On Debunking Color Realism

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1. Introduction

You see a cherry and you experience it as red. A textbook explanation for why you have this sort of experience is going to cite such things as the cherry's surface microstructures, the wavelengths of light it is disposed to reflect on account of having those surface microstructures, and the sensitivity curves of the various types of cones in your retina. What does not show up in this explanation is the redness of the cherry. Even those who think redness is *some* sort of physical property know better than to identify redness with the specific physical properties in this explanation, on account of the well-known phenomenon of "metamerism": objects with radically different surface microstructures and spectral reflectance properties may appear exactly the same shade of red in normal viewing conditions, meaning that colors are at best reducible to disjunctions of properties or to multiply realized property types.

Many allege that the availability of this sort of color-free explanation of color experience somehow calls into question our beliefs about the colors of objects around us.[1] Our aim here is to explore *how* such explanations are supposed to undermine color beliefs, and in particular whether evolutionary considerations have any special role to play. In an effort to reduce the number of moving parts in this paper, we'll narrow our focus to what should be the easiest and most natural target for such challenges (thereby stacking the deck in the debunker's favor): a robust realist account of color, analogous to the robust moral realist theses targeted by evolutionary debunking arguments in metaethics.[2]

In Section 2, we explain what robust realism is and draw out some important features of the view. In Section 3, we explain why the sort of color-free explanation sketched above—in terms of proximate causes of color experience—is insufficient to underwrite an effective debunking

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[1] For instance, Mackie (1976: 19), Dennett (1991: 376), Goldman (1992: 49–52), Chalmers (2006: 67), Mendelovici (2010: 61–66), and Mendelovici and Bourget (ms). Galileo very likely had something like this in mind in his oft-cited remark: "I think that tastes, odors, colors, and so on are no more than mere names so far as the object in which we place them is concerned, and that they reside only in the consciousness" (quoted in Gow 2014: 803).

[2] See Vavova (2015) for an overview of moral debunking arguments.

argument against robust realism, and in Section 4 we explain how such an argument can potentially be bolstered by evolutionary explanations. Then, in Sections 5–7, we explore a variety of accounts of what it is in virtue of which evolutionary explanations of color vision are meant to be epistemically damning. Our aim in this paper is to examine what it would take for a debunking argument against robust color realism to be successful, and what resources are available to robust realists for resisting the argument. As we will see, the cogency of the debunking argument hangs on controversial issues that cannot be settled in this paper, and so we won't be taking a strong stance on whether such an argument is ultimately successful.

2. Robust Realism

Robust color realism, or "robust realism" for short, is a four-part thesis.[3] First, physical objects do by and large have the colors we take them to have: cherries and stop signs are red, lemons and canaries are yellow, and so on. This sets robust realism apart from eliminativist views according to which colors are either non-existent, uninstantiated, or instantiated only by mental items. Second, colors are mind-independent properties. This sets robust realism apart from dispositionalist views according to which colors are constitutively dependent upon the experiences of perceiving subjects. Third, colors are distinct from all "physical properties," that is, properties identified by the physical sciences.[4] This sets robust realism apart from physicalist views according to which colors are types or disjunctions of surface microstructures or spectral reflectance profiles. Fourth, colors nevertheless *supervene* on the physical surface properties of their bearers. Robust realists may take the supervenience to be merely nomological, however some of the moves we suggest on behalf of the robust realist below arguably require a stronger, *metaphysical* supervenience thesis.[5]

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[3] This is meant to capture what others have called 'the simple view', 'naive objectivism', 'naive realism', 'nonreductive realism', 'prelapsarianism', and 'realist primitivism'. Advocates include Campbell (1993), Yablo (1995), McGinn (1996), Gert (2008), Brogaard (2010), Allen (2016), Cutter (2018), and Sethi (2020: 596).

[4] This is intended as a stipulation about how 'physical' is to be understood here. It may be that colors still come out as "physical" by robust realist lights on some other, broader sense of 'physical'. See Allen (2016: 75–76) for relevant discussion.

[5] See Allen (2016: 76–82) and Cutter (2018: 47–50) in defense of metaphysical supervenience.

One can get an initial sense of the attraction of robust realism by considering one of the perceived shortcomings of rival, physicalist views.[6] We can evidently know which colors resemble which just on the basis of ordinary visual experience. But if physicalism is true, it's an open question which colors resemble which, one that can be answered only with the help of a microscope or a spectrophotometer. Indeed, it would not be at all surprising if the physical correlates of red—that is, the surface microstructures and reflectance profiles of red objects— turned out to be no more similar to the physical correlates of orange than to the physical correlates of blue. This, by physicalist lights, would mean that red *itself* is no more similar to orange than to blue. For this reason, there's considerable pressure to take the color of an object to be a further property, distinct from its physical correlates, which stands—and can be known in a straightforward way to stand—in the relevant resemblance relations to other colors.

