 50 white balls.
Urn Y contains 70 black balls and 30 white balls. I randomly

⁷Goodman and Salow (2025, §4) express a similar sentiment regarding the proposed counterexample to ANTICIPATION. Though note that their approach predicts other failures of ANTICIPATION (2025, §8, §10).

⁸Hart and Titelbaum are responding to (White 2009), arguing White's case against imprecise credences rests on a case in which we are susceptible to make errors when updating on biconditionals. See also (Titelbaum and Hart 2020), in which they argue a similar problem involving biconditionals occurs in a discussion of the Principle of Indifference in (James Hawthorne et al. 2017).

select one ball from each urn. Then, without showing you the balls, I tell you that the two balls have the same color. You have all the relevant background information. What's the probability that the drawn balls were black?

Hart and Titelbaum write:

Initially your credence that the X ball would be black was 0.5, and your credence that the Y ball would be black was 0.7. Since these credences must now come together somehow [since you know one ball is black iff the other is black], most people to whom we pose Urn Matching—even probabilistic sophisticates—answer somewhere between 0.5 and 0.7. (2015, p. 254)

But that's incorrect. Surprisingly, your credence ball Y is black should *remain* 0.7. In general:

When a biconditional between two initially-independent propositions is learned and one of them had prior probability $\frac{1}{2}$, the posterior value equals the prior of the other proposition. (2015, p. 255)

Hart and Titelbaum suggest that most are oblivious to this, making them inclined to make probabilistic errors when updating on biconditionals.

Here's my point: at t_2 in Composers you are *also* asked to update on a biconditional—the proposition that all three composers are compatriots is equivalent, given your evidence, to the proposition that Verdi is French iff Satie is. So, since we already have reason to believe people are bad at forming rational doxastic attitudes when updating on biconditionals, we have independent reason to think that people are going to make mistakes when judging the rational response in Composers is—in particular concerning whether one should continue to believe that Satie is French at t_2 . We therefore appear to have good, independently motivated grounds for dismissing CAUTIOUS.

This is an attractive view. It used to be *my* view. But I would now say it is only the second-best view. My central reservation is that it fails to capture the following intuition about the case, highlighted by Stalnaker:⁹

⁹Stalnaker is in fact discussing a structurally analogous case to Composers; the parenthetical edit changes to case back to Composers.

A bold believer might reason as follows: the hypothesis of two independent errors is less plausible than the hypothesis of one error, so I should conclude that [all three composers are French]. But it seems too strong to force this conclusion on our subject. A more cautious believer might grant that this possibility is more likely, but refrain from reaching a definite conclusion. This more cautious policy does not seem unreasonable. (Stalnaker 2019, p. 65)

That is, there is an intuitive sense in which the choice between CAUTIOUS and BOLD is a *permissive* one. Neither is flatly irrational, but rather, which reaction one should have depends on how bold an epistemic agent we are considering. The bolder of us can reasonably conclude that we were wrong about only one composer, yet it is also not unreasonable for the more cautious of us to leave open that we were wrong about two.

The current approach instead rejects CAUTIOUS as an outright irrational reaction. It suggests those who judge in line with CAUTIOUS make a probabilistic error—that they just can’t do the maths. But that does not seem right. On the face of it, those who endorse CAUTIOUS are not committing anything resembling a fallacy; rather, they are just being more, well, cautious. So, before casting CAUTIOUS aside, I think it’s at least worth seeing whether other views can capture this intuition that the choice between CAUTIOUS and BOLD is permissive.

Now, some of you may worry about this. Perhaps you are sceptical of this kind of permissivism that White (2005) argues against. I cannot adjudicate this debate here—see (Smith 2025) for a recent overview. Instead, I’ll now argue that, even if you are unsympathetic to Permissivism, you can still be interested in the project I’ll be undertaking in the rest of this paper, so long as you think CAUTIOUS can be rational *in at least some cases*.

Consider the following variant of Composers. This version is adapted from (Schultheis 2018, Ch. 2), with higher practical stakes added:

Blood Transfusions. You are a doctor that regularly approves blood transfusions for patients. Ollie, Adam and Arnie are each in need of a blood transfusion. Their respective medical records indicate that Ollie has blood type O, whereas Adam and Arnie have blood type A. (O and A are the only two blood types.) These medical records are exceptionally reliable: they provide

sufficient evidence for forming a belief in patients' blood types, and you consistently approve successful blood transfusions on this basis. Accordingly, you believe that Ollie has type O, whereas Adam and Arnie have type A.

