



*A Problem of Variability*

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Recently Dimitria Electra Gatzia has argued that individual colour variations present difficulties for both colour objectivism and colour subjectivism (Gatzia 2010). On the objectivist side, she has singled out Byrne and Hilbert's colour physicalism for criticism (Byrne and Hilbert 2003; 2007). The aim of this paper is to defend Byrne and Hilbert's colour physicalism against an argument of Gatzia's.

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### **1. Introduction**

In a series of publications, Byrne and Hilbert have ably defended an attractive physicalist view of colour (Hilbert 1987; Byrne and Hilbert 1997b; 2003; 2004; 2007). According to this view, colours are mind-independent (or “objective”) physical properties of physical objects. In particular, Byrne and Hilbert identify colours with spectral productances, certain sets (or disjunctions) of dispositions of physical objects to modify light (Byrne and Hilbert 2003). Among other things, in this paper I defend colour physicalism against an innovative argument of Dimitria Electra Gatzia’s (Gatzia 2010, pp. 335-338).

It often happens that the same coloured chip, viewed in the same normal conditions, looks pure green to one normal perceiver (say, Smith) and greenish blue to another (say, Robinson). This phenomenon of perceptual variability or shifted spectra is often held to pose a problem for colour physicalism (Tye 2006a; Cohen *et al.* 2006; 2007; Kalderon 2007; Gatzia 2010: 535-540). Although many have felt there to be a problem for physicalism here, there is little detailed consensus on what exactly that problem is supposed to be (Tye 2006a; 2006b; 2007; Cohen *et al.* 2006; 2007; Byrne and Hilbert 2007). Byrne and Hilbert claim that perceptual variability poses no problem at all for colour physicalism (Byrne and Hilbert 2007, p. 89). Others have contested this (Kalderon 2007; 2008; Gatzia 2010, p. 539).

The plan of this paper is as follows. After presenting the phenomenon of perceptual variability, I turn to Gatzia’s presentation of the putative problem of variability. Then I explore the colour physicalist’s prospects for answering an ingenious argument that Gatzia has given against colour physicalism, an argument that rests on the claim that colour physicalism makes knowledge of things’ determinate colours impossible (Gatzia 2010, pp. 537-538). By adopting a safety account of knowledge and distinguishing some varieties of epistemic luck, I show that the possibility of colour knowledge can be vindicated (Sosa 1999; and especially Pritchard 2005, chapters 5 and 6). It turns out that Gatzia’s argument poses no serious threat for Byrne and Hilbert’s version of colour physicalism. I conclude that Gatzia has not yet shown there to be a problem of variability for colour physicalism.

### **2. The putative problem of individual variability**

Smith and Robinson are normally sighted colour perceivers viewing a uniformly coloured chip in normal viewing conditions, and

- (1) The chip looks pure green to Smith and greenish blue to Robinson.

Smith and Robinson are statistically normal colour perceivers—each can pass standard tests for normal colour vision. Yet they experience the chip as having different colours: pure green is not the same colour as greenish blue (no doubt, they are both shades of green). Moreover, if Robinson were to look at another chip, it would probably look different in colour to him than it would to Smith. Because of differences in the peak sensitivities of their retinal cone cells, Smith and Robinson are spectrally shifted with respect to each other (Block 1999; Hardin 2003; 2004; Gatzia 2010). The evidence from vision science strongly suggests that you and I are like Smith and Robinson. We probably have shifted spectra with respect to each other. Indeed, all of us are spectrally shifted with respect to many different statistically normal colour perceivers.

Should colour physicalists such as Byrne and Hilbert worry about shifted spectra? Gatzia thinks they should (Gatzia 2010, pp. 535-540). If Byrne and Hilbert are right, then there is one disposition to modify light—one set (or disjunction) of spectral productances—that is the determinate colour of the chip. More generally, on Byrne and Hilbert's version of colour physicalism, colours are incompatible in this way:

- (2) No uniformly coloured region can be pure green and greenish blue at once.

