

Close Error, Visual Perception, and Neural Phase: A Critique of the Modal Approach to Knowledge

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Abstract

The distinction between true belief and knowledge is one of the most fundamental in philosophy, and a remarkable effort has been dedicated to formulating the conditions on which true belief constitutes knowledge. For decades, much of this epistemological undertaking has been dominated by a single strategy, referred to here as the “modal approach.” Shared by many of the most widely influential constraints on knowledge, including the sensitivity, safety, and anti-luck/risk conditions, this approach rests on a key underlying assumption—the modal profiles available to known and unknown beliefs are in some way asymmetrical. The first aim of this paper is to deconstruct this assumption, identifying its plausibility with the way in which epistemologists frequently conceptualize human perceptual systems as excluding certain varieties of close error under conditions conducive to knowledge acquisition. The second aim of this paper is to then argue that a neural phase phenomenon indicates that this conceptualization is quite likely mistaken. This argument builds on the previous introduction of this neural phase to the context of epistemology (Bricker 2019), expanding the use of neural phase cases beyond relatively narrow questions about epistemic luck to a much more expansive critique of the modal approach as a whole.

KEYWORDS: sensitivity, safety, anti-luck epistemology, anti-risk epistemology, weak modal approach

1. Introduction

With this paper, I want to advance a critique of not just individual epistemological principles and conditions on knowledge, but an entire strategy for constructing these principles and conditions. The strategy I have in mind, which here I’ll refer to as the “modal approach,” has enjoyed widespread application in epistemology for decades. This approach, on which conditions on knowledge are formulated by appeal to the modal structure of belief and/or belief-forming processes, is responsible for such principles as sensitivity and safety, as well as the canonical formulations of anti-luck and anti-risk conditions on knowledge. The foundational assumption of this approach is that there is some identifiable difference in the modal profiles available to known and merely true beliefs, the plausibility of which emerges from the way that epistemologists normally think about the cognitive systems we rely on for gaining knowledge. On this picture of human cognition, there is at least some sense in which these knowledge-supporting systems cannot easily err. Thus, when we gain knowledge from these systems, there is some variety of cognitive error that couldn’t have easily occurred. However, as I will argue here, we now have good empirical reason to suspect that this picture

is mistaken. This then undermines the intuitive foundations of the modal approach, calling into question whether we might still think that knowledge has special modal features.

With the project laid out in this way, we might understand that my success in this endeavor rests, primarily at least, on my argument that the intuitive picture of human cognition—from which the plausibility of the modal approach derives—is in fact mistaken. My design in constructing this argument is to avoid leaning too heavily on individual counterexamples, at least in isolation, and focus equal attention on the conditions that enable the generation of such counterexamples. In doing so, I will draw heavily from empirical findings provided by cognitive neuroscience that fascinatingly demonstrate that our ordinary perceptual capacities fluctuate with regular, rapid fluctuations in neural phase. Here I'll take the neural phase case, which I have previously discussed as a problem for the modal account of epistemic luck (Bricker 2019), and provide a detailed appraisal of how these empirical findings pose a structural problem for the intuitive foundations of the modal approach as a whole: The full phase space of these fluctuations, which can be the difference between knowing and cognitive error, is naturally understood as occupying close possible worlds. The revelation of these close possible errors erases any necessary differences between the modal profiles available to known and merely true beliefs that might have been associated with our intuitive picture of human cognition. Accordingly, we might understand how these empirical findings pose a challenge for the enterprise of constructing modal conditions on knowledge.

In constructing this critique of the modal approach, this paper is structured in the following way: I begin by tracing the modal approach from its historical origins to the present day, with an emphasis on (i) the shared architecture of the modal conditions it produces and (ii) the remarkable influence and longevity of the approach (§2). I then provide something of a deconstruction of the modal approach, seeking an explanation for this influence and longevity within the approach's internal framework. Ultimately, I identify such an explanation in a foundational assumption of the program, "modal asymmetry," along with the intuitive picture of human cognitive systems that supports the plausibility of this assumption (§3). After this, I present my heavily empirical argument that this picture of human cognition is in fact quite mistaken, undermining its capacity to offer intuitive support for modal asymmetry (§4). Following this critique of the modal approach, I then consider two potential refinements that one might maintain are capable of avoiding this critique. The first of these, individuating belief-forming processing according to reliability, I argue is ultimately unsuccessful (§5). However, by abandoning much of the intuitive motivations that broadly characterize the modal approach, a second option—a very weak formulation of the modal approach—does avoid problems associated with neural phase (§6). Finally, I close by reflecting on where all this leaves the modal approach (§7). While my argument certainly isn't the sort that could justify categorically rejecting the modal approach, it does seem to force a choice between restricting modal conditions to very weak formulations, bereft of the picture of human cognition that made the modal approach so appealing in the first place, and pressing pause on the modal approach until a new source of intuitive plausibility might be identified.

Finally, as here I will specifically utilize an iteration of previously introduced neural phase cases—albeit formulated a bit differently—I want to make clear precisely how this paper advances my 2019 account. Most importantly, here neural phase is applied to a different set of theoretical structures. My previous target was specifically the modal account of epistemic luck, only hinting at a potential application to safety. In contrast, here I develop a comprehensive account of the intuitive origins and theoretical foundations underlying the appeal of the modal approach (§3), and then apply neural phase cases to this account (§4). All this goes well beyond the scope of the 2019 paper. Next, I consider a specific individuation strategy proposed by Broncano-Berrocal, along with a few corresponding cases from the

philosophical literature (§5), all of which was overlooked previously. Finally, here I also consider weak formulations of the safety condition, at least a version of which crucially doesn't appear to have the same problem with neural phase that characterizes the modal approach generally. Accordingly, my discussion of the weak modal approach (§6) provides an important expansion of the epistemological understanding of neural phase cases.

2. The Modal Approach: Past and Present

My aim with this section is to make clear precisely what I mean by the “modal approach” by providing an overview of its major incarnations. To be clear, this will in no way constitute an exhaustive description of every output of the modal approach. As is characteristic of conditions on knowledge generally, the “canonical” formulations of the modal approach’s primary expressions—sensitivity, safety, and modalized anti-luck/risk epistemology—often differ from the more sophisticated formulations defended by epistemologists, formulations which will themselves vary between individual proponents of the same condition. However, at least until section five, the canonical formulations will suffice, and here I won't get into the specifics of individual formulations and incremental improvements. Reserving critique for the following sections, my focus here will be on the history and shared architecture of the modal approach. In doing so, this section will be structured roughly chronologically, working from the origins of the sensitivity condition through to safety and anti-luck epistemology, ending with the contemporary anti-risk project.

To begin a bit before the beginning, it is important to note that the use of modal formulations to explicate the structure of knowledge significantly predates what I'm considering the “modal approach.” The earliest such example of which I'm aware actually comes from Bertrand Russell: In *The Problems of Philosophy*, he explains our ability to gain knowledge from a newspaper announcement with the fact that the announcement “would not be made if it were false” (1912, 77). Another early example comes from Walting, who used a similar modal basis to explain our ability to, e.g., gain knowledge that a fire was burning simply from observing smoke (1955, 90). However, what demarcates these early efforts from the modal approach proper is their emphasis on the modal structure of certain facts about the external world, not beliefs. The birth of the modal approach came with the shift from explicating knowledge through the modal features of the reasons justifying our beliefs to explicating knowledge through the modal features of beliefs themselves.

Additionally, the emergence of the modal approach was characterized by an explosion in the volume of modal accounts of knowledge. The first explicit application of the modal approach appears to be from Armstrong¹ in 1968, followed by Carrier and Dretske (independently) in 1971 and Goldman² in 1976. While variously displaying vestiges of the preceding reason-centric proto-modal approach (especially Dretske and Carrier), all these early efforts produced conditions with a comparable modal structure: Knowledge that p requires something like not believing p were p false. In 1981, this structure found its canonical expression by way of Nozick's formulation of sensitivity:

SENSITIVITY: “If p weren't true, S wouldn't believe that p.” (Nozick 1981, 172)

¹ Armstrong said that his account was inspired by his reading of Wittgenstein (1968, 189; citing Wittgenstein 1953, §324). I'm not sure that I see the connection.