However, before you approve the corresponding transfusions, your overly anxious assistant performs some tests on the patients' blood samples. These tests establish, definitively, whether two blood samples are of the same type or not. Your assistant first tests Ollie and Adam's blood and reports that they are of the same type. Your assistant then tests Adam and Arnie's blood and reports that they are also of the same type, meaning you now know they all have the same blood type.

What should you now believe? The intuition that you shouldn't conclude they are all type A, and instead leave it open that they are all type O, is particularly strong. So, revising your beliefs here in line with a pattern analogous to CAUTIOUS seems eminently reasonable. Yet the key epistemic features of the case have not changed from Composers. We can assume, for instance, that each of the patients' medical records provide independent evidence of their respective patients' blood types—meaning that just after learning Ollie and Adam share the same blood type, you should still believe Arnie has type A.¹⁰ All that's been changed is the practical stakes, yet the intuition that you should respond cautiously is stronger than before.

What explains this? Permissivism is one contender: perhaps higher stakes more strongly incline us to adopt an equally permissible cautious attitude. But there are other potential explanations. For instance, perhaps there is some kind of pragmatic encroachment: in Blood Transfusion you should be cautious, whereas in Composers you should be bold, because the practical stakes in the former are higher.¹¹ Or perhaps something contextualist is happening, whereby raising the practical stakes shifts the context to one in which a higher-standards meaning of 'rational belief'

¹⁰To spell this out more, we can assume that these medical records were collated by different, extremely reliable medical experts that bear no relation to each other, and that each patient is from an entirely separate background, etc.

¹¹See (Gao 2025) for a recent defensive overview of pragmatic encroachment. Alternatively, we might instead think it is a kind of moral encroachment at play in this specific example—see (Lloyd 2025) for recent discussion.

is operative.¹² Generally, what is needed to explain this phenomenon is some ‘shifty’ view about rational belief—whether that shift is down to agent dependence, stake dependence, context dependence, or what have you.

Here’s my point. No such shifty view is viable if LOCKEAN SUPERVENIENCE is endorsed. Since the key epistemic features in Composers and Blood Transfusions are the same, the rationality of a cautious reaction to them is inconsistent with LOCKEAN SUPERVENIENCE. Just as with your belief that Satie is French in Composers, in Blood Transfusions if the corresponding cautious response is rational, dropping your belief that Arnie is type A is rationally permitted even though the probability of this claim has not decreased. Therefore, so long as you are sympathetic for the need of some kind of shifty view—even if you don’t endorse Permissivism—you should be sympathetic for the search for a theory of belief on which LOCKEAN SUPERVENIENCE fails.

The rest of this paper will conduct a search for such a theory of belief. For simplicity, I’ll frame this as a search for a Permissivist view, but the reader may substitute in their preferred ‘shifty’ view, if they have one. I will begin this search by first examining Lin’s (2019) popular incomparability model of the case, before defending my own position in §5.

4 Incomparable Composers

Lin (2019) outlines the following influential model of Composers.¹³ We start with the following theory of rational belief: it is rational to believe p iff p is true in all the most plausible worlds compatible with one’s evidence. However, we then concede that it is not always possible to compare the plausibility of two worlds. If w is implausible in one way, yet w' is implausible in a different way, w and w' are *incomparable*. In such a case, if both w and w' aren’t less plausible than other worlds, both must be left open.

Such incomparabilities might occur in Composers. Perhaps a world in which you’re wrong about just Verdi is arguably not more plausible than,

¹²See (Wedgwood 2008) for a contextualist view about rational belief in particular, rather than about knowledge. We could equally endorse a relativist view along the lines of (MacFarlane 2013), or an expressivist view along the lines of (Chrisman 2012).

¹³Boylan and Schultheis (2021), and Pollock (1981) before them, use incomparabilities to account for counterfactual variants of Composers.

but rather incomparable to, a world in which you're wrong about both Bizet and Satie. For, since these beliefs were formed on independent bases, these two worlds are implausible in different ways. On this approach, to say that it's more plausible that you were mistaken just about Verdi would be like saying that a world in which your normally honest partner lied to you is more plausible than a world in which you both mistakenly thought you could smell coffee and you misremembered the time of your job interview.

We can represent the following model of Composers diagrammatically, with the following conventions. '*ABC*' is the possibility in which Verdi, Bizet and Satie are, respectively, nationalities *A*, *B* and *C*; '*I*' for Italian, '*F*' for French. An arrow from one node to another says that the former is at least as plausible than the latter. Arrows inferrable from reflexivity or transitivity are omitted. We stipulate that *ABC* is at least as plausible *DEF* iff any mistake you make in *ABC* you also make in *DEF*. These conventions produce the following diagram for your beliefs at t_0 :

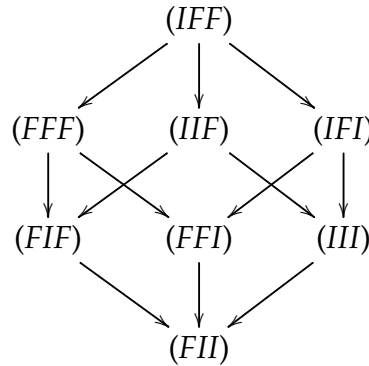


Figure 1: Incomparability model at t_0 .