Robust realism, as stated, is neutral on the question of whether nonphysical colors *cause* color experiences. But robust realists invariably maintain that they do. They also invariably grant that color experiences are *also* caused by the physical correlates of colors, and are unmoved by exclusion arguments portraying this as an intolerable sort of overdetermination—in part because exclusion arguments threaten to overgeneralize to chemical, biological, and geological causes, and in part because responses to the structurally identical exclusion arguments that arise in connection with mental causation seem equally effective for resisting the exclusion arguments against robust realism.[7]

Those sympathetic to causal exclusion arguments surely won't be satisfied by these quick remarks. But we don't want to get embroiled in debates over the viability of exclusion arguments. So (now stacking the deck in the robust realist's favor) we'll simply grant that supervenient nonphysical colors *would* if instantiated have the power to cause color experiences, despite those experiences also being caused by their physical correlates. Accordingly, if color-free explanations of color experience are indeed damning, it's not by way of showing that nonphysical colors are

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[6] See Boghossian and Velleman (1991: 85–100) and Johnston (1992: 236–239) for a version of this objection; cf. Pautz (2006: 537–540). See Byrne and Hilbert (1997: 274–279) for a physicalist response. See Gow (2014) for an overview of the different theories of color.

[7] See Campbell (1993: 183), Yablo (1995: 486–487), Allen (2016: 102–107), Cutter (2018: 44–46), and McGrath (2020: 122) for responses to exclusion arguments against robust color realism, and see Thomson (1996: 79–80) and Shafer-Landau (2003: 98–114) for related discussion of exclusion arguments against moral realism.

excluded from causing color experiences. That leaves open that color-free explanations are damning for some other reason. For instance, perhaps recognition of the color-free explanation somehow severs the justificatory link between color experience and color belief, thereby undermining any reason we have for believing that physical objects have the colors that would otherwise be poised to cause our color experiences.

Notably, if robust realism is true, then our color beliefs are *modally secure*. That is, they are sensitive and they are safe.[8] This is significant because, as we'll see, debunking arguments often proceed by targeting the safety or sensitivity of the relevant beliefs. So the debunker will have her work cut out for her.

To see that color beliefs turn out to be sensitive—that had colors been different, color beliefs would have been correspondingly different—let's suppose you're looking at a ripe cherry in good viewing conditions and you believe it's red. Given robust realism, the cherry is red and your belief is correct. Had the cherry not been red, would you have believed that it's red? Put another way, are the nearest worlds in which it isn't red also worlds in which you believe it's red? Since (given robust realism) colors supervene on their physical correlates, the nearest worlds in which it isn't red will be worlds in which it has the physical correlate of some other color. And since your visual system works more or less the same in the nearest-by worlds, the color experiences you have when interacting with those different physical properties will be correspondingly different as well, as will the beliefs you form on the basis of those experiences. In other words, you don't believe it's red in the closest worlds in which it isn't. The belief is sensitive.[9]

To see that color beliefs turn out to be safe—that we couldn't easily have been mistaken about the colors of objects—let's again suppose you're looking at a ripe cherry in good viewing conditions and you believe it's red. Given robust realism, the cherry is red and your belief is correct. Your belief is safe so long as there are no nearby worlds in which (i) it isn't red yet you

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[8] The reasoning that follows is an adaptation of Clarke-Doane's (2015) argument for the modal security of moral beliefs.

[9] *Pace* Mendelovici (2010: 61–63) and Mendelovici and Bourget (ms). None of this is to deny that there are possible worlds in which the cherry isn't red and yet you still believe it is, for instance worlds in which your eyes and brain are radically different. But these worlds are distant in comparison to worlds in which the cherry has turned brown as a result of corresponding changes to its physical properties.

believe it is or (ii) it's red and yet you believe it isn't. But there won't be nearby worlds of either type. Since (given robust realism) colors supervene on their physical correlates, the nearby worlds in which the cherry is red will all be ones in which it has one of the actual physical correlates of red, and all the nearby worlds in which it isn't red will be ones in which it has one of the actual physical correlates of some other color. And since your visual system works more or less the same in nearby worlds, you'll have experiences as of a red object when interacting with those actual physical correlates of redness, and will form the belief that it's red; and you'll have correspondingly different color experiences and form correspondingly different color beliefs when interacting with the non-red cherry. So there are no nearby worlds of type-(i) or type-(ii): your belief is safe.

3. From Color-Free Explanations to Defeat

Equipped with this understanding of robust realism and its implications, let's consider how the availability of a color-free explanation of our color experiences is meant to cause trouble for robust realism. We'll begin with a suggestion from David Chalmers. Chalmers offers the following account of why color-free explanations of color experience give us reason to doubt that physical objects instantiate the robust realist's nonphysical color properties: "Science does not reveal any [nonphysical] properties in the object, and furthermore, the hypothesis that objects have the relevant [nonphysical] properties seems quite unnecessary in order to explain color perception" (Chalmers 2006: 67).[10]

We are given two reasons here to think that color-free explanations undermine robust realism. The first is that "science does not reveal any [nonphysical] properties in the object." It's not entirely clear what it is for science to "reveal" a property, but in whatever sense science fails to reveal that objects have nonphysical colors, it presumably also fails to reveal that the cherry belongs to you. Neither compositional analysis of your receipt nor of the cherry itself is going to reveal that it's yours. Surely, though, that doesn't give us reason to doubt that the cherry is yours.[11]

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[10] We take the liberty of replacing 'primitive' with 'nonphysical', since robust realism, as we have formulated it, is committed only to colors being irreducible to properties identified by the physical sciences, not to their being primitive *tout court* (cf. Allen 2016: 5). Chalmers goes on to admit that this isn't an especially strong objection to robust realism, and goes on to advance what he takes to be a more serious objection, which we take up below in Section 5.