² Note that Goldman's causal theory of knowledge (1967) is widely recognized as a direct predecessor of these early efforts to formulate modal conditions on knowledge.

Moreover, sensitivity was accompanied by a second modal condition, subsequently referred to as “adherence:”

ADHERENCE: “If *p* were true, he would believe it.” (Nozick 1981, 176)

Note that while adherence will reappear later on in the paper, as sensitivity is by far the more consequential of the two conditions, here we will set adherence aside for the time being.

As with his predecessors,³ it was Nozick’s contention that this sensitivity of beliefs to truth was a necessary condition for knowledge, basing this argument on familiar appeals to individual cases and anti-skeptical concerns. Remarkably, Armstrong, Carrier, Dretske, and Nozick all seem to have more-or-less independently had the idea to formulate conditions on knowledge by appeal to the modal structure of belief.⁴ Reminiscent of the phenomenon of “multiple discoveries” in the sciences, on which major advancements are made, roughly simultaneously, by multiple parties independently, this further speaks to the deep intuitive appeal of the modal approach. As Nozick remarked upon surveying the contemporary proliferation of sensitivity-like conditions on knowledge, “Clearly, the idea is one whose time has come” (1981, 690). While sensitivity is certainly not as popular today as it might have once been, its significance in epistemology has endured (see especially Becker and Black 2012). Extending well into the 21st Century, defenders of versions of sensitivity abound (e.g. Adams and Clarke 2005; Black and Murphy 2007; DeRose 2010; Ichikawa 2011; Broncano-Berrocal 2018; Wallbridge 2018).

While sensitivity-based approaches to knowledge have been subject to multiple high-profile criticisms (e.g. inductive knowledge: Vogel 1987; Sosa 2000), perhaps the most glaring theoretical cost of sensitivity is that it doesn’t preserve the closure of knowledge under known entailment—*S* can know (i) that *p*, and (ii) that *p* entails *q*, without knowing (iii) that *q*. While some like Dretske (1970) and Nozick (1981) exploited the rejection of closure as part of an anti-skeptical strategy, for many epistemologists this is simply an unacceptable cost. This was one of the primary reasons cited by Sosa for developing an alternative to sensitivity, which he dubbed “safety,” the canonical formulation⁵ for which he introduced in 1999:

SAFETY: “Call a belief by *S* that *p* ‘safe’ iff . . . not easily would *S* believe that *p* without it being the case that *p*.” (Sosa 1999, 142)

As with sensitivity, proponents of safety characteristically maintain that the safety of *S*’s belief that *p* is (at least) a necessary condition for *S* knowing that *p*.

The core safety subjunctive—*S* would believe that *p* only if *p*—is structured like the contrapositive of sensitivity subjunctive—if not *p*, then *S* wouldn’t believe that *p*. Famously, however, the key innovation of safety was the observation that because “subjunctive conditions do not contrapose” (1999, 146), safety and sensitivity represent distinct constraints on knowledge. This allows for safety to, among other things, preserve closure. Accordingly, the popularity of safety has largely outstripped that of sensitivity. Versions of safety have

³ “Predecessors” is used here only in the temporal sense. At least as Nozick tells it in *Philosophical Explanations*, he had written a draft chapter on sensitivity before becoming aware of the modal accounts of Armstrong, Carrier, Dretske, or Goldman (1981, 689).

⁴ Goldman is a partial exception to this, citing both Armstrong and Dretske in his 1976 paper. However, as already noted (fn. 2), his own contributions to the origins of modal approach predate his explicit employment of it.

⁵ Early versions of safety were present in Williamson (1994, ch. 8), Sosa (1996), and Sainsbury (1997). Something resembling the safety condition appears earliest from Luper-Foy (1987a; 1987b), who, despite explicitly noting that “the contrapositives of counterfactual conditionals are not equivalent” (1987a, 572) has been confoundingly accused of precisely the opposite by Bernecker (2018, 572).

been defended by Williamson (2000, especially ch. 7), Pritchard (e.g. 2005; discussed more below), and a number of other philosophers since (Manley 2007; Carter 2010; Broncano-Berrocal 2014; Grundmann 2018; Hirvelä 2019; Schulz 2020).

Moreover, safety notably forms the foundation for its own anti-skeptical argument,⁶ as well as the dominant means of formulating anti-luck epistemology, which seeks to (at least partially) analyze knowledge as something along the lines of true belief that isn't true as a matter of luck. While this strategy was notably employed by Unger contemporarily with the emergence of the modal approach (1967; 1968), it was not until much later that the two would merge.⁷ The terms of this merger came by way of Pritchard's modal account of epistemic luck, which aimed to explicate, in modal terms, the theoretical structure of both luck generally and epistemic luck specifically. The centerpiece of this account is Pritchard's modal formulation for *veritic*⁸ luck, the luck that a belief is true, the canonical expression of which came in 2005:

VERITIC LUCK: “[T]his demands that the agent's belief is true in the actual world, but that in a wide class of nearby possible worlds in which the relevant initial conditions are the same as in the actual world—and this will mean, in the basic case, that the agent at the very least forms the same belief in the same way as in the actual world . . . —the belief is false.” (Pritchard 2005, 146)

Positioning his account firmly within the tradition of anti-luck epistemology, Pritchard maintains that a necessary condition on a belief constituting knowledge is that it isn't true as a matter of veritic luck. However, contrasting with previous accounts of epistemic luck (e.g. Foley 1984; Hall 1994; Vahi 2001), the key innovation of Pritchard's approach was that it did so through appeal the conceptual structure of luck itself. As we might quickly observe, when this approach is applied to the modal formulation of veritic luck, the result is nothing short of a version of the safety condition (on which safety is relativized to belief-forming processes). That is, safety is a necessary condition on knowledge precisely because it precludes the species of epistemic luck that is incompatible with knowledge.

This unification with the theoretical framework of anti-luck epistemology represented an enduring advancement in the modal approach. Although the modal account of epistemic luck has undergone a series of subsequent refinements (e.g. Pritchard 2007b; Carter and Pritchard 2015; Bondy and Pritchard 2018), its core formulation remains the dominant means of explicating the structure epistemic luck, and it is quite common to see this formulation applied to other questions in philosophy (e.g. Becker 2008; Michaelian 2013; Baker-Hytch 2014).

More recently, a new variant of anti-luck epistemology has emerged, on which the notion of knowledge-precluding veritic luck is replaced with knowledge-precluding veritic *risk*. Applying a parallel theoretical strategy to that of anti-luck epistemology, risk is first understood in modal terms—the riskiness of an event is a function of its modal closeness—and epistemic risk events are just understood as false beliefs. On the resulting “anti-risk epistemology,” knowledge requires “true belief on a particular basis . . . where the risk event

⁶ The basic idea is that because we couldn't easily be, e.g., brains in vats (BIVs)—it is, after all, a quite distant possibility—our beliefs that we aren't BIVs are safe. The thrust of Sosa's 1999 paper, this type of anti-skeptical strategy has subsequently been dubbed “Neo-Mooreanism” by Pritchard, with whom it is now largely associated (see e.g. Pritchard 2007a; Pritchard 2012a).

⁷ Note that the earliest example of which I'm aware that approximates combining anti-luck epistemology with the modal approach comes from Heller (1999).