Since *IFF* is the most plausible world, you start out rationally believing that Verdi is Italian and that Bizet and Satie are French.

At t_1 , when you learn that Verdi and Bizet are compatriots at t_1 , the diagram changes to the following, where worlds inconsistent with what you've learned have been eliminated:

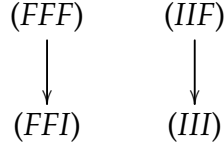


Figure 2: Incomparability model at t_1 .

Since *FFF* and *IIF* are now the most plausible—and pairwise incomparable—worlds, you become ambivalent about Verdi and Bizet’s nationality, but still believe Satie is French.

Upon learning that all three composers are compatriots at t_2 , you are left with two incomparably plausible worlds:



Figure 3: Incomparability model at t_2 .

Since these worlds are pairwise incomparable, you should leave both open. So, per **CAUTIOUS**, you should be ambivalent as to whether the composers are all French or all Italian.

I think there is much to like about this approach. However, so far it also fails to capture the intuition that the choice between **CAUTIOUS** and **BOLD** is permissive. But this time the situation is reversed: once we introduce incomparabilities, **CAUTIOUS** comes out as the uniquely rational pattern of belief revision. In contrast, those who endorse **BOLD** are making comparisons between the plausibility of two situations when they shouldn’t. But again, it does not seem like those who endorse **BOLD** commit any more of a fallacy than those who endorse **CAUTIOUS** do.

There is, however, a potential reply here. Perhaps what marks the permissive difference between **CAUTIOUS** and **BOLD** comes down to a further permissive difference as to whether you take worlds in which you’ve made different kinds of mistakes to be incomparable. If, for instance, you think worlds in which you made exactly one mistake is just as plausible as a world in which you also make exactly one mistake about a different composer, we end up with the following, quite different model at t_0 and t_1 :

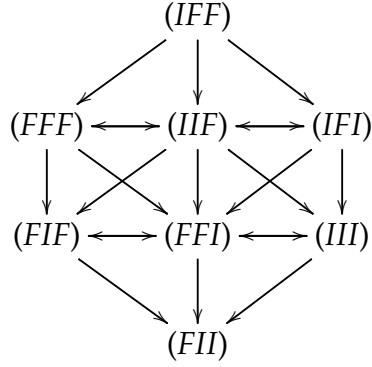


Figure 4: Comparability model at t_0 .

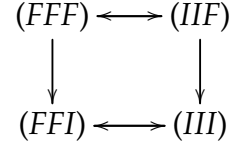


Figure 5: Comparability model at t_1 .

Crucially, since *FFF* is now *more plausible* than *III*, we get the following at t_2 :



Figure 6: Comparability model at t_2 .

Hence, learning that all three composers are compatriots will put you in a position to justifiably believe you are in *(FFF)*, per BOLD. So, can't this approach capture the permissive element of Composers after all?

The problem is that, even if we concede that what worlds are/aren't comparable is something that can shift, this approach still cannot account for permissibility once we complicate the case. Consider:

Four Composers. You justifiably believe (at time t_0) that Verdi is Italian, Bizet is French, Satie is French, and Boulanger is French. These four beliefs are formed on equally strong, independent bases. You know for certain, for each composer, that they are either French or Italian. At t_2 , you learn that *all four* composers are compatriots.

The choice for you at t_2 is now between the possibilities that you were wrong only about Verdi, or that you were wrong about all three of Bizet, Satie, and Boulanger.

Here's my point. Suppose, first, that you consider worlds in which you make mistakes about the nationalities of different composers to be comparable. Then at t_2 , in both Composers and Four Composers, this approach says you should believe Verdi is French: one mistake is more plausible than two and more plausible than three.

Suppose second that you consider worlds in which you make mistakes about the nationalities of different composers to be *incomparable*. Then at t_2 , in both Composers and Four Composers, this approach says you'll be ambivalent as to whether all composers are French or all are Italian: the plausibility of the situation in which you were wrong about just Verdi is incomparable to the plausibility of the situation in which you were wrong about all of the others.