Of course, green and greenish blue are just examples, so (2) generalizes: no uniformly coloured region can be more than one equally determinate colour at once.

Byrne and Hilbert think of visual experience as having representational content (Byrne and Hilbert 2003; 2007). When the chip looks pure green to Smith he undergoes a visual experience that represents it as pure green. His experience veridically or correctly represents the chip's colour if the chip is pure green. Otherwise his experience is unveridical, incorrect, or illusory with respect to the chip's colour. *Mutatis mutandis* for Robinson. Given this representational conception of visual experience it follows from (1) and (2) that:

- (3) The chip is either not the colour Smith's visual experience represents it as having or it is not the colour that Robinson's visual experience represents it as having or it is neither of those colours.

This conclusion has often been felt to be puzzling, troublesome, or problematic for colour physicalism (Hardin 2003; 2004; Cohen 2004; Cohen *et al.* 2006; 2007; Tye 2006a). Why this feeling? Different authors offer different answers. For example,

Cohen et al. point out that it would seem arbitrary to judge that either Smith or Robinson veridically experiences the chip's colour (Cohen *et al.* 2006, p. 336). The feeling seems to be that if the chip had a perceiver-independent determinate colour, then the choice between Smith and Robinson would not be arbitrary. Instead we would have some way to determine which of them, if either, perceived the colour of the chip. So we would have some way of determining the chip's determinate colour. Of course, the colour physicalist has been given no reason to agree with this.

Gatzia presents a line of criticism similar to Cohen *et al.*'s, but with greater force and in greater detail. After pointing out that at least one of the perceivers must be misperceiving the colour of the object in shifted spectra cases, Gatzia asks a pointed question:

The question is which one? Since both perceivers have normal vision, there seems to be no non-arbitrary way of ruling out one of their color experiences as illusory. Unless there is a privileged class of normal perceivers, there is no non-arbitrary way of deciding which of the perceivers is misperceiving the colour of the object. But there seems to be no such privileged class (Gatzia 2010, pp. 535-536).

As a reviewer for this journal has pointed out to me, the structure of this argument is the following: if there is no privileged class of normal colour perceivers, then there is no non-arbitrary way of deciding which of the perceivers is misperceiving the colour of the object. It seems, however, that there is no such privileged class. Therefore, it seems that there is no non-arbitrary way of deciding which of the perceivers is misperceiving the colour of the object. That is, every way of deciding which of the perceivers is misperceiving the object's colour would be arbitrary.

This short argument appears to be sound. Its premises appear to be true and its conclusion appears to follow from them. Hence, given any pair of perceivers, in a situation like that of Smith and Robinson's, there no way to decide which perceiver is misperceiving the colour of the object at which they are looking.

How should a colour physicalist respond to that conclusion? One response would be to play the skeptical card: perceptual variability shows that there is no non-arbitrary way of ruling out certain normal perceivers' colour experiences as illusory, and *thus* we have good reason to think that no one knows the determinate colour of anything by looking. Nonetheless, there are "unknowable colour facts" about things' determinate colours, truths about things' colours that hold independently of our ability to know them. Byrne and Hilbert have sometimes seemed to suggest that the

physicalist should grant the epistemic possibility that no one ever perceives anything as having a determinate colour that it has (Byrne and Hilbert 2003). This response, however, seems too radical, especially if a less skeptical response is available (as Byrne and Hilbert would no doubt concede).

Of course, everyone agrees that it would be arbitrary to select either Smith's or Robinson's experience as unveridical (or, for that matter, as veridical) or to pick out either as a generally less reliable colour perceiver than the other. And everyone agrees that we have no idea how to go about *identifying* a privileged subset of the normal perceivers who veridically experience the colours of objects. Moreover, I think we should grant the stronger claim that there exists no set of privileged normal colour perceivers such that its members always veridically perceive the colours of objects in appropriately favorable conditions. Importantly, it is a further question, quite independent of the truth of colour physicalism, whether anyone ever happens to veridically visually perceive the colour of something or whether anyone ever happens to know the colour of something. Of course, we might never be in a position to pick out such lucky people, but that doesn't show there aren't any.