⁸ The term “veritic luck” itself originated with Engel (1992).

of forming a false belief on that same basis . . . is not too modally close (Pritchard 2016, 566; see also Pritchard 2017). While it is unclear whether anti-risk epistemology will ultimately command the staying power of its predecessors, it does speak to the continued status of modalized epistemology as an active, evolving research program. It is not only the case that sensitivity, safety, and (modal) anti-luck epistemology remain epistemologically relevant—the modal approach itself is continuing to iterate.

Now, with all this laid out before us, it is important that we don't overstate the status of the modal approach within epistemology. While my aim here was not to catalog extant criticisms of modal conditions on knowledge, it is crucial to appreciate that objections abound.⁹ The modal approach is highly influential in epistemology, and it is undoubtedly one of a small number of major theoretical frameworks widely employed in formulating epistemic conditions on knowledge. However, it certainly does not enjoy anything close to consensus support amongst epistemologists. Indeed, even some of its most high-profile exemplars have complicated histories with the modal approach: Sosa, at least for a time, abandoned the idea that safety is a necessary condition on knowledge (see Greco 2018); Pritchard has since advocated for supplementing the modal approach with virtue epistemology (2012b), softening on his previous claim that “there is no need to endorse the more radical theory of knowledge proposed by virtue theorists” (2005, 9); finally, as discussed further below (fn. 14), Goldman's 1976 paper certainly doesn't represent the final form of his thought.

None of these equivocations, however, detract from the lasting legacy and continued importance of the modal approach to knowledge. By tracing the course of its history, its profound and enduring influence comes sharply into relief. This is perhaps one of the main lessons to be gained from the consistent philosophical output of arguments against its various constituent parts—the modal approach remains a force to be reckoned with in epistemology.

3. Modal Asymmetry

My aim with this section is to provide what might be called a “deconstruction” of the modal approach as a whole. First, this will mean identifying a key, foundational assumption of the modal approach, roughly that there is some asymmetry in the modal profiles available to known and merely true beliefs. Here I just refer to this assumption as “modal asymmetry.” After this, I'll explore why we might take this assumption to be plausible. In the end, the best explanation I can provide is that the intuitive plausibility of modal asymmetry, and therefore the modal approach itself, largely derives from how we intuitively think about the cognitive systems we rely on to support knowledge acquisition.

Let's begin by identifying the foundational assumption of the modal approach that will be the subject of the present critique. While this isn't to say that the modal approach doesn't commit to additional assumptions, here I will only focus on the one. Ultimately, I'm not that sure what I have to say here is especially surprising or profound, but it is nonetheless necessary that we state it explicitly: The modal approach to knowledge—which seeks to formulate conditions on knowledge by appealing to the modal structure of beliefs and/or belief-forming processes—assumes that there is a structural difference between the modal profiles available to known beliefs vs. unknown true beliefs. This modal asymmetry might be formulated in the following way:

⁹ Becker's “Modal Epistemology” Oxford Bibliography—last updated in 2018—does an especially good job at outlining key criticisms regarding the modal approach (2010).

MODAL ASYMMETRY: There is some property of the modal profiles of all known beliefs that is not displayed by at least some unknown true beliefs.

Before continuing, here we need to be a bit careful, and a few points of clarification are in order. First, here I will use “modal profile” to imprecisely refer to how possible worlds are situated in modal space with respect to the actual world. Thus, taking some belief to be held in the actual world, this belief’s modal profile is just a matter of which possible worlds are close and which are not. Next, in keeping with our conceptualization of the modal approach as seeking to describe (at least) necessary conditions that separate mere true belief from knowledge, this formulation of modal asymmetry assumes the standard, belief-centric analytic approach as its starting point.¹⁰ Finally, and perhaps most importantly, it is crucial that we don’t confuse modal asymmetry with the claim that the modal profile of *tokens* of knowledge states are necessarily asymmetrical, but instead keep in mind that this is an asymmetry between *types*. On modal asymmetry, knowledge and mere true belief differ as types of states in what modal profiles are available to specific instances of these states, but there still might be tokens of knowledge and mere true belief that display symmetrical modal profiles. This is a reflection of the widespread sentiment among practitioners of the modal approach that a modal condition might be necessary for a true belief to constitute knowledge without being sufficient—In fact, I expect some might puzzle that modal asymmetry just appears to be an unusual way of saying that there is some necessary modal condition on knowledge. This, I’ll concede, isn’t entirely incorrect, but I assure the reader that it will come in handy to express things in terms of modal asymmetry as we dig into the intuitive foundations of the modal approach.

With these clarifications out of the way, we might then understand modal asymmetry to express the bare minimum requirement for formulating a modal condition on knowledge—there must be some modal difference between knowledge and the type of epistemic state (i.e. mere true belief) we’re seeking to contrast it with. Despite forming the basis for one of the primary approaches to analytic epistemology, this assumption is not frequently noted, and it is quite rare to see it directly questioned. One notable exception comes from Vogel, whose formulation of this assumption is that, “knowledge is essentially modal in character: Actual true belief is insufficient for knowledge; true belief in some range of counterfactual situations is also required” (2007, 73). Seemingly determined to disparage the modal approach,¹¹ Vogel dubs this assumption “subjunctivitis.” Interestingly, however, despite setting out to argue against this modal assumption about knowledge, Vogel proceeds to criticize sensitivity and safety on independent grounds. All this, then, raises the question of why the assumption itself seems to attract so little criticism—What is it that makes the foundations of the modal approach so plausible? For the remainder of this section, my goal will be to guide us towards the best explanation that I can gather.

I want to begin by considering an analogy offered by Williamson, which he introduced to convey ideas like safety,¹² danger, stability, and instability:

Imagine a ball at the bottom of a hole, and another balanced on the tip of a cone. Both are in equilibrium, but the equilibrium is stable in the former case, unstable in the latter. A slight breath of wind would blow the second ball off; the first ball is harder to shift. The second ball is in danger of falling; the first ball is safe. Although neither ball did in fact fall, the second could easily have fallen; the first could not. (2000, 123)

¹⁰ It might be worth noting that, due to his knowledge-first approach, Williamson’s support for safety of course defies this characterization of both modal asymmetry and the modal approach.

¹¹ “Conjunctivitis” refers to ocular inflammation more commonly known as “pink eye.”

¹² Understood in the broader sense, not the strictly epistemological one.

While Williamson didn't do so explicitly,¹³ it is no great leap to extend this analogy to knowledge and mere true belief. The stable ball of course represents knowledge, while the unstable ball represents (at least a class of) mere true belief. Moreover, "falling" here represents some variety of cognitive error, although here we must be careful. It would be a mistake to read too much into the use of "safety" in the general sense—The danger need not be expressed as a violation of safety (in the epistemological sense; believing falsely). Instead, there are two different ways we might disambiguate cognitive error: (1) "Falling" could mean not believing the operative *p* when *p* is true, or (2) "falling" could mean believing the operative *p* when *p* is false. Regardless of how we fill in the details of cognitive error, however, intuitively this analogy seems to capture something important about knowledge, something that clearly supports an assumption like modal asymmetry: Further borrowing language from Williamson (2000, 123), knowledge and the stable ball are alike in that any danger is always *distant*, only occurring under sufficiently dissimilar conditions. This contrasts with the unstable ball and many mere true belief, for which, regardless of how *slight* the relevant dangers are, they are certainly not distant. Ultimately, we are left with a quite compelling picture of at least part of what separates knowledge and merely true belief. When we know, the possibility of knowledge-precluding cognitive error (whatever that might be) is not merely slight but categorically distant. The same cannot be generally said for merely true belief.