But there is surely some middle ground here! It would seem perfectly reasonable to, in the original Composers case, hesitate and leave open the possibility that you were mistaken about two composers, yet nevertheless in Four Composers conclude that you must have been mistaken about just Verdi rather than *three* composers. The incomparability approach cannot naturally account for this. Generally, no matter the number n of purportedly French composers we introduce, an agent either treats cases with different kinds of mistakes as comparable, in which case they always conclude they were wrong about just Verdi, or the agent treats cases with different kinds of mistakes as incomparable, in which case they, no matter the value of n , leave it open that they may have been mistaken about n composers. Yet there must be some permissible middle ground between these two extreme reactions.

I'll now outline an alternative approach that captures the permissive element of Composers without succumbing to this objection.

5 Composers Composed

Without incomparabilities, how else might we predict that CAUTIOUS is rationally permissible? Here's a clue. Recall that the motivations for CAUTIOUS in §2 did not concern *the proposition* that Satie is French—they did not rest on the false claim that the probability of this proposition drops at t_2 . Rather, the focus was on *the possibility* that all three composers are Italian—the thought was that this is a possibility you cannot rule out at

t_2 .¹⁴ Crucially, it's possible for the possibility that all three composers are Italian to increase, even if the probability of the proposition that Satie is French does not drop. A theory of rational belief that focuses on the probability of possibilities—that is, the most fine-grained possible worlds we are considering—rather than propositions—that is, sets of those possibilities—may therefore have a shot at facilitating CAUTIOUS.

Here's a rough outline of such a theory, taking inspiration from (Pearson 2025). When is one entitled to rule a possibility out? Plausibly, when that possibility is sufficiently unlikely. Indeed, this answer fits nicely with the popular view that the function of belief is to simplify reasoning: beliefs allow us to ignore those possibilities that are so unlikely we need not bother thinking about them.¹⁵ Following this idea, we can define rational belief as follows: it's rational to believe p iff p is true throughout the possibilities you are not entitled to rule out.

Call this theory *Atomic Lockeanism*. Like Lockeanism, rational belief is determined by probabilities and a threshold; unlike Lockeanism, this threshold only determines which possibilities—or 'atoms'—one must leave open, rather than all of the propositions one can rationally believe.¹⁶

We can use Atomic Lockeanism to compose Composers in a way that facilitates CAUTIOUS. Consider the following model. Let W be a set of possibilities, consisting of ordered triplets ABC , with each position indicating the nationality—either Italian ('I') or French ('F')—of Verdi, Bizet and Satie respectively:

- $W = \{IFF, FFF, IFI, IIF, FIF, FFI, III, FII\}$

Let P be the following probability distribution over W , representing your credences at t_0 .

- $P(IFF) = 0.729$

¹⁴Both Stalnaker's (1994, p. 19) and Schultheis's (2018, p. 32) considerations motivating CAUTIOUS are similar in this respect.

¹⁵See (Harsanyi 1985), (Lance 1995), (Lin 2013) and (Ross and Schroeder 2014); see (Staffel 2019) for recent criticism.

¹⁶Levi (1967) defends a theory of belief that entails the same predictions with respect to what one is rational in believing at a time. However, Levi's approach is importantly different to the one defended here with respect to how one's rational beliefs change on receiving new evidence, which prevents it from predicting CAUTIOUS. See fn. 18 for details.

- $P(FFF) = P(IFI) = P(IIF) = 0.081$
- $P(FIF) = P(FFI) = P(III) = 0.009$
- $P(FII) = 0.001$

These specific values do not matter. Rather, I have chosen them arbitrarily within two constraints:

- Worlds in which you have more false beliefs at t_0 are less probable than worlds in which you have less false beliefs at t_0
- Propositions specifying the nationality of a composer are probabilistically independent from propositions specifying the nationality of a different composer.

Where $e_{t_n} \subseteq W$ is your evidence at t_n , we can define what Atomic Lockeanism takes to be your strongest rational belief given evidence e_{t_n} , B_{t_n} as follows. Where $P(p \mid e_{t_n}) = \frac{P(p \& e_{t_n})}{P(e_{t_n})}$, and $0 \leq \tau \leq 1$:

$$B_{t_n} = \{w \in W : P(w \mid e_{t_n}) \geq \tau\}$$

In words: your strongest justified belief at t_n , B_{t_n} , is that you are in one of the possibilities with sufficiently high probability. Atomic Lockeanism says it's rational to believe p at t_n iff B_{t_n} entails p .