[11] Cf. Yablo (1995: 486).

The second reason we're given is that "the hypothesis that objects have the relevant [nonphysical] properties seems quite unnecessary in order to explain color perception." This is an excellent reason to doubt that nonphysical colors exist *if* your principal reason for believing in them is that color experience is inexplicable without them. But robust realists don't believe in nonphysical colors primarily on the basis of an indispensability argument or any other such abductive grounds.[12] Rather, they believe that things have colors on ordinary, non-inferential perceptual grounds, and they believe that those colors are distinct from their physical correlates on philosophical grounds (e.g., the argument from resemblance discussed in Section 2).[13] Nor should we expect robust realists to be moved by the complaint that the availability of the color-free explanation reveals the postulation of nonphysical colors to be unparsimonious. True, supervenient nonphysical colors plausibly can't be written off as an "ontological free lunch." But, even so, robust realists will likely insist that they must be "purchased" anyhow to do a job that nothing figuring in the color-free explanation is able to do (e.g., to do justice to the color resemblance facts).[14]

A different approach—modeled on debunking arguments in metaethics and elsewhere—is to contend that the availability of a color-free explanation points to color beliefs lacking some epistemically important feature. The recognition that they lack this feature is meant to serve as an undercutting defeater for those beliefs, removing the non-inferential perceptual justification they once enjoyed. What this "epistemically important feature" is varies from one presentation of the debunking arguments to the next. As we are about to see, however, neither of the standard ways of filling in the details has any traction against the robust realist.

On one way of developing the debunking arguments, the recognition that one's beliefs about Fs (e.g., colors, values, numbers) can be explained without reference to Fs themselves undercuts those beliefs (if it does) by virtue of revealing the beliefs to be modally insecure, that is,

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[12] By contrast, the discovery of a phlogiston-free explanation of combustion provided reason to doubt the existence of phlogiston, *precisely because* the only reason for believing in phlogiston was that it was supposed to be necessary for explaining combustion.

[13] Cutter (2018: 44) makes a similar point; cf. Plantinga (2000: 326–321) on religious belief. Though see Allen (2016: 16–20) and Cutter (2018: 43) for abductive considerations in support of robust realism.

[14] See White (2010: 583–585) for more on appeals to parsimony in debunking arguments.

unsafe or insensitive.[15] It is *prima facie* plausible (though not uncontroversial) that one cannot go on rationally believing something after recognizing that one could easily have been mistaken about it or would have believed it regardless of whether it was true. However, as we saw in Section 2, if robust realism is true, then our color beliefs are both safe and sensitive, despite (and to some extent *owing to*) the color-free explanation. Accordingly, the robust realist can assure herself that her beliefs are safe and sensitive, thereby escaping defeat. Thus, even supposing that a concession of modal insecurity would serve as defeater, it's hard to see how to extract that concession from robust realists.

On another way of developing the debunking arguments, the recognition that one's beliefs about Fs can be explained without reference to Fs undercuts those beliefs (if it does) by virtue of revealing there to be no appropriate explanatory connection between our F-beliefs and the F-facts.[16] However, as we saw in Section 2, if robust realism is true, then colors arguably causally explain our color experiences and associated beliefs, despite (and, again, perhaps owing to) there also being a color-free causal explanation in terms of the physical properties upon which they supervene. Thus, even supposing that an explanatory concession would serve as a defeater, it's hard to see how to extract that concession from robust realists.[17]

One might naturally feel that there's something illicit about these lines of response to the debunking arguments. It's one thing to observe that color beliefs are modally secure or explained by colors *if* robust realism is true. It's quite another, the idea goes, to insist that, *because* robust realism is true, color beliefs are modally secure or explained by colors. For in so doing, robust realists would be taking for granted that the objects in question in fact have the colors they appear to have, and in particular that it's red and not some other color or no color at all that supervenes on the physical properties responsible for red experiences. And that, one might object, blatantly begs the question.

But this is to misunderstand the dialectical situation. When assessing an argument against your view, you are entitled to help yourself to any aspects of your view that you were antecedently

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[15] See, e.g., Clarke-Doane (2015, 2020), Clarke-Doane and Baras (2021), and Mendelovici and Bourget (ms).
[16] See, e.g., Locke (2014), Lutz (2018, 2020), Faraci (2019), Korman and Locke (2020a, 2020b), and Bogardus and Perrin (forthcoming).
[17] That said, a debunking argument of this sort could be made to work *if* the robust realist can be driven to epiphenomenalism by an exclusion argument (see Section 2).

justified in believing. Even the debunker should grant that the robust realist is antecedently (perceptually) justified in believing that the cherry is red. A debunking argument is meant to show that other aspects of the robust realist view, together with the color-free explanation of color experience, yields a defeater for that antecedently justified belief. And it is meant to yield a defeater by way of forcing robust realists to make the damning concession that the belief is modally insecure or that it isn't explained by the associated facts. Accordingly, there is nothing amiss—dialectically or epistemically—when the robust realist draws on her not-yet-defeated beliefs in the course of assessing whether her various commitments force her to make the damning concession.[18]

What we are seeing is that the various elements of robust realism serve as *defeater-deflectors* against charges of modal insecurity or explanatory disconnection. To appreciate how defeater deflection works, take the following case.[19]

> PARANOID FARMER
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> While driving past a farm, your trustworthy husband tells you that he spotted some sheep, and also mentions that the farmer who owns the place is weirdly paranoid about sheep poachers. You later encounter the farmer, who rolls her eyes at the report of sheep on her farm and claims that people are always mistaking her sheepdogs for sheep.