I now want to explore this picture of knowledge a bit further, in order to gain an idea of where it—along with the intuitive appeal for modal asymmetry—might come from. It is my contention that we tend to think about knowledge in this way precisely because of the way we think about the cognitive systems that support knowledge acquisition: *Under those conditions conducive to gaining knowledge, the danger of cognitive error is distant*. This sort of thinking is perhaps best exemplified by Goldman:¹⁴

What kinds of causal processes or mechanisms must be responsible for a belief if that belief is to count as knowledge? They must be mechanisms that are, in an appropriate sense, "reliable." Roughly, a cognitive mechanism or process is reliable if it not only produces true beliefs in actual situations, but would produce true beliefs, or at least inhibit false beliefs, in relevant counterfactual situations. (1976, 771)

Let's call this idea the "distant error" picture of knowledge-generating cognitive processes. This sentiment, I maintain, represents the core of modal asymmetry's plausibility, and thus broadly explains the appeal of the modal approach. In order to understand why, first observe that there are two types of knowledge-incompatible cognitive error implicit in this formulation: (1) the failure to produce true beliefs and (2) the failure to inhibit false beliefs, both in "relevant counterfactual situations." Assuming that the relevance of these situations is understood in terms of modal closeness to the actual world, we then see that (1) corresponds with a violation of adherence, and (2) corresponds with a violation of both sensitivity and safety. In short, baked into the idea that the cognitive systems we rely on for knowledge cannot easily err are the roots of the sensitivity, adherence, and safety conditions themselves. The theoretical structure of these conditions might even be explained as a reflection of two fundamental modes of error for a detection system. To borrow terms from signal detection

¹³ Indeed, his knowledge-first commitments complicate the sort of natural extension that I'll provide here.

¹⁴ Note that the use of the word "reliability" here doesn't quite match the more received sense in epistemology, which we see in Goldman just a few years later (e.g. 1979), on which reliability simply means producing a high proportion of true beliefs. Accordingly, here I'll refrain from using "reliability" in this modal sense.

theory, adherence demands no easy *misses*, whereas sensitivity and safety demand no easy *false alarms*.¹⁵

This now puts us in a position to venture a reasonable response to the question I hoped to answer here—What explains the plausibility of modal asymmetry? Put simply, the way we normally think about the cognitive systems we rely on for knowledge. A bit more precisely, modal asymmetry seems plausible because we as epistemologists tend to think that knowledge-producing cognitive systems themselves display certain modal characteristics, at least when conditions are conducive to knowledge acquisition, which are then inherited by the modal profiles of the known beliefs generated by these systems. As a good deal of merely true beliefs quite clearly don't display these modal characteristics, the natural conclusion is then that the modal profiles of known beliefs display properties that the modal profiles of at least some unknown true beliefs do not. Moreover, because these modal characteristics of knowledge-producing cognitive systems are understood in terms of suppressing some variety of cognitive error regarding S's believing that p (at a minimum under those conditions for which it is possible for S to use those systems to gain knowledge that p), we are left with a rather narrow set of options for explicating what these special properties of the modal profiles of known beliefs might be. Broadly speaking, this error might either be (1) missing that p, i.e. failing to believe that p when p is true or (2) a false alarm that p, i.e. believing that p when p is false. The former corresponds with an adherence-based approach, on which the modal profiles of known beliefs display no close possible worlds containing (1). Similarly, the latter corresponds with a both a sensitivity- and safety-based approach, on which the modal profiles of known beliefs display no close possible worlds containing (2). In quite short order, then, we might observe that this picture of the cognitive systems we rely on for knowledge generates both plausibility for modal asymmetry and a theoretical framework that displays the very contours we observe for the modal approach. For this reason, I am quite convinced that much of modal asymmetry's plausibility, and indeed the appeal of modal approach itself, is founded on this widely accepted idea that, when we are in a position to gain knowledge from some knowledge-producing system, there is some variety of cognitive error that such a knowledge-producing cognitive system cannot easily succumb to.¹⁶ In the next section, however, I will argue that this idea appears mistaken, calling the foundations of the modal approach into question.

4. Neural Phase and the Modal Profile of Known Belief

Up to this point, we have discussed the considerable influence and staying power of the modal approach to knowledge, along with the likely origins of the strong intuitive plausibility of its foundations—the view that knowledge-generating cognitive systems cannot, in some sense, easily err. My aim now is to argue that, in light of recent developments in cognitive neuroscience, this view is mistaken. In doing so, I'll begin by discussing two key features of an electrophysiological phenomenon known as “neural phase:” (i) the whole of neural phase space is represented in close possible worlds, and (ii) our perceptual detection thresholds vary with neural phase. While these features only directly refute the “distant error” picture of knowledge-supporting cognition in a narrow band of conditions, which will generally only obtain in a laboratory setting, this is nonetheless sufficient to undermine the picture's intuitive plausibility. Here I'll walk through the consequences of this loss for each major

¹⁵ A miss is not perceiving a stimulus when it is presented, and a false alarm is perceiving a stimulus when it is not presented.

¹⁶ One partial exception to this may come from the very weak formulation of the modal approach, discussed in section 6.

iteration of the modal approach. Crucially, at the conceptual level, the key lesson from neural phase is that it is simply not reasonable to employ the distant error view as an inoculation against a class of counterexamples to outputs of the modal approach. All told, there appears to be no asymmetry in the modal profiles available to known and merely true beliefs, at least which might have been generated by modal characteristics of knowledge-producing cognitive systems. In this manner, we might understand that whatever the merits of modal asymmetry might be, they do not derive from properties of human cognition.

Before I say anything further, it is important to not forget that this neural phase phenomenon has previously been applied to the modal account of epistemic luck (Bricker 2019), and here I will in no small way follow my previous treatment of the phenomenon. While I've opted to use a different presentational mode and framing, both the overview of neural phase and the specific case I provide here largely recapitulate content from the 2019 paper (especially §§3-4). Crucially, however, the way I apply this case is entirely different. While before I didn't quite fully grasp the significance of all this, constructing a relatively narrow argument about the modal account of epistemic luck, here I'll systematically apply neural phase to the framework I introduced in the previous section for understanding the modal approach to knowledge as a whole. Ultimately, far from simply giving us reason to suspect the canonical modal formulation sometimes confuses different species of epistemic luck, the case of neural phase calls into question much of the present enterprise of formulating modal conditions on knowledge.

With this point of precedent in mind, I now want to say a bit about the brain. One especially salient characteristic of neural activity, particularly when measured using EEG, is that the brain displays regular oscillatory behavior in a number of frequency bands. The strongest of these bands, around 10 Hz, is known as the "alpha band." While the dynamics of neural oscillations are quite complex, here I will only focus on the two key points referenced above regarding the phase¹⁷ of these oscillations, the first of which concerns their modal profile.¹⁸

If you close your eyes for about a second, in that time your brain will have completed around 10 full oscillations in the alpha frequency band, which quite possibly would have been strong enough to easily observe on a real-time EEG recording. Upon opening your eyes, while the power of these oscillations quite likely decreased, they did not disappear. At least in normal conditions, your brain will always be displaying some kind of oscillatory behavior. The point here is that, for some frequency band, when your brain is in neural phase state ϕ , very little needs to change for you to be in some different ϕ . Indeed, with you sitting there with your eyes closed for a second, your brain cycled through all possible phase configurations around 10 times. This, I think, is sufficient to illustrate the following property of the modal profile of neural phase: *When S is in neural phase state ϕ and world W , the whole of S 's neural phase space ($\phi \pm \pi$) occupies possible worlds very close to W .*

The second point about neural phase I want to highlight here is perhaps a bit more interesting: A number of studies from cognitive neuroscience have demonstrated that *visual*¹⁹ *detection thresholds vary with neural phase*, especially in the alpha band (Busch et al. 2009; Mathewson et al. 2009; Ronconi et al. 2017; Harris et al. 2018; however see Ruzzoli et al. 2019 for a partially dissenting account). That is, how well you can detect a visual stimulus is not fixed, but instead is rapidly changing with your neural phase. One way to think of this is

¹⁷ Because these oscillations are regular (approximately sinusoidal), we can think about their phase just like any other wave function. Phase is, roughly, "where" a wave is in its oscillation at some given point in time.

¹⁸ For much more on neural oscillations, see VanRullen (2016).