Setting $\tau = 0.1$, we get the following predictions in Composers:

- At t_0 , you believe you are in the only possibility with sufficiently high probability, *IFF*. See Figure 7.¹⁷
- At t_1 you learn that Verdi and Bizet are compatriots, so $e_{t_1} = \{FFF, IIF, FFI, III\}$. The updated probabilities of these four remaining possibilities are:

- $P(FFF \mid e_{t_1}) = P(IIF \mid e_{t_1}) = 0.45$;
- $P(FFI \mid e_{t_1}) = P(III \mid e_{t_1}) = 0.05$;

¹⁷Note that the ratios between the bars in figures 7, 8 and 9—representing the probabilities of the relevant possibilities—are not in proportion with each other. This is to keep each bar visible and the figures readable. Other key features, such as whether the probability of a possibility reaches the threshold τ , are preserved, meaning the figures are still helpful for illustrative purposes.



Figure 7: Atomic Lockean model at t_0 .

So at t_1 your strongest belief is $FFF \vee IIF$ —that Satie is French yet Verdi and Bizet could either be both French or both Italian—in alignment with CAUTIOUS (and BOLD). See Figure 8.

- At t_2 , you learn that all composers are compatriots, so $e_{t_2} = \{FFF, III\}$ and our updated probabilities are:
 - $P(FFF \mid e_{t_2}) = 0.9$
 - $P(III \mid e_{t_2}) = 0.1$

Since III now has probability of at least τ , it is a member of B_{t_2} , meaning your strongest belief is $FFF \vee III$, per CAUTIOUS but contra BOLD. See Figure 9.

Ok, so Atomic Lockeanism can predict CAUTIOUS is rational.¹⁸ But how can it capture the intuition that the choice between CAUTIOUS and BOLD

¹⁸Why can't Levi's theory (1967)—see fn. 16—make these predictions? Here's a quick overview of Levi's view. Let q be a constant measuring an agent's 'epistemic boldness'—their inclination to form informative beliefs at the cost of forming false beliefs—and let $cont_e$ be a function taking propositions to a measure of their content, that depends on an agent's evidence e . Levi's theory states that $w \in W$ is a member of an agent's belief set iff:

(*) $P(w) \geq q \times cont_e(W \setminus \{w\})$.

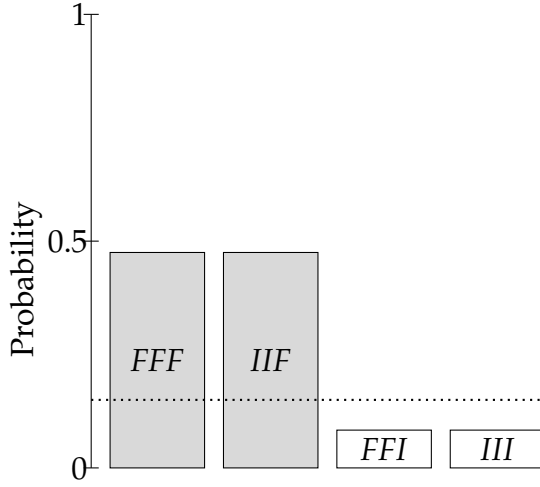


Figure 8: Atomic Lockean at t_1 .

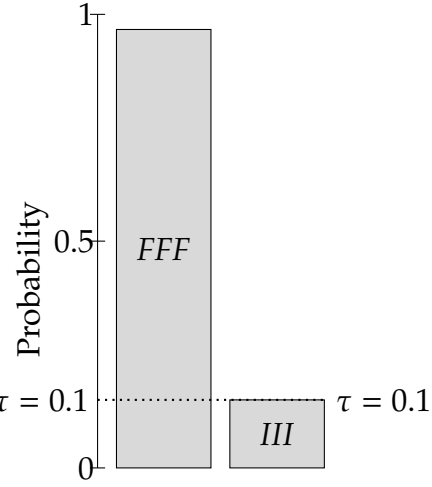


Figure 9: Atomic Lockean at t_2 .

is permissive? It can do this by supposing that, for agents who are more epistemically ‘bold’—agents who are inclined to rule out more probable possibilities than more cautious agents are— τ ought to be set higher. For example, if we set $\tau = 0.2$, then while your rational beliefs at t_0 and t_1 are no different from those above, at t_2 *III* remains a sufficiently unlikely possibility, meaning you can rationally believe *FFF*, as per BOLD.