What the farmer said would ordinarily serve as a defeater, preventing your husband's claim to have seen sheep from justifying your belief that there were sheep. However, your husband's additional testimony about the farmer's paranoia serves as a defeater-deflector, preventing the farmer's testimony from undermining the justification you receive from your husband's claim to have seen sheep. And just as you deflect defeat by relying on the very testimonial source the farmer is trying to discredit, the robust realist deflects defeat by relying on the very perceptual source that the debunker is trying to discredit.

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[18] Moreover, constraints that prohibit this sort of "question begging" maneuver threaten to lead straight to sweeping skeptical results; see our (2020: 314–316) for discussion.

[19] The case is adapted from Plantinga (2011b: 347). See Plantinga (2002: 224) on the difference between defeater-deflectors and defeater-defeaters.

4. Evolutionary Explanations

What the debunker needs is some way to stay one step ahead of the deflecting robust realist. And here is where evolutionary explanations may be able to do some work for the debunker. Explanations of why we have the doxastic sources we do—including those that we are antecedently justified in deploying—can sometimes undermine our entitlement to rely on those sources, and *a fortiori* undermine our entitlement to rely on their deliverances as defeater-deflectors.[20]

As an illustration, consider the following example.[21] Jack, a physics student, has a more or less automatic tendency to believe, upon seeing a certain kind of streak in a cloud chamber, that there was a proton where the streak is. He has just seen such a streak and, accordingly, spontaneously forms the belief that a proton just went through the chamber. If pressed to concede that his belief is unsafe, insensitive, or explanatorily disconnected from protons, he'll refuse. His belief that there's a proton, he'll insist, was caused by a proton (by way of causing a streak). He wouldn't have believed there's a proton if there hadn't been, he'll say, since if there hadn't been one there wouldn't have been a belief-prompting streak either. And he couldn't easily have been mistaken, he'll say, since a proton couldn't easily have been in there without leaving a streak, nor could there easily have been a streak without a proton there to leave it.

Suppose, however, Jack now learns that this streak-to-proton disposition was implanted in him by a mad neuroscientist who knows nothing about physics but likes the sound of 'proton' and 'streak'. Having learned this, Jack plausibly can no longer rationally rely on this doxastic source (the streak-to-proton disposition), and *a fortiori* can no longer rely on it (as he previously did) en route to assuring himself that his proton beliefs are safe, sensitive, and caused by protons.

Can color beliefs be debunked in similar fashion by what we know about the evolution of color vision? We'll proceed on the assumption that something like the "foraging account" of the evolution of trichromatic color vision is correct.[22] According to this account, trichromatic color

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[20] Cf. Schechter (2010) on the reliability challenge for logical beliefs. In his terminology, one needs a satisfying answer not just to the *operational* question but also to the *etiological* question.

[21] We use this example to similar effect in the context of moral debunking arguments. See Locke (2014: 231–232) and Korman and Locke (2020a: 320–321, 2020b: 196). The reference to cloud chambers is a nod to Harman (1977: 6–9).

[22] See, e.g., Mollon (1989), Sumner and Mollon (2000), Regan et al. (2001), and Bompas et al. (2013). For alternative accounts, see Hall (1996) and Akins and Hahn (2014). We suspect that not much turns on which of these accounts is correct.

vision enhanced our ancestors' foraging abilities (and reproductive success) by providing them with a phenomenally striking way of tracking and representing physical differences between ripe fruit and surrounding foliage. This is naturally viewed as an "irrelevant influence" on the selection of our particular brand of color vision, insofar as securing phenomenally striking color representations seems entirely irrelevant to securing *accurate* color representations. And, as reflection on Jack's case reveals, the discovery of irrelevant influences on one's doxastic sources has the potential to undermine continued reliance on those sources.

If the robust realist's entitlement to rely on color vision is indeed undermined by the foraging hypothesis, notice how this short-circuits the strategies sketched in Section 3 for assuring oneself that color beliefs are safe, sensitive, and caused by colors. In each case, the line of reasoning begins with the belief that the cherry is indeed red. Since this starting belief is antecedently justified solely on the basis of the deliverances of color vision, should robust realists lose entitlement to rely on color vision, they can no longer avail themselves of these strategies and are left without any means of resisting the debunking arguments. Crucially, the strategies are in this case revealed to be illicit *not* because they are somehow question-begging, but rather because they involve deployment of a doxastic source that has been undermined.