Gatzia is aware of all this, but presses onward (Gatzia 2010, p. 536). She claims: 'If colors are objective physical properties of objects, it seems reasonable to expect that we can know which perceivers correctly represent the colors of objects' (Gatzia 2010, p. 536). But, according to her, the phenomenon of perceptual variability shows we cannot know which perceivers' visual experiences correctly represent the colours of objects. She finds it reasonable to conclude that the colours are not objective physical properties of their bearers.

Colour physicalists (at least of Byrne and Hilbert's stripe) have reason to deny Gatzia's claim that 'If colors are objective physical properties of objects, it seems reasonable to expect that we can know which perceivers correctly represent the colors of objects' (Gatzia 2010, p. 536). On colour physicalism, an object's having a particular colour is an objective fact about it. It is a fact that obtains independently of our ability to know that it obtains. This "objectivism" sits comfortably with the possibility of shifted spectra and with the claim that we therefore might be unable to know which perceivers perceive the true colours of objects. It is precisely their objectivity – their independence from our mental states and capabilities – that makes us unable to identify either the true colours of objects or those lucky people, if such there be, who sometimes (even if very rarely) experience the true colours of objects.

Byrne and Hilbert even provide a way to explain our ignorance of which colour experiences are veridical. They point out that the human visual system has evolved

to be highly complex. According to them, that complexity predicts that we should see some variation in colour appearances among normal perceivers (Byrne and Hilbert 2007, p. 88). Just as there is some variation in the accuracy of automobile speedometers, so we should expect that some statistically normal perceivers are less accurate colour perceivers than others on many occasions. In support of this, Byrne and Hilbert remind us of the fact that some normally sighted perceivers have much greater visual acuity than others (Byrne and Hilbert 2007, pp. 87-88). We might add: different normal hearers have greater or less sensitivity to high and low pitches, and some normal perceivers are more sensitive to temperature gradients than others. And sounds and temperatures are objective. If colours are objective physical properties, we shouldn't expect colour vision to be different from our other senses in this regard. We should expect some variability in colour experience.

A reviewer has pointed out that colours differ from sounds, temperatures, and speeds in crucial respects (the same point is made by Gatzia 2010). First, unlike sounds and temperatures, our only epistemic access to colours is through visual experience. Second, unlike speedometers the human eye is far from a lazy receptor of the passing show. Colour vision is an adapted system and is active in a way that passive mechanical devices such as speedometers are not (Gatzia 2010).

These two points suggest that perceptual variability does indeed constitute some *prima facie* evidence against the physicalist's idea that the colours are objective physical properties of their bearers. Similarly, widespread disagreement about positive moral claims is often held to constitute some sort of *prima facie* evidence against moral realism (for recent discussion, see Enoch 2009). Like the moral realist, the colour physicalist can justly ask why perceptual variability should be taken to be more than merely *prima facie* evidence against physicalism. Yet Gatzia, Hardin, and others—with equal justice—may insist that the probability of physicalism given perceptual variability is lower than the probability of physicalism considered alone.

Let us take stock. I have argued that it (epistemically) might be that sometimes some normal perceivers veridically perceive objects' determinate colours even though perceptual variability is widespread and even though there are no super reliable privileged colour perceivers. Doubtless, this claim is fairly weak. It doesn't require, for example, that we can identify normal perceivers who veridically perceive the determinate colours of objects. It doesn't even require that anyone ever knows the determinate colour of an object. Here colour physicalism might appear vulnerable: you might suspect that perceptual variability combined with physicalism makes knowledge of things' determinate colours impossible.