¹⁹ Note that this phase effect isn't limited to visual perception. It has also been observed for somatosensory perception (Ai & Ro 2014; Baumgarten 2015) and appears to reflect a more general feature of the neural bases of human cognition (Jensen & Mazaheri 2010).

in terms of “periodic fluctuations of visual perceptual abilities” (Busch et al. 2009, 7875). Another way this might be conceptualized is as “gated inhibition,” on which “alpha activity produces bouts of inhibition repeated every 100 ms” (Jensen & Mazaheri 2010, 1 & 4). I would direct the reader to Bricker (2019, §3) for a narrow, epistemology-gearred introduction to this effect, as well as VanRullen (2016) for a broad, neuroscience-gearred treatment. While this is quite a complex phenomenon, the key takeaway here is that rapidly, constantly, and outside of our awareness, our ability to detect visual stimuli is fluctuating.

Taken together, the above two points allow us to confidently make the following observation: Whatever our actual visual detection thresholds happen to be at any given point in time, there are close possible worlds in which they are different. This follows directly from the modal profile of neural phase space and the fluctuation of visual detection power with neural phase. In some cases, this will mean that there are close possible worlds in which S’s detection power is higher than it is in the actual world; in other cases, the ones we’ll be interested in here, this means that there are close possible worlds in which S’s detection power is lower than it is in the actual world. This is simply a feature of ordinary human perception, more or less hardwired into the neural structures that support it. Now, it is important that we don’t overstate the empirically supported details of these easy changes in perceptual ability. Because they are very rapid and relatively minor, actual fluctuations will only be epistemically relevant for stimuli typically only encountered in laboratory settings, in which stimulus intensities are near-threshold and stimulus durations are exceedingly short. However, when such conditions hold, this means that close possible worlds in which S’s visual detection power is lower become close possible worlds in which there is a greater chance that S commits a cognitive error—Because S could have easily had a higher threshold for visual detection, there are close possible worlds in which the probability of both misses and false alarms are greater than they are in the actual world.²⁰

This, I would submit, is all the empirical background required to undermine the distant error view of knowledge-producing cognitive systems. In order to unpack this, let’s take it in steps. First, the simple part is that ordinary visual perception is of course a knowledge-producing cognitive system, perhaps even *the* epistemic paradigm of such systems. Accordingly, there can be little doubt that properties of our ordinary visual systems are indeed properties of the cognitive systems that we rely on for knowledge. Next, it seems reasonable to assume that, if there is a large class of possible worlds containing a significant chance of cognitive error, then at least some of these will be worlds in which this cognitive error in fact occurs. Accordingly, we can observe that the increased probability of error in close possible worlds associated with certain portions of neural phase space will indeed result in some of those close worlds containing cognitive error.

Now, the critical question becomes whether this can occur under conditions conducive to the acquisition of knowledge through visual perception, and it is here we must make our transition from empirical to conceptual argument. Presently, I’m not sure it’s clear whether the available empirical evidence documents actual cases of potential knowledge acquisition.²¹ However, what all this empirical framework does do is provide us with the tools needed to clearly illustrate that such cases are *possible*—As we’ll see shortly, conceptually, there is nothing to stop us from positing cases in which the neural phase effect is moderately stronger than it is in the actual world. Indeed, this is precisely what I’ve done previously, imaging a counterexample in which, at certain ϕ s, S’s visual detection threshold was such that S could reliably detect some stimulus and thereby know whether it had been

²⁰ I should note here that here I’m using “false alarm” a bit loosely, so that it includes cases like those in which the “stimulus” is a lack of flash of light. The motivation behind this is discussed further on in this section.

²¹ For example, as is common procedure for these kinds of experiments, the Busch et al. study used a quite demanding detection task, with a mean hit rate of only 54% (2009, 7870).

presented, but, at other ϕ s, her detection threshold was high enough that her beliefs were scarcely more accurate than chance (Bricker 2019, §3). While such a counterexample is stipulative, going beyond what can be justified by empirical evidence alone, this really isn't the point. Rather, the point is that the empirical evidence puts us in a strong position to easily imagine such cases, providing us with a neural phase mechanism capable of explaining how the relevant varieties of close possible error might emerge. This is particularly important given that epistemologists often think of perception as something that cannot randomly err, instead requiring an explanation for error. As put by Martin Smith, "It can't be that I just misperceive—there has to be more to the story" (2016, 38). The value of neural phase is that it gives us this story.

In this manner, we can understand the nature of the challenge neural phase poses to the distant error view of knowledge-supporting cognition—It provides the empirical foundation required to exacerbate a conceptual breakdown between how we think about knowledge and how we think about distant error. In order to understand this a bit better, let's consider a reframing of something resembling the "Cameron" counterexample (Bricker 2019, 6): First, let's imagine some individual, Charles, with actual-world properties of ordinary visual perception. For some simple stimulus, say a flash of light, Charles can reliably detect whether the stimulus has been presented—It is well within Charles' visual capacity to easily discriminate between a flash of light and no flash of light, and the vast majority of the time (say >99%), he will do so correctly. Clearly, we have no problem granting that Charles' visual perception in this case is a knowledge-producing cognitive system, and thus that Charles can come to know whether the stimulus was presented. Now, let's posit that for some narrow phase band, say less than 1% of Charles' neural phase space, Charles' visual detection power is too low for him to reliably detect whether the stimulus has been presented. Otherwise, however, his visual system functions normally.

Now we come to the pivotal question: In positing this anomalous phase band, do we thereby remove Charles' ability to gain knowledge when not in this phase band —on the basis of his ordinary, reliable perceptions—whether the stimulus was presented? While elsewhere I've presented a highly detailed argument to this end (2019, §4), I would contend that our intuitions are quite clear on this matter. Obviously, Charles can still know whether the stimulus was presented when outside of the anomalous phase band. This is despite the fact, however, that there will be close possible worlds, corresponding with the anomalous phase band, in which Charles' belief succumbs to cognitive error. Indeed, there seems to be no epistemically relevant species of cognitive error to which Charles' knowledge could not have easily succumbed. In order to illustrate this point, we now need to disambiguate what is meant by "epistemically relevant cognitive error." In so doing, it will become clear that the distant error picture is simply mistaken, along with its support for the idea that known and merely true beliefs display asymmetrical modal profiles. Moreover, as the varieties of cognitive error we're interested in here happen to recapitulate the iterations of the modal approach discussed in section 2, this disambiguation also serves to summarize how sensitivity, adherence, safety, and anti-luck/risk epistemology all struggle with neural phase.

The first thing we might mean by "cognitive error" is a *miss*, i.e. not perceiving a stimulus when it is presented. Accordingly, we might then ask whether Charles with the narrow phase band issue could, as the result of being in this phase band, fail to perceive the stimulus when it is presented. Here the answer is straightforwardly yes, as he wouldn't have the detection power to perceive this stimulus. Crucially, however, this of course doesn't mean that Charles cannot know that a stimulus was presented when outside of this phase band, in which case his visual system is functioning reliably, as normal. Thus, we might observe that any asymmetry between the modal profiles of (i) Charles' known belief and (ii) unknown true beliefs cannot be understood in terms of a difference in whether there are close possible

worlds in which Charles' doesn't believe that a stimulus was presented when one was. Both the modal profiles of (i) and (ii) can contain such close possible worlds. Moreover, we might note that this of course constitutes a violation of *adherence*: Here Charles can know that p despite there being close possible worlds in which p is true, but Charles fails to believe that p . In short, taking cognitive error in the sense of a miss, we can understand that the distant error picture fails for visual perception, with the corollary modal condition of this type of error—*adherence*—failing along with it.