What remains to be seen is whether the foraging hypothesis does in fact undermine robust realists' entitlement to rely on color vision, and if so why it does. After all, irrelevant influences on the selection of a doxastic source don't always undermine entitlement in this way. I can recognize that my selection of this alarm clock rather than one of the others at the store was influenced by its sleek design—and that this is irrelevant to whether it accurately tells time—without thereby losing entitlement to rely on it. In virtue of what, then, does the news about the mad neuroscientist undermine Jack's entitlement to rely on his streak-to-proton disposition? In virtue of what does the foraging hypothesis undermine the robust realist's entitlement to rely on color vision, if indeed it does? More generally:

The Guiding Question
In virtue of what does the discovery of irrelevant influences on our having a given doxastic source undermine one's entitlement to rely on that source, when it does?

In short, what is the "damning revelation" in virtue of which irrelevant influences undermine (when they do) or the "damning concession" that the discovery of irrelevant influences sometimes compels one to make?

We'll consider two closely related but nevertheless distinct answers to the Guiding Question: that we could easily have ended up with an unreliable doxastic source (Section 5), and that it would be a coincidence if we ended up with a reliable doxastic source (Section 6).

5. Easy Possibilities

Let's start with the following, fairly natural answer to the Guiding Question:

> *The Easy Possibilities Account*
> The discovery of irrelevant influences on a doxastic source undermines entitlement to rely on that source, when it does, by way of revealing that the processes responsible for one's having that source could easily have yielded an unreliable doxastic source.

The news about the mad neuroscientist, the idea goes, undermines Jack's entitlement to rely on his streak-to-proton disposition by way of revealing that he could easily have ended up with an unreliable doxastic disposition (perhaps a streak-to-helium disposition). The foraging account undermines our entitlement to rely on color vision by way of revealing how easily (by robust realist lights) unreliable systems of color vision could have emerged from the evolutionary processes responsible for color vision.[23]

Let's see how the foraging account might support this epistemic upshot. Let S's *visual pairings* be the function from physical correlates to the colors they cause to be represented in S's experience. The argument can be broken down as follows:

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[23] Cf. Chalmers: "Evolutionary processes will be indifferent between perceivers in which apples produce phenomenally red experiences, perceivers in which apples produce phenomenally green experiences, and perceivers in which apples produce phenomenally blue experiences. Any such perceiver could *easily come to exist* through minor differences in environmental conditions or brain wiring. If we accept the reasoning above [against color pluralism], only a very small subset of the class of such possible perceivers will normally have veridical experiences, and there is no particular reason to think that we are among them" (2006: 69).

The Argument from Easy Possibilities

(EP1) We could easily have ended up with different visual pairings.[24]

(EP2) If we could easily have ended up with different visual pairings, then by robust realist lights we could easily have ended up with unreliable visual pairings.

(EP3) If by robust realist lights we could easily have ended up with unreliable visual pairings, then robust realists mustn't rely on color vision.

(EP4) So, robust realists mustn't rely on color vision.

EP1 is at least initially plausible in light of the foraging hypothesis. After all, if the evolutionary benefit comes just from having *some* phenomenally striking way of differentiating between objects with different physical surface properties, then evolution presumably could just as easily have achieved its ends with alternative visual pairings. It's hard to see, for instance, why inverts would be at any disadvantage, since a ripe berry would presumably "pop out" just as dramatically if experienced as a small patch of green against a background of red-looking foliage.

EP2 is likewise *prima facie* plausible. On the natural assumption that objects don't simultaneously instantiate all of the various colors that they could have been represented as having, most visual pairings pair the physical properties of objects with colors that those objects don't have. Accordingly, if we could easily have had different visual pairings, we could easily have had unreliable color vision.[25]

EP3 is a consequence of the Easy Possibilities Account. In addition to simply being *prima facie* plausible—putting its finger on what does seem to be a damning revelation—this account draws support from its ability to diagnose cases like the following (adapted from Plantinga 2011a: 439):

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[24] We take the liberty of saying that *we* could easily have ended up with different visual pairings. But, strictly speaking, the damning revelation needn't be that we ourselves—you and the two of us or any other existing humans—could easily have had different visual pairings. And rightly so, since the requisite changes in evolutionary history would almost certainly have resulted in an entirely distinct population of humans. All that's required for the argument is that different visual pairing could easily have arisen.

[25] Though see Mizrahi (2006) and Kalderon (2007) for a defense of color pluralist views that reject this "natural assumption." The pluralist response to the debunking arguments echoes plenitudinous responses to object debunking arguments (see Korman 2014: 6–10) and access problems for platonism (see Balaguer 1995).

DEFECTIVE THERMOMETERS

Tayshia is handed a thermometer. She has no evidence of its reliability apart from her background knowledge of what thermometers are for and her previous interactions with reliable thermometers. She then learns that this one was drawn at random from a box of mostly defective thermometers.

Clearly Tayshia should doubt that her thermometer is reliable and must no longer rely on its verdicts about the temperature. The Easy Possibilities Account provides a plausible diagnosis of why that is: it's because, in learning what she did, she thereby learns that she could easily have ended up with an unreliable thermometer.