Consider the following argument: if the colours of objects are objective features of their bearers, then some perceivers sometimes know the determinate colours of objects. But no perceiver ever knows the determinate colour of an object if perceptual variability is widespread. Perceptual variability is widespread. So the colours are not objective features of their bearers. So physicalism is false.

I accept that we should expect that some people sometimes know the determinate colours of objects if colours are objective properties of their bearers. If colour physicalism makes visually based colour knowledge impossible, then Gatzia is right that we have compelling reason to abandon it. The important question is not whether there could be perceivers who experience objects as having the determinate colours that they have. Nor is it whether, if there were such perceivers, we should expect to be able to identify them. The important question is whether physicalists like Byrne and Hilbert can show that we have some visually grounded colour knowledge.<sup>1</sup> Can we have knowledge of things' determinate colours even if perceptual variability is widespread? Gatzia has argued that we cannot (Gatzia 2010, pp. 537-538).<sup>2</sup> I will argue that we can.

After explaining why I think objectivists should accept that we have colour knowledge, I consider Gatzia's argument that we cannot have any such knowledge given that perceptual variability is widespread.

### 3. Colour knowledge and perceptual variability

Byrne and Hilbert write: 'Physical objects are coloured: roses are red, violets are blue, and so forth' (Byrne and Hilbert 2007, p. 87). Why agree with them that roses are red? The answer has a familiar Moorean ring: we have much more confidence in the claim that roses are red than we do in any philosophical or scientific theory that denies it.

But why think that anyone knows the colour of anything given widespread perceptual variability? The realist answers: when a thing appears pure green to one

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<sup>1</sup> By 'colour knowledge' I mean visually grounded knowledge of the colours of things. Knowing that a canary is yellow because it looks yellow would be an example. If you know that a perceived canary is yellow, then you can work out that something is yellow. Such generalizations also count as colour knowledge.

<sup>2</sup> First, Gatzia argues that colour physicalists cannot appeal to epistemic externalism to argue that some of us can know the determinate colours of things (Gatzia 2010, pp. 337-338). Second, she argues that a teleological sense of 'normal perceiver' cannot be used to argue for this conclusion (Gatzia 2010, pp. 388-340). I don't have much to say about this second argument. If I am correct, colour physicalists have no need for a teleological conception of a Normal Perceiver.

normally sighted perceiver, bluish green to another, yellowish green to a third, pure yellow to a fourth, and pure blue to a fifth, then that thing will be exactly one of those colours. Suppose it is pure blue. Then, claims the epistemically optimistic realist, the perceiver to whom it appears pure green will often be in a position to know that it is pure green. So there is some colour knowledge, both of the determinable and determinate colours of objects.

Suppose a chip is pure blue and that it looks pure blue to Smith and that its looking pure blue causes Smith to believe that it is pure blue in the normal way. Is Smith's belief knowledge? Or does the chip's looking greenish blue to Robinson deprive Smith of knowing the chip's colour? On the one side, Smith is a statistically normal perceiver, viewing a pure blue chip in normal conditions, and experiencing a pure blue chip as pure blue. On the other side, Robinson visually experiences the pure blue chip as looking greenish blue, it is not greenish blue, and Robinson is just as statistically normal as Smith. Can Smith know that the chip is pure blue under these circumstances?

On many accounts of knowledge, Smith would know that the chip is pure blue under these circumstances. For example, according to an early form of "epistemic externalism" proposed by Fred Dretske, a subject *S* knows that *p* iff *S* has a conclusive reason to believe *p*, that is, *S* believes *p* because of a reason that he possesses that would not obtain unless it were the case that *p* (Dretske 1971). Smith possesses the following conclusive reason for believing that the chip is pure blue: the chip looks blue to him. The chip is blue and Smith would not possess that reason if the chip were not blue: his reason is conclusive.<sup>3</sup> Hence, Smith would know that the chip is pure blue on this account of knowledge. The fact that other people have inconclusive reasons for believing the chip is some other colour does not undercut Smith's knowledge. Inconclusive reasons are not contagious.