So far, we have seen that Atomic Lockeanism is at least as good as the incomparability approach discussed in §4. So, how does it fare with the likes of Four Composers, where the incomparability approach faltered? Better. Setting our value of τ back to 0.1, at t_2 in Composers you ought to leave open the possibility that all three composers are Italian. Yet, on considering a natural extension of the probability function P as applied to Four Composers, it is predicted that you ought to rule out the possibility that all four composers are Italian. For the probability at t_2 of the possibility, in Four Composers, that all four composers are Italian will be much lower

Levi defines the content of a proposition to be the proportion of worlds in $W \setminus e$ inconsistent with it. At t_1 , $W \setminus e_{t_1}$ has four elements, meaning that by (*), at t_1 one leaves open those worlds w which are such that $P(w) \geq q \times \frac{1}{4}$. Hence, if we set $0.2 < q \leq 1.8$, at t_1 you’ll leave open just *FFF* and *IIF*, per CAUTIOUS. However, since $W \setminus e_{t_2}$ only has two elements, by (*), at t_2 one leaves open those worlds w which are such that $P(w) \geq q \times \frac{1}{2}$. In order to be ambivalent about *FFF* and *III* at t_2 , we therefore need q to be at most 0.2. There is therefore no single value of q that can be used, on Levi’s approach, to vindicate CAUTIOUS.

than the probability at t_2 , in Composers, that all three composers are Italian. The following footnote contains the details.¹⁹ Atomic Lockeanism can, therefore, find the desired middle ground between being sceptical as to whether all the composers are French in Composers, yet being convinced that all the composers are French in Four Composers.

And there are more reasons to like this Atomic Lockean model of Composers. By adjusting the value of τ , we can predict the rationality of *further* reactions to Composers—beyond CAUTIOUS and BOLD—that on reflection also seem perfectly reasonable. For example, setting $\tau = 0.05$, at t_0 , you suspect you may be wrong about one of the composers' nationality; after learning at t_1 that you are wrong about at least one of them, you leave it open that you may be wrong about two. That is, you are always such that, if you know you have at least n mistakes, you leave it open that you have made $n + 1$ mistakes. Perhaps this is quite a cautious way to leads one's life, but it is not obviously unreasonable.

So, we have a natural account of belief, Atomic Lockeanism, that makes a range of attractive predictions regarding Composers. However, the account is currently very simple, and as it stands faces two objections. I'll close this section by suggesting how the theory can be developed in response to them.

Objection 1: Possibilities

Given Atomic Lockeanism, rational belief looks objectionably sensitive to the fineness-of-grain of the possibilities in W . Suppose, for instance, you learn that a coin will be flipped, and therefore begin to distinguish between worlds in W according to how the coin lands. Each possibility in W will then be split into two—a heads-possibility and a tails-possibility— with

¹⁹We first extend our set of worlds to include possibilities in which Boulanger is French and possibilities in which she is Italian: $W^* = \{FFFF, FFFF, IIFF, IFIF, IFFI, FIFF, FFIF, FFFI, IIIF, IIFI, IIIL, FIIF, FIFI, FFIL, IFIL, FIIL\}$. We then extend the probability distribution P to distribute over W^* while conforming to the constraints (i) and (ii) as follows. Where m_n , with $0 \leq n \leq 4$, is some world where you initially made n mistakes in Four Composers, let $P(m_0) = 0.6561$, $P(m_1) = 0.0729$, $P(m_2) = 0.0081$, $P(m_3) = 0.0009$ and $P(m_4) = 0.0001$. Where e is the proposition that all four composers are compatriots, only $FFFF$ and $IIIL$ are not ruled out, and we have $P(FFFF \mid e) \approx 0.99$ and $P(IIIL \mid e) \approx 0.01$. If $\tau = 0.1$, it's rational at t_2 to believe you only made one mistake, even though in Composers it's rational to, if $\tau = 0.1$, leave it open that you made two mistakes.

each assigned half the probability of the original possibility. Assuming τ remains fixed, this means that more possibilities can be ruled out, meaning you may now form more rational beliefs than before, say a belief that p , even if the fact that a coin has been flipped is irrelevant as to whether p . This feels absurd.²⁰

The most promising reply to this worry is to endorse a version of the view in which belief is *question-sensitive*. This is a common move nowadays—see (Leitgeb 2017), (Yalcin 2018), (Blumberg and Lederman 2020), (Hoek 2022), (Dorst and Mandelkern 2022), (Holguin 2022), (Hong 2023), (Goodman and Salow 2025) and (Pearson 2025). On this type of view, the fineness-of-grain of the relevant possibilities depends on which question is, in some sense, relevant. In particular, the relevant possibilities make all and only those distinctions that matter for determining the correct answer to relevant question. So long as the flip of a fair coin is in fact irrelevant to this question, the relevant possibilities will not be distinguishable in terms of how the coin lands, meaning we can avoid the above objection.