One might object to EP1 on *externalist* grounds. Here the idea would be that the contents of color experience are fixed by whatever it is in our environment that those experiences track (or are designed to track). Accordingly, while there could easily have arisen visual systems with permuted color *phenomenology*—for instance, tracking ripe berries via phenomenally blue experiences—such experiences would not differ from ours in which color they *represent*. This would simply be an alternative way of tracking, and thus representing, the color of those berries, namely, red.[26] Whatever one might think of this style of view, it is a bad fit for robust realism. After all, it's similarities in color phenomenology that enable us to know on the basis of ordinary visual experience alone that red is more similar to orange than it is to blue. By divorcing colors represented from the associated phenomenology in the way, the robust realist would lose any reason to expect color experience to reveal the resemblances among the colors, thereby undermining the advertised advantage of robust realism over its physicalist rivals (see Section 2).

The more serious problem with EP1 is that, however appealing it may seem from the armchair, it's an unsubstantiated empirical conjecture.[27] It's not obvious, and certainly not *a priori*,

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[26] Alternatively, the robust realist may combine a tracking account of content determination with the intentionalist thesis that the phenomenology of a color experience is fixed by its content. We take this sort of "phenomenal externalism" to be deeply implausible for the reasons given in Block (1990), though it evidently is quite popular among robust realists. See Campbell (1993: 267), Mendelovici (2013), Cutter (2018: 43–44), and Mendelovici and Bourget (ms) for more on externalist responses.

[27] See Byrne and Hilbert (2007: 88–89) for a forceful articulation of this objection.

that alternative visual pairings would have served our ancestors' purposes equally well. Perhaps, given other features of the perceptual and cognitive systems of the dichromats from which we evolved, spots of green against a red backdrop, or blue against yellow, wouldn't "pop out" or draw attention as dramatically as red against green. In that case, the imagined inverts would have been inferior foragers and such visual pairings (were they even to arise in the first place) would have been selected against. And perhaps, even supposing that they would have been equally effective foragers, there is no easy evolutionary road from the dichromats from which we evolved to the imagined inverted trichromats. In other words, perhaps facts about the hard-wiring that predated trichromacy made it more or less inevitable that our particular form of color vision was selected (if any was). Until these "perhapses" are ruled out on empirical grounds, robust realists have no good reason to accept EP1.

6. Coincidental Accuracy

Let's turn to a second answer to the Guiding Question:

> *The Coincidence Account*
> The discovery of irrelevant influences on a doxastic source undermines entitlement to rely on that source, when it does, by way of revealing that it would be a coincidence if that source is reliable.

On this account, the news about the mad neuroscientist undermines Jack's entitlement to rely on his streak-to-proton disposition by way of revealing that it could only be a coincidence if it yields correct beliefs about what's leaving those streaks. The foraging hypothesis undermines our entitlement to rely on color vision by way of revealing that it could only be a coincidence if our visual pairings pair correlates with colors that in fact supervene on them.[28]

What makes the Coincidence Account different from the Easy Possibilities Account is that something can plausibly be a coincidence even if it couldn't easily have failed to happen.[29] For instance, the same physical constant might appear in multiple physical laws, and this may simply be a coincidence, notwithstanding the fact that neither law could easily have failed to obtain.

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[28] Cf. Bedke (2009) on moral debunking arguments.
[29] Cf. Byrne and Hilbert (2007: 97), Setiya (2012: 89–99), Faraci (2019), and Berry (2020).

Indeed, there can be coincidences that couldn't *possibly* have failed to obtain. When some interesting string of numbers makes an appearance in two very different domains of mathematics, we'll naturally seek a unifying explanation, but we can't rule out from the outset that it's just a coincidence.[30] Accordingly, evidence that it was more or less inevitable that we ended up with the visual pairings we did poses no immediate problem for the hypothesis that it would be a coincidence if our visual pairings were accurate.[31]

So let's examine the prospects of a debunking argument built on coincidence:

The Argument from Coincidence

(CO1) By robust realist lights, it would be a coincidence if color vision were reliable.

(CO2) If by robust realist lights it would be a coincidence if color vision were reliable, then robust realists mustn't rely on color vision.

(CO3) So, robust realists mustn't rely on color vision.

The idea behind CO1 is much the same as the idea behind EP1. The evolution of color vision is (on the foraging account) driven by pressure towards visual pairings that deliver enhanced abilities to spot the characteristic physical surface properties of ripe fruit, and such evolutionary forces are blind and indifferent to which colors actually pair with which physical surface properties. To see this, suppose we discover that long ago there indeed was once a subpopulation with inverted visual pairings, and they proved to be less fit than those with our visual pairings. What could explain why they were less fit? Perhaps the explanation is that the inversion somehow required more processing power, or somehow made it harder to spot the berries. But it's difficult even to make sense of the idea that representing the berries as green was maladaptive because that's not their true color. And if evolutionary forces truly are indifferent in this way to the actual pairings of colors and correlates, it would only be a coincidence by robust realist lights if these

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[30] See Berry (2020: 699–700) for an example; though see Baras (forthcoming) for critical discussion.