Now let's consider "cognitive error" in the sense of a *false alarm*, i.e. perceiving a stimulus when none is presented. Here things get a bit more complicated. While it is certainly not the case that the anomalous phase band could result in Charles perceiving a flash of light when none is presented, Charles might instead have false alarms for the absence of a flash of light. Accordingly, understanding the "stimulus" to be no flash of light, when in the narrow phase band (in which his visual detection power is much lower than normal), we might observe that Charles will still perceive that no stimulus was presented, even when it isn't the case (i.e. one is presented). Again, this crucially doesn't mean that Charles cannot know that no stimulus was presented when outside of the narrow phase band, as his detection power is strong enough to perceive a stimulus when presented. Accordingly, we might now observe that any asymmetry between the modal profiles available to known and mere true beliefs does not derive from whether Charles can easily perceive that p when not p . This property can instead be displayed by both the modal profiles of known and unknown true beliefs alike. Moreover, this disambiguation of course corresponds with a violation of both the *sensitivity* and *safety* constraints on knowledge: Here Charles can know that p (no stimulus was presented), despite there being close possible worlds in which p is false, but Charles still believes that p . In short, understanding cognitive error as a false alarm fares no better than understanding it as a miss. So disambiguated, the distant error picture still doesn't hold for visual perception, and the sensitivity and safety conditions that derive from this picture no longer seem like reflections of the modal profiles available to known beliefs.

Beyond cognitive error corresponding with any possible misses or false alarms, there remains a more restricted sort of error that also requires our attention, that on which *belief-forming processes* are held fixed. After all, it could be that the modal profiles available to known and unknown true beliefs differ with respect to the cognitive errors produced by the same belief-forming process as the target belief, even if such errors are more broadly represented in both. Indeed, this is the attitude reflected in the method-based approach to safety that provides the basis for modalized anti-luck and anti-risk epistemologies. The critical question is then whether, when Charles forms beliefs based on perceptions acquired in the anomalous phase band, he is employing the same belief-forming process as when he forms beliefs based on perceptions acquired outside of that phase band. Intuitively, I think it is quite clear that he is of course using the same belief-forming process in both cases, simply basing his beliefs on what he does or doesn't see, as is ubiquitous in ordinary human cognition. Moreover, while I'll consider a closely related question in much more detail in the next section, we might observe here that it would seem to be a mistake to try to individuate Charles' belief forming processes on the basis of his neural phase state at the time his perceptions formed. This would entail that our latent belief-forming processes, at least involving visual perception, are constantly changing with the rapid changes in our neural phase states, the unpalatable consequence of which is that it would now be extraordinarily difficult to specify when two individuals (or one individual at two points in time) apply the same belief-forming process. Accordingly, we might say, at least preliminarily, that when Charles knows that no stimulus has been presented, there are close possible worlds—corresponding with the anomalous phase band—in which this same belief, formed in the same way, is false. Even restricting cognitive error to individual belief-forming processes, the

distant error picture of knowledge-supporting cognitive systems still appears mistaken. We again fail to observe any difference between the modal profiles available to known and unknown true beliefs.

As there was a good deal going on in this section, it might be helpful to reflect a bit before considering potential limitations of my critique. Our starting point was a recently discovered neural phase phenomenon, which we noted was at odds with the distant error picture of human cognition: Knowledge-generating cognitive systems, e.g. ordinary visual perception, can in fact easily err, even in conditions conducive to knowledge acquisition. As the distant error picture broadly serves as the intuitive basis for modal asymmetry, with the observation of this mistakeness came the conceptual tools necessary to undermine the putative modal asymmetries (sensitivity, safety, etc.) that derive from the distant error picture. While it might happen that there are often modal differences between tokens of knowledge and merely true belief, we can now understand that this might not reflect anything fundamental about the theoretical structure of knowledge. Ultimately, with the idea of distant error no longer available, it isn't clear that the modal approach retains its efficacy or its appeal.

5. Endogenous Change and Individuating via Reliability

With the above critique of the modal approach in place, I now want to examine potential weak points in the argument I've presented. Perhaps most obviously, in section two, I focused primarily on the history and architecture of the canonical modal conditions on knowledge, without paying close attention to the nuances of individual conditions. While this fits with the broad ambitions of the paper, it does come at the cost of not giving the modal approach a fair shake, as there are certain specific modal accounts that are notably more resistant to neural phase problems. Accordingly, the aim of the next two sections is to consider a pair of ways through which proponents of the modal approach might seek to avoid problems with neural phase cases. In this section, I'll consider a reliability-based strategy for individuating belief-forming processes, endorsed by multiple epistemologists, on which Charles' in-phase beliefs would form according to a different process than his out-of-phase beliefs. Ultimately, I'll argue that, despite offering a way around the Charles case specifically, such a strategy ultimately runs afoul with a different sort of neural phase case. For this reason, I don't think that it represents a promising way forward for the modal approach.

Let's begin with those modal accounts that do not consider Charles' in-phase beliefs to form according to the same process as his out-of-phase beliefs. First, both Broncano-Berrocal (2014) and Hirvelä (2019) have advanced versions of safety on which belief-forming processes are individuated by reliability, so that if two process tokens generate differential reliability over some range of cases, they cannot be tokens of the same process type.²² Broncano-Berrocal's mechanism for this is simply a stipulation that a necessary condition for two method tokens being of the same method type is that they are equally reliable over the "same field of propositions and the same range of circumstances" (2014, 74), and Hirvelä applies this same strategy to his own account (2019, 1180). When such an individuation strategy is taken together with a version of safety that is relativized to belief-forming processes, the results then seem to straightforwardly undermine my critique of the modal approach. As in- and out-of-phase beliefs correspond with different degrees of

²² Note that we see something similar in Sosa's seat-shape-situation framework for one's present "disposition to judge correctly" (see e.g. 2015, 113), on which Charles' shape is modulated by his neural phase. However, given the complexities of Sosa's account, not the least of which is its relationship with the modal approach, here I've opted to focus primarily on Broncano-Berrocal's strategy.

reliability over the same range of circumstances, they would correspond with different belief-forming processes. We might then disambiguate cognitive error in terms of individual belief-forming processes in a way that still preserves the distant error picture of knowledge-support cognition, circumventing any issues with neural phase cases.

To be clear, here I will not contest that this sort of individuation strategy offers a mechanism on which Charles' in-phase and out-of-phase beliefs might be stipulated to form according to distinct belief-forming processes, thereby offering a response to my critique of the modal approach. Instead, I'll aim to show that this response falls flat because the individuation strategy it employs is almost certainly mistaken. In doing so, we'll find that, in committing to its own version of the distant error picture for knowledge-supporting cognition, this individuation strategy goes wrong precisely in the same way as the modal approach generally. In order to understand why this is, let's start by taking a look at the sorts of cases that might motivate us to individuate belief-forming processes by the reliability of process tokens. One such example, which is remarkably similar to the Cameron/Charles case, comes from Neta and Rohrbaugh:

I am participating in a psychological experiment, in which I am to report the number of flashes I recall being shown. Before being shown the stimuli, I consume a glass of liquid at the request of the experimenter. Unbeknownst to either of us, I have been randomly assigned to the control group, and the glass contains ordinary orange juice. Other experimental groups receive juice mixed with one of a variety of chemicals which hinder the functioning of memory without a detectable phenomenological difference. I am shown seven flashes and judge, truly and knowingly, that I have been shown seven flashes. Had I been a member of one of the experimental groups to which I was almost assigned, I would have been shown only six flashes but still believed that I had been shown seven flashes due to the effects of the drug. It seems that in the actual case I know that the number of flashes is seven despite the envisaged possibility of my being wrong. And yet these possibilities are as similar in other respects as they would have to be for the experiment to be well designed and properly executed. (2004, 400)

Similar cases have been presented by Lasonen-Aarnio, who imagines a barometer that is only accurate at high altitudes (2010, 7), and Sosa, who imagines the precipitous drop in perceptual capacities that would have been associated with one more strong drink (2015, 113). While our respective protagonists could have easily chosen the wrong juice, used the barometer at the wrong altitude, or gone for that final stiff one—and accordingly subjected themselves to cognitive error—because they didn't, we nonetheless judge that they can gain knowledge from their unimpaired faculties and/or meteorological instruments. The natural explanation a safety theorist might offer for these judgements is that, had our subjects been in the error conditions, they would have been using different belief-forming processes. Therefore, such cases do not pose a problem for the safety condition. Again, here I'm not disputing this claim about different belief-forming processes being employed, and I find it especially plausible in the two drink-based cases. Instead, what I want to show here is that Broncano-Berrocal's individuation strategy does not provide a viable route to a similar conclusion in the Charles example. While it gets the above cases right, it simply isn't equipped to handle neural phase.