Perhaps this reasoning is too quick. You might think that it does not take seriously the phenomenon of perceptual variation. Smith's reason for thinking that the chip is pure blue is that it looks pure blue to him. Is this reason really one that is conclusive, that he would not possess unless the chip were blue? One might say No. After all, *it could have been* that the chip is greenish blue and that Smith still believes that it is pure blue because it looks pure blue to him. For example, Smith's medium

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<sup>3</sup> The claim is not that the chip is blue and Smith could not possess that reason if the chip were not blue. At distant possible worlds (possible worlds very dissimilar to the actual world) the chip appears blue to Smith even though it is yellow. For example, at some distant worlds mad brain scientists cause Smith to have experiences of blue whenever he looks at yellow objects. Worlds that differ so much from actuality are not relevant alternatives to Smith's actual situation. They do not defeat his knowledge.

wavelength cones might have been receptive to light of slightly shorter wavelengths. He might be old and have had severe macular degeneration. And so on. So Smith could have been looking at a greenish blue chip that would have looked pure blue to him. Isn't it a matter of luck that Smith is facing a pure blue chip? Isn't his reason (namely, his visual experience of pure blue) for thinking the chip is pure blue potentially misleading? I will argue that although this is in some sense correct, it does not undermine Smith's reason.

Dretske's account of knowledge is a simple form of "externalism". It is difficult to say what externalism is, but most externalist accounts of knowledge agree that a true belief is knowledge primarily because it is appropriately related (causally, counterfactually, modally, or objective probabilistically) to truth, where the appropriate relation need not be mentally accessible to the believer (Swinburne 2001, p. 11). In her paper, Gatzia gives a new and ingenious argument that seems to entail that Smith could not know that the chip is pure blue even if externalism about knowledge were true (Gatzia 2010, pp. 337-338).

In particular, Gatzia argues that Byrne and Hilbert cannot appeal to Robert Nozick's truth-tracking theory of knowledge to ground our colour knowledge (Gatzia 2010, pp. 337-338; Nozick 1981). Very roughly, Nozick's truth-tracking theory of knowledge is: a subject S knows that p iff S believes p, it is true that p, S would not believe p if not-p, and S would believe p if it were true that p (Nozick 1981, p. 172). In the case of Smith, Smith knows that the chip is pure blue iff Smith believes that the chip is pure blue, Smith would not believe that the chip is pure blue if it were not, and Smith would believe that the chip is pure blue if it were.

Remember on Byrne and Hilbert's view, being pure blue is having a spectral productance. Let us call the spectral productance that Byrne and Hilbert identify with pure blue 'SP-blue'. On Nozick's truth-tracking account of knowledge, it is very roughly the case that Smith knows that the chip is pure blue iff Smith believes that it is pure blue, it is SP-blue, and at the nearest possible worlds at which the chip is not SP-blue, Smith does not believe it is pure blue. For Byrne and Hilbert the nearest possible worlds at which the chip is not SP-blue are worlds at which the chip has some other spectral productance, one that is not identical with pure blue. And at those worlds, it would seem, Smith does not believe that the chip is pure blue. Instead she believes it is somewhat greenish blue. Moreover, at those close worlds at which the chip is pure blue, Smith believes it is pure blue. Accordingly, it seems that if Nozick's analysis of knowledge is true, then Smith can know that the chip is pure

blue if it is pure blue. By the same token, Robinson would have been able know that the chip is greenish blue if it had been greenish blue.

Gatzia concedes this, but argues that Nozick's truth-tracking account fails to deliver the verdict that there could be colour knowledge if physicalism is true. Gatzia points out that normally sighted colour perceivers locate pure green somewhere between 490 nanometers and 520 nanometers (Gatzia 2010, p. 537). Suppose that S, who is a normally sighted colour perceiver, locates pure green at 515 nanometers. Because S could have located pure green somewhere else, Gatzia thinks that perceptual variability creates cases strongly analogous to famous barn façade cases.