[31] Indeed, debunking arguments in the moral domain often *emphasize* the inevitability of our moral systems. See White (2010) on the apparent tension between appeals to contingency and inevitability in presentations of debunking arguments.

evolutionary forces yielded visual pairings that paired physical properties with the colors that do in fact supervene on them.[32]

CO1 draws additional support from reflection on metamers (i.e., radically different physical properties that yield phenomenally identical color experiences).[33] As Alvin Goldman explains:

> the receptor system … is not always able to discriminate between wavelength mixtures. The receptor output produced by a single wavelength can typically be duplicated by a mixture of three suitably balanced other wavelengths. This is a consequence of the receptor system functioning like an integrator, i.e., like an adding machine that records total sums without keeping track of the component figures. Since the receptor outputs from some wavelength combinations are exactly equal, the system has no way of knowing how the color was generated. This is responsible for metamerism, in which widely disparate wavelength stimuli produce equivalent hue experiences. (1992: 50)

Suppose then that ripe berries reflect a mixture of wavelengths M; that stop signs reflect an entirely different mixture of wavelengths M*; and that both M and M* yield the same receptor outputs when run through the visual system, resulting in indistinguishable color experiences. If as the foraging hypothesis would have it, the visual system was designed to track M with red-representing experiences, it's nothing but an artifact of that system that M* produces the same experiences. This, in turn, suggests that it would be nothing but a coincidence if the diverse reflectance profiles that yield the same receptor output when run through our visual systems aligned exactly or even roughly with those diverse reflectances profiles that (by robust realist lights) are supervenience bases for the same color.

Premise CO2 is a consequence of the Coincidence Account. Like the Easy Possibilities Account, the Coincidence Account is *prima facie* plausible—putting its finger on what does seem to be a damning revelation—and draws support from DEFECTIVE THERMOMETERS, for which it

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[32] The externalist and color pluralist objections mentioned in Section 5 could be raised against CO1 as well.

[33] Here we adapt an argument from Goldman (1992: 49–51), which we think better serves Goldman's purposes and circumvents some of the objections raised by Schaffer (2016: 352).

offers a slightly different diagnosis. What undermines Tayshia's entitlement to rely on her thermometer, on this account, is that she recognizes that it would at best be a coincidence if she ended up with a reliable thermometer.

Robust realists might challenge CO2 by insisting that the Coincidence Account is in need of modification.[34] It's true, they may admit, that recognizing a doxastic source to be at best coincidentally reliable is sometimes damning. But, they may insist, one can sometimes have good reason to believe that the needed coincidence has occurred. For instance, suppose Jack learns from a physics textbook that such streaks are indeed caused by protons. In that case, he has learned that the coincidence that would have to have occurred in order for him to have ended up with a reliable source of information about streaks has in fact occurred, and having learned this he is surely entitled to go on as before relying on that source. With this in mind, robust realists may insist upon the following, nearby answer to the Guiding Question:

> *The Qualified Coincidence Account*
> The discovery of irrelevant influences on a doxastic source undermines entitlement to rely on that source, when it does, by way of revealing that it would be a coincidence *which one has no reason to believe occurred* if that source is reliable.

By the lights of the Qualified Coincidence Account, the concession that it would take a coincidence for one's source to be reliable is not itself damning, lest textbook-informed Jack be damned too. What would be damning, rather, is the concession that it would take a coincidence *and* that (unlike enlightened Jack) one has no reason to believe that the needed coincidence occurred.[35]

But if *that's* the damning concession, then robust realists are arguably in a position to assure themselves that they don't have to make it. They can grant that it would be a coincidence if color vision is reliable, which (on the Qualified Coincidence Account) isn't yet enough to undermine their entitlement to rely on its verdicts. They would then have not-yet-defeated perceptual reasons for believing that cherries are red, as well as unimpugned introspective reasons for believing that their visual pairing pairs the cherry's physical surface properties (whatever those may be) with red. (*Mutatis mutandis* for lemons and blueberries.) This adds up to an undefeated reason to believe

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[34] A similar objection could be raised against EP3.
[35] Cf. White (2010: 589) and Setiya (2012: 66–76).

that the needed coincidence has indeed occurred; they have, by their lights, "won the cosmic evolutionary lottery."

One might complain that there is something illicit about the envisaged line of reasoning, insofar as the robust realist is relying on her beliefs about the colors of objects en route to assuring herself that the needed coincidence has occurred. But (as indicated in Section 3) the problem cannot simply be that the robust realist is "begging the question" by relying on the very doxastic source that her opponent means to be challenging. Nor it is illicit in virtue of using "track-record reasoning" to bootstrap from the deliverances of a source to the reliability of the source. We agree with Bergmann (2004, 2006) that such reasoning is epistemically unobjectionable, so long as one neither has, nor or ought to have, doubts about the reliability of the source.[36] And whether one ought to doubt the reliability of color vision turns on exactly the question under discussion: which revelations are and aren't damning.