In order to understand why individuating by reliability doesn't work for certain neural phase cases, I now want to ask how such cases differ from the chemical- and altitude-induced errors present in the cases above. Put simply, error associated with fluctuations in neural phase is *endogenous*. Its source is internal, originating within our neurocognitive systems themselves. The transition from a state of reliable belief formation (e.g. the in-phase condition) to one of diminished reliability (e.g. the out-of-phase condition) not attributable to any external factor, but instead occurs spontaneously, a byproduct of our neural architecture. In contrast, the other errors considered above are *exogenous*, originating externally. They

either involve the introduction of some foreign substance or a change in environment. This endogenous-exogenous distinction then allows us to make a critical observation. Because error associated with fluctuations in neural phase is endogenous, this allows for modal characteristics that are difficult to reproduce exogenously. Most notably, the entirety of neural phase space seems to stand in a different sort of relation to the actual world than the entirety of, for example, drink space.²³ After all, even when you very easily could have had that drink, at no point do you cycle through the entirety of drink space at 10 Hz. While I'm not sure precisely how to best conceptualize the nature of this extremely close modal relationship between one's phase state in the actual world and the rest of phase space, it is intuitively quite clear that this is rather different than the modal relationship we see with exogenous state changes in the examples discussed above. In short, not only are neural phase cases distinguished by their endogeneity, but this endogeneity seems to facilitate modal characteristics that are difficult to imagine originating from exogenous error sources.

Now we're in a position to ask how the reliability-based individuation strategy handles endogenous sources of cognitive error, especially with the hyper-close characteristics displayed by neural phase. As discussed above, it does provide the result sought by safety theorists that Charles' in-phase beliefs form according to a different process than his out-of-phase beliefs. However, the problem with this strategy is that the individuation doesn't stop there. In what might be dubbed "explosion," it now seems that, for visual perception, at least most differences in neural phase between belief-forming process tokens will entail different process types.²⁴ Even restricting ourselves to real-world cases, we might still easily imagine laboratory circumstances in which the slight differences in detection power entailed by differences in neural phase produce small but measurable differences in reliability. After all, this is precisely what is shown by the studies documenting the phenomenon in the first place. Say we form some perceptual belief B_1 in phase state ϕ_1 , which corresponds with some degree of reliability R_1 for some experimental task that is sensitive to neural phase.²⁵ On the Broncano-Berrocal individuation strategy, only beliefs that form in ϕ s that also correspond with a reliability of R_1 can form according to the same process as B_1 . However, as reliability appears to decrease roughly monotonically as ϕ s increase/decrease from 0 (see e.g. Busch et al. 2009), there will be very few ϕ s besides ϕ_1 that will result in a reliability of R_1 for this experimental task. Moreover, as there's nothing to stop us from positing a scenario in which reliability falls off perfectly monotonically, symmetrically, and significantly²⁶ from $\phi = 0$, in which case there will only be one other phase state corresponding with a reliability of R_1 , $\phi_1 + \pi$. This means that, whenever S forms some belief on the basis of visual perception in some phase state, we can describe a scenario in which the vast majority of other neural phase states will generate beliefs at a different level of reliability. Taking this to entail a difference in belief-forming process, we can then understand the nature of the explosion entailed by such an individuation strategy. In short, almost all of our beliefs formed on the basis of visual perception would in fact correspond with different belief-forming processes.

That this mirrors what we observed in the previous section for the prospects of directly individuating according to neural phase shouldn't come entirely as a surprise. After

²³ Drink space = {had the drink, didn't have the drink}.

²⁴ The obvious exception comes from phase angles that correspond with equal detection powers on either side of $\phi = 0$. For example, in a symmetrical distribution, $\phi = \pi/2$ would correspond with the same reliability as $\phi = -\pi/2$.

²⁵ There is a concern here that "forming a belief in phase state ϕ " might not be a well-defined concept for most everyday cases, in which belief formation will occur over a range of phase states. I would have to agree with this and concede that I'm using this as loose talk to refer to the specific phase state at the moment visual information from the relevant stimulus is first processed.

²⁶ The key here is that, by positing as precipitous a fall in reliability as we like, we might preempt any attempt to reformulate the individuation strategy to a coarser grain of reliability.

all, in these cases, reliability is correlated with neural phase. Accordingly, as I indicated in the previous section, I think it is quite clear that this result is highly undesirable, entirely missing what we have in mind when we talk about belief-forming processes. Individuating according to the reliability differences associated with differences in neural phase, we would no longer be able to meaningfully talk about two different people employing the same belief-forming processes, or one person employing the same process at two different points in time. Moreover, we might quickly observe that such individuation poses its own significant problem for safety, short-circuiting its ability to handle cases that shouldn't cause it any trouble. Considering the following:

*The Phase-Resetting Sheep*²⁷

Standing in a field, Sarah sees a sheep-like dog standing far enough away that she mistakenly believes it to be a sheep. Accordingly, Sarah forms the belief that there is a sheep in the field. However, unbeknownst to Sarah, there is a sheep standing on the very periphery of Sarah's visual field, so her belief is true.

The sheep is situated in Sarah's visual field so that, while not reaching Sarah's conscious awareness, low-level visual information from the sheep is still processed unconsciously. At it happens, Sarah has a neurological abnormality on which this precise sheep-like dog + sheep stimulus configuration resets²⁸ here neural phase state to ϕ_1 , corresponding with reliability R_1 for some phase-sensitive scenario. However, this same neurological abnormality also resets her neural phase when there is a sheep-like dog in her visual field in the absence of any sheep, but this time to ϕ_2 ($\neq \phi_1$), which corresponds with R_2 ($\neq R_1$) for that same phase-sensitive scenario.

In such a case, we of course judge that Sarah doesn't know that there is a sheep in the field, and our expectation is that a process-relativized safety condition should easily be able to handle this sort of sheep-in-the-field case. Indeed, as long as we don't individuate belief-forming processes according to reliability, we find exactly that. There will be many close possible worlds (i.e. those absent a sheep) in which Sarah's same belief, formed in the same way, will be false. However, if we individuate according to reliability, we find that our safety condition is no longer able to provide this result. Now, there will be no worlds in which the same belief *formed in the same way* is false. Instead, whenever Sarah's belief is false (i.e. there isn't a sheep), she will be in a different phase state, which corresponds with a different level of reliability in certain scenarios, and therefore entails that here respective belief-forming processes cannot be reliable to the same degree for the same field of propositions and the same range of circumstances. Accordingly, process-relativized safety would no longer be able to explain why Sarah clearly doesn't have knowledge in this case. Ultimately, because the Broncano-Berrocal individuation strategy undercuts safety's ability to handle cases it clearly should be able to, in addition to requiring a strong break with our intuitive understanding of belief-forming process, it doesn't seem to represent a successful strategy for individuating beliefs. In this manner, we might diffuse the challenge it presents to my interpretation of the Cameron/Charles case.

²⁷ Note that this might be considered something of a spiritual successor to the "Greg in the Field" case (Bricker 2019, 12).