For the purposes of this paper, I'll remain neutral as to whether the relevant question should be interpreted as a 'question-under-discussion' in a conversational context, as it is in, for example, (Hong 2023) and (Goodman and Salow 2025), or as something closer to subjective sensitive invariance, where what question is relevant depends can depend on the agent and their practical concerns, as in, for example, (Leitgeb 2017).²¹

Formally, we'll modify Atomic Lockeanism as follows. Where Q is the relevant question—a partition of W —and where $[\cdot]_Q$ sends $w \in W$ to the cell of Q that w is a member of, we redefine one's strongest belief as sensitive both to one's evidence and to the relevant question as follows:

$$B_{t_n, Q} = \{w \in W : P([w]_Q \mid e_{t_n}) \geq \tau\}$$

Note that what you can rationally believe now crucially depends on the

²⁰The problem is similar to one in Staffel's (2016) critique of (Leitgeb 2014).

²¹Note that latter approach fits more naturally with pitching Atomic Lockeanism, like I did above, as a view on which the function of belief is to allow agents to simplify reasoning by ruling out low-probability possibilities. For partitioning a complex and large set of possibilities into fewer chunks is another natural way for agents to simplify their reasoning. The idea that coarse-graining possibilities is a way for agents to simplify decision problems is also common in economics; see, for example: (Ahn and Ergin 2010), (Epstein, Marinacci, and Seo 2007) and (Gul, Pesendorfer, and Strzalecki 2017). See also (Dorst and Mandelkern 2022, pp. 611–12).

relevant Q . Importantly, while Atomic Lockeanism makes the advertised predictions when Q distinguishes possibilities according to the eight possible assignments of nationalities (as in figures 7-9), it does *not* do so for other potential Q s. For instance, suppose Q is the polar question *Is Satie French?*. Then since the probability that Satie is French does not change throughout *Composers*, Atomic Lockeanism cannot predict CAUTIOUS to be rational. Rather, depending on our choice for τ , it either predicts you believe that Satie is French throughout or that you do not believe Satie is French throughout. This raises a crucial issue: why assume Q is more fine-grained, like with the model above, and not more coarse-grained like this polar question? I have two replies.

First, if Q is the polar *Is Satie French*, then throughout *Composers* you are learning information that cross-cuts Q . For instance, on learning that Verdi and Bizet are compatriots at t_1 , you'll be learning information that cuts across the distinctions made by the relevant question. It is not completely obvious whether we should allow for this. Lin and Kelly (2012) effectively presuppose this never happens. And as (Goodman and Salow 2025, pp. 21–3) and (Pearson 2025, pp. 30–2) discuss, assuming this never happens can secure the validity of some quite plausible principles of belief revision. So, if there is good reason to constrain the relevant question in this manner, there is good reason to think *Is Satie French* is not the relevant question in *Composers*.²²

Second, it is unclear that we must settle the matter of how to determine Q before we've settled on a view on which patterns of belief are rational. Rather, perhaps a more holistic methodology is possible, on which plausible verdicts about what beliefs are rational to form in a case—like the plausibility of CAUTIOUS and BOLD—can be used as evidence concerning which question is relevant. So, the fact that my choice of question, combined with Atomic Lockeanism and an appropriate flexible choice for τ , makes attractive predictions can itself be seen as evidence that this choice of question is correct. See (Goodman and Salow 2025, pp. 22–3) for similar methodological remarks concerning question sensitivity.

Of course, these replies do not fully settle the matter of determining the relevant Q s, which I leave as an important issue for further research.

²²On the other hand, Goodman and Salow (2025, p. 20) argue that for some cases, we need to assume the information we learn cross-cuts the relevant question to avoid sceptical consequences. So this consideration is not decisive.

Objection 2: Low Probability

Given Atomic Lockeanism, it's rationally permissible to believe highly unlikely propositions. Suppose the threshold τ is $\frac{1}{3}$, and the relevant question Q consists of four answers, a , b , c and d , such that $Pr(a \mid e_{t_n}) = \frac{1}{3}$, yet $Pr(b \mid e_{t_n}) = Pr(c \mid e_{t_n}) = Pr(d \mid e_{t_n}) = \frac{2}{9}$. Here, $B_{e_{t_n}, Q} = a$ and so you can rationally believe a proposition that's only $\frac{1}{3}$ rd likely. A particularly acute version of this problem occurs if none of the answers to Q have probability of at least τ . In that scenario, $B_{e_{t_n}, Q}$ is the empty set, and so you can rationally believe the contradiction. That can't be right!²³