The problem, rather, is with the Qualified Coincidence Account itself. To see that it can't be right, notice that it leaves us without a diagnosis of why Tayshia mustn't rely on the thermometer in DEFECTIVE THERMOMETER. After all, if the revelation that she at best coincidentally ended up with a reliable thermometer isn't yet damning, then she can use the same sort of bootstrapping reasoning to assure herself that she coincidentally drew the reliable thermometer. To account for DEFECTIVE THERMOMETER, the damning concession must be somewhat less demanding, and if not the unqualified coincidence concession, then something else—perhaps that it would take a coincidence that one has no *independent* reason to believe occurred.[37]

A more promising line of resistance for the robust realist is to question why the Coincidence Account (in any form) should be preferred to the Easy Possibilities Account. Unlike the Qualified Coincidence Account, the Easy Possibilities Account does offer a diagnosis of Tayshia's loss of entitlement. And while we did identify a problem with the Easy Possibilities Account in Section 5, the "problem" was just that it can't be used to underwrite an effective debunking argument, insofar as robust realists have no good (empirical) reason to concede that alternative visual pairings could easily have been selected. In other words, the Easy Possibilities Account, unlike the Coincidence Account, is a robust-realist-friendly answer to the Guiding

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[36] Though see Weisberg (2012) for a variety of perspectives on track-record reasoning.
[37] Cf. Vavova (2014: 79–87, 2018: 144–146) on the need for independent evidence.

Question. The debunker owes the robust realist some explanation of why she should accept the robust-realist-unfriendly Coincidence Account, when the robust-realist-friendly Easy Possibilities Account seems already to give a perfectly good answer to the Guiding Question.[38]

Critics of robust realism may be tempted at this point to dispense with CO2 and to let CO1 stand on its own as a problem for robust realism—thereby sidestepping thorny questions about how to answer the Guiding Question.[39] They may insist that its commitment to the inexplicability of reliable color vision is already, all by itself, an indication that something is seriously wrong with robust realism. This seems clearly to be what Byrne and Hilbert (2007: 97) have in mind when they emphasize that their argument from coincidence against robust realism is not intended to be "epistemic," and that the problem is just that robust realists "must admit that there is some kind of pre-established harmony or bizarre cosmic coincidence. And … pre-established harmony is not [a] hypothesis to be taken seriously."[40]

We don't exactly disagree, but we do think something important is lost in stopping short of the epistemic upshot that robust realists' entitlement to rely on color vision has been undermined. While it indeed is hard to take seriously a view that's committed to massive coincidences, it is also hard to take seriously eliminativist views on which objects aren't really colored, in the same way that it is hard to take seriously the hypothesis that we don't really have hands.[41] What makes the latter hypotheses hard to take seriously is that they fly in the face of perceptual appearances. "Stopping short" of premises like CO2 or EP3 leaves those perceptual appearances unimpugned, making it entirely legitimate to weigh the absurdity of a massive coincidence against the absurdity of a colorless world. A successful debunking argument, by contrast, would show that sort of weighing to be entirely illegitimate. By establishing a lack of entitlement to rely on color vision, it would "silence" color appearances, rendering them unable to

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[38] Friends of the Easy Possibilities Account can still accept that coincidental reliability is often *derivatively* damning, insofar as it's an (imperfect) indicator of easy possibilities of unreliability.

[39] Thanks to Sharon Berry, Brian Cutter, and Josh Schechter for helpful discussion here.

[40] Cf. Pautz (2011: 400–419) and Cutter (forthcoming). This also seems to be Field's (1989: 25–30) conception of access problems for Platonism and Enoch's (2010: 421–422) conception of reliability challenges for robust moral realism.

[41] It's likewise hard to take seriously physicalist views that can't secure the truism that red more closely resembles orange than blue, or the idea that their resemblance consists only in their dispositions to produce experiences with similar color phenomenology (see Byrne and Hilbert 1997: 274–279). All views about color are hard to take seriously, each in its own way.

justify color beliefs and removing any reason we could have for thinking that color eliminativism is absurd or for not taking it seriously.

7. Conclusion

We have seen that, so long as robust realists can successfully fend off exclusion arguments against the causal efficacy of colors, mere appeals to the proximate physical causes of color experience are not sufficient to underwrite a successful debunking argument. We did see, however, that evolutionary accounts of the origins of color vision may be up to the task. And we saw that the prospects for an evolutionary debunking argument turns on subtle questions—which we have not attempted to answer—about what precisely it is in virtue of which the discovery of irrelevant influences undermines entitlement to rely on one's doxastic sources. If it's by way of revealing that one's sources are at best coincidentally reliable, then the debunking argument likely succeeds since robust realists ought to admit that color vision is at best coincidentally reliable. If, on the other hand, it's by way of revealing that one could easily have ended up with unreliable color vision, then the debunking argument likely fails since robust realists have no good reason to admit that we could easily have ended up with unreliable color vision.

Nor are these the only possible answers to our Guiding Question. We ourselves are attracted to a somewhat different answer, one that digs a bit deeper by pointing to that in virtue of which reliability would be coincidental (when it is). What undermines Jack's entitlement is the revelation that he ended up with a disposition that pairs streaks with protons for reasons having nothing to do with whether streaks are in fact paired with protons. What undermines entitlement to rely on color vision (given robust realism) is the revelation that the facts about which colors go with which physical properties are no part of the explanation for why we ended up with the visual system we did. Developing and defending a general answer to the Guiding Question along these lines, however, is no small feat and lies beyond the scope of this paper.

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