²⁸ Phase resetting is a very real phenomenon on which a stimulus can shift or "reset" one's neural phase from the pre-stimulus value (see e.g. Makeig et al. 2004). However, I'm of course taking some liberties here for the purpose of making a conceptual point.

At this point, as a word of moderation, I should note that I of course cannot definitively rule out the possibility that some other individuation strategy might allow a proponent of the modal approach to maintain that Charles uses distinct types of belief-forming processes in the in-phase vs. out-of-phase conditions. However, I would maintain that, apart from the Broncano-Berrocal strategy discussed here and the simple individuation via phase state considered in the previous section, there is no obviously forthcoming principled rationale for doing so. While one might simply stipulate that the in-phase and out-of-phase process tokens correspond with distinct process types, it isn't clear what differences between the two cases—if we exclude reliability and phase—might justify such a stipulation.

Before moving on to a second consideration for my critique of the modal approach, I want to say something about the reason that individuating belief-forming processes according to reliability doesn't seem to work. Put simply, I think that the problem for this strategy is that it commits to the implicit assumption that knowledge-supporting cognitive systems, especially visual perception, aren't subject to *endogenous* changes with the same epistemic characteristics as some of the *exogenous* changes they can be subjected to. Specifically, these systems cannot endogenously undergo easy decreases in capacity like they might exogenously. However, once we note that these changes can indeed occur endogenously, along with the modal characteristics associated with such endogenous changes, we find that the reliability-based individuation strategy just isn't properly equipped to handle them. This, I would submit, mirrors the more general problem the modal approach has with neural phase cases. After all, the assumption that we can't have easy endogenous decreases in perceptual capacity is just something like a narrower formulation of the distant error picture of knowledge-supporting cognition discussed in the previous two sections. The lesson here, as with the modal approach generally, is that the distant error picture just does not provide a suitable platform for doing epistemology.

6. The Very Weak Modal Approach

In the previous section, I considered how one might employ a specific modal account in order to avoid problems associated with neural phase, ultimately arguing that this would be unsuccessful. Now, I want to consider a second strategy, restricting the modal approach to very weak formulations, by which modal theorists might handle the challenges of neural phase. In contrast with the strategy of individuating belief formation via reliability, the very weak modal approach has a reasonable claim to circumventing the challenges posed by neural phase. However, as it does so at the cost of abandoning the distant error picture of knowledge-supporting cognition, thereby losing much of the intuitive appeal of the modal approach, I don't want to firmly commit to this restriction as the obvious solution to neural phase problems. Instead, a fairer characterization is that the very weak modal approach represents one possible option for modal theorists moving forward.

Let's begin by considering how we might weaken the modal approach so that it no longer faces the problems with neural phase discussed above. Starting with a distinction like that between strong and weak formulations of safety,²⁹ we might easily distinguish between strong and weak versions of the modal approach. What we've been considering thus far has unambiguously been a *strong* version of the modal approach. Most importantly, this means that the property with respect to which known beliefs are asymmetric with unknown true

²⁹ On strong safety, which we've been considering thus far, S knows that p only if there are *no* close possible worlds in which S believes that p when p is false. In contrast, on weak safety, S knows that p only if there are *few* close possible worlds in which S believes that p when p is false. This explicit weak/strong distinction comes from Greco (2007) and is also notably present in Sosa (e.g. 2015, 120; see also Greco 2018).

beliefs is *no close error*, so that, when S knows, there will be no close possible worlds in which she commits some operative variety of cognitive error. Conversely, however, we might also describe a parallel *weak* version of the modal approach. On this version, the property with respect to which known beliefs are asymmetric with unknown true beliefs would be something like *no high-density of close errors*, so that, when S knows, there will be at most only a few close worlds in which S commits some variety of cognitive error. Finally, we might then specify that such a formulation constitutes a *very weak* version of the modal approach only if there is no subset of very close possible worlds on which *no close error* holds.³⁰ When this condition doesn't hold for an otherwise weak formulation, we might call this a *moderately weak* version of the modal approach.

So understood, the very weak modal approach has a plausible claim to avoiding neural phase problems. Notably, the Charles case discussed above is one in which most nearby worlds are free from the operative varieties of cognitive error. After all, the “anomalous phase band” is so named because it comprises only a sliver of Charles’ modal phase space. In the vast majority of close worlds, he is not in this phase band, and thus his perceptual systems function reliably. Accordingly, the very weak modal approach can easily accommodate the case as described. Crucially, however, were we to posit that the anomalous band covers a significantly higher proportion of his phase space, it’s no longer clear whether we would still want to say that Charles can gain the relevant knowledge outside of the anomalous phase band. Indeed, I am tempted to say the opposite. Say, for example, that one third of Charles’ neural phase space now entails greatly diminished perceptual capacities. In such a case, I think it is plausible that Charles cannot gain the operative knowledge, even when outside of that phase band. In this way, we can understand not only that the very weak modal approach can handle the Charles case discussed above, but that it doesn’t appear that neural phases cases can easily be adapted to overcome this.

At this point, we might observe that the very weak modal approach avoids problems with neural phases cases precisely because it abandons so much of what has broadly characterized the modal approach. Not only does it not assent to the distant error picture of knowledge-supporting cognition, but it doesn’t even seem to nicely fit into the Williamson analogy. If a slight breath of wind in just the right direction could send a ball in an otherwise total valley plummeting through a narrow opening, is it still safe from falling? Now I’m not so sure. While it’s clear that forgoing the *no close error* intuition allows the very weak modal approach to avoid problems with neural phase, on which the close danger represents a small fraction of possible outcomes, it may come at the cost of giving up too much of what has broadly defined the modal approach.³¹ This cost is especially conspicuous once we consider that the plausibility of *no high-density of close errors* is likely parasitic on that of *no close errors*. Apart from the idea that knowledge-supporting cognitive systems cannot easily err, it’s not clear why we might expect there to be only a low density of these close errors.³² While this of course doesn’t mean that a very weak modal condition cannot be successful, it does cut off the practice of constructing these conditions from our reason for finding this practice plausible in the first place.

³⁰ Since error possibilities are hyper close in neural phases cases, this stipulation is required to exclude weak formulations (e.g. Pritchard 2007b, 292) on which there is still some modal distance within which there are no error worlds.

³¹ Observe that many of even the more recent modal accounts of knowledge mentioned in §2 (e.g. Pritchard 2012; Broncano-Berrocal 2018; Grundmann 2018) don’t leave space for this very weak formulation.

³² One might be tempted to respond that the *reliability* of our cognitive systems provides us with such a reason, but I don’t think that this is correct. Reliability’s exclusion of high overall error densities doesn’t itself support the idea that no subsets of very close worlds display elevated densities of error.

For this reason, I don't want to conclude that restricting the modal approach to very weak formulations definitively represents the best choice. Instead, it is better understood as one option available to the modal theorist, an option that is likely to be most appealing to those who are happy to continue developing modal conditions on knowledge in the absence of independent intuitive reason for thinking that knowledge has special modal properties.

7. Conclusion: The Future of the Modal Approach

I want to conclude this paper with a word on what all this means for the current and future prospects of the modal approach to knowledge. In short, without the distant error picture of cognition to provide intuitive support, we are left without our primary basis for thinking that there is an asymmetry in the modal profiles available to known and unknown true beliefs. At the present, it seems that this presents proponents of the modal approach with a binary choice. The first option is to continue with a version of modal approach—divorced from the distant error picture of human cognition that made it so intuitively appealing in the first place—which is limited to very weak modal constraints on knowledge. The second option is to push pause on the modal approach until a new intuitive motivation for modal asymmetry can be identified, which might then facilitate new strong and/or moderately weak formulations of the modal approach. Here I won't speculate on which of these options is more attractive, as it presently isn't clear how easy or difficult it might be to develop a new motivation for modal asymmetry. However, at this point we can confidently observe that the modal approach can no longer be thought to occupy the strong theoretical position that it has enjoyed for most of its history.

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