I'll fix this in a manner that broadly follows—but is slightly different to—the approach I consider in (Pearson 2025).²⁴ We first specify a different, more standard Lockean threshold T , which determines the minimum probability any proposition must have in order to be justifiably believed. Now, in cases where τ is set high enough, the set of all possibilities that are at least τ -likely may not be at least T -likely. In such a case, rather than concede that one can rationally believe a proposition that is less than T -likely, an alternative suggestion is that you should retreat to some smaller threshold, $\tau^- < \tau$, whereby the set of all τ^- -likely possibilities *is* at least T -likely. This new set is then identified as the strongest proposition you can rationally believe. This strikes me as a natural solution to the problem. If you are usually comfortable ignoring worlds that are less than τ -likely, then on encountering a situation in which the set of τ -likely worlds is itself not so probable, the natural reaction is to lower your standards so that only worlds that are less than τ^- -likely are ruled out, rather than, as the first-pass theory suggested, form a belief in a proposition that is highly unlikely.²⁵

²³While proponents of weak belief, such as (John Hawthorne, Rothschild, and Spectre 2016), (Dorst 2019), (Dorst and Mandelkern 2022) and (Holguin 2022), will be happy with rational beliefs in *unlikely* propositions, they will not be happy with rational beliefs in *contradictory* propositions.

²⁴This approach of mine is in turn influenced by the approaches in (Hong 2023) and (Goodman and Salow 2025).

²⁵The approach I suggest in (Pearson 2025) is more idealised. There, I in effect say that you should set τ^- to the highest possible value that's less than τ but is such that the strongest proposition you believe is at least T -likely. I take it that while this sounds like a more rational approach to take to setting τ^- , it is a little less realistic.

6 Conclusion

So, I have offered an independently motivated and defensible theory of belief, Atomic Lockeanism, which provides a satisfactory model of Composers that allows for the permissibility of differing but reasonable reactions like CAUTIOUS and BOLD. Job complete?

Hold on. What about the *epistemological anarchy* I harped on about in §2? Since Atomic Lockeanism predicts the rationality of CAUTIOUS, we still get the same failures of PRESERVATION, ANTICIPATION and LOCKEAN SUPERVENIENCE outlined in §2. Don't these drastic consequences give us good reason to reject the view?

I'll close by explaining why, on the whole, I think not. First, consider PRESERVATION and ANTICIPATION. While I do think these principles have considerable intuitive appeal, they are in fact under more pressure than merely the intuitive judgments in favor of CAUTIOUS. In particular, (Goodman and Salow 2025) and (Pearson 2025) together provide various intuitive counterexamples—motivated by considerations relating to anti-skepticism and the possibility of inductive knowledge—to both PRESERVATION and ANTICIPATION, of quite a distinct kind from Composers. So, given we also have independent reasons to give these principles up, endorsing an approach to Composers that violates them no longer looks so bad.

What about LOCKEAN SUPERVENIENCE? Three points. First, a variety of recent theories of rational belief, beyond Atomic Lockeanism, do not entail it—such as those in (Lin and Kelly 2012), (Leitgeb 2014), (Holguin 2022) and (Goodman and Salow 2025). So, to the extent that these theories have good motivations, the case against for LOCKEAN SUPERVENIENCE is stronger than merely trying to capture the rationality of CAUTIOUS. Second, failures of LOCKEAN SUPERVENIENCE seem more natural with Atomic Lockeanism in view. The idea being that, even if new evidence does not decrease the probability of a proposition p , it may nevertheless increase the probability of a currently ignored possibility w that conflicts with p . If the probability of w is increased to the extent that it can no longer be ignored, I must now pay attention to some $\neg p$ possibilities, and so it's no longer rational to believe p . Third, note that Atomic Lockeanism nevertheless preserves a weakened kind of supervenience: two agents with the same credences, *and the same threshold* τ , will not differ in what propositions it's rational for them to believe. So, although belief does not supervene on credence locally—we cannot determine whether one can rationally believe p by simply looking at

one's credence that p —it nevertheless supervenes on credence globally—given an appropriate threshold τ , we can determine whether one rationally believes that p by looking at one's entire credence function.

Of course, if Atomic Lockeanism is the correct theory of rational belief, then there are far fewer principles governing rational belief than it initially seemed. In that sense, epistemological anarchy does ensue. But Atomic Lockeanism is nevertheless a regimented theory of belief that has clear, concrete and testable predictions.²⁶ So, although I may be endorsing epistemological anarchy, it is not as though I am giving into complete epistemological *chaos*.

On the whole, I conclude that we have a theory of rational belief that is well-motivated, natural, and stands up to scrutiny. Moreover, it provides a model of Composers that delivers various attractive results. Composers has been composed.

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²⁶Indeed, see (Pearson 2025, pp. 722–727) in which I investigate which other principles of belief revision are still valid under a theory like Atomic Lockeanism.

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