Ingenious as it is, I am not persuaded by Gatzia's argument. First, I explain her argument. Then I explain why I am not persuaded by it.

Fake barn examples allegedly show that a subject S can be facing a real barn and perceiving that there is a real barn before him in the normal way, although S does not know that there is a real barn before him because there are lots of barn façades about that he would have mistaken for real barns had he been faced with one. In fake barn country, S has visual experiences of a barn and believes that there is a barn before him and there is a barn before him. Yet, unbeknownst to S, he is in part of the countryside populated with very many fake barn façades. At some near possible worlds, S believes there is a barn before him, although he is looking at a barn façade. Because S might easily have been facing a fake barn, it is pure luck that S is not facing one. Hence, although there is an actual barn before S and S believes that there is a barn before him, S doesn't actually know that there is a barn before him.

Gatzia invites us to suppose that some normally sighted colour perceiver, S, locates pure green at 515 nanometers and that pure green is located at 515 nanometers. Suppose that stimulus x is pure green. Gatzia points out that at some close possible worlds, x reflects 490 or 520 nanometer wavelength light and that at such worlds S does not believe x is pure green. Gatzia rightly says that that is what we should expect if S knows that x is pure green. But, Gatzia notes, at these worlds we are assuming that S has reliable colour vision just as he actually does. We are holding S's visual capacities fixed. But, Gatzia points out, there are close possible worlds at which S has unreliable colour vision. In some such worlds S believes that x is pure green, even though x is some other colour (say, x is greenish blue). Gatzia thinks that these close worlds are relevant to whether S knows that x is greenish blue: she thinks that we should not ignore these close worlds. She argues, quite originally, that they pose a fake barn-like problem.

As in the original barn façade case, the subject of Gatzia's colour variation case does not satisfy that Nozick's third condition for knowledge (as it was stated above).<sup>4</sup> In Gatzia's color variation case, S actually believes that x is pure green and x is pure green. Yet, Gatzia claims, it is false that S would not believe x is pure green if x had not been pure green. This is false because we are now evaluating the counterfactual conditional with respect to close worlds at which S's visual system *unreliably* locates pure green somewhere other than 515 nanometers. At such worlds, non-pure-green objects look pure green to S. Observe that the counterfactual 'S would not believe x is pure green if x had not been pure green' come out false on some evaluations of it, since there are close worlds at which S has unreliable colour vision.

Even so, I am not yet persuaded that Nozick's full analysis of knowledge yields the consequence that S does not know that x is pure green in Gatzia's case. This is because Nozick's full analysis of knowledge involves the notion of a method or way of coming to know. On Nozick's finished analysis of knowledge, methods must be specified in stating his third and fourth conditions for knowledge (Nozick 1981, p. 179). According to that account, a subject S knows that p if and only if:

(C1) It is true that p

(C2) S believes, via method or way of coming to believe M, that p

(C3) If it weren't the case that p and S were to use M to arrive at a belief whether (or not) p, then S wouldn't believe, via M, that p.

(C4) If it were the case that p and S were to use M to arrive at a belief whether (or not) p, then S would believe, via M, that p.

Nozick introduces methods to deal with cases where a person's belief intuitively constitutes knowledge, although had things gone slightly differently her belief would not have constituted knowledge. Grandmother sees that her visiting Grandson is well. If he were sick or dead, her relatives would tell her he was well in order to spare her heartache. It is false that: if Grandson weren't well, Grandma wouldn't believe he was well. She would believe it. But this, Nozick claims, doesn't show that her belief is not knowledge. Grandma satisfies (C3). If Grandson weren't

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<sup>4</sup> Notice that Gatzia can easily generate cases in which a subject does not satisfy Nozick's (first approximation to) his fourth condition for knowledge: that if it were true that p, then S would believe that p. There are close worlds at which S experiences x as greenish blue. In such worlds S does not believe that x is pure green although it is pure green. These cases, I believe, can be handled in the way that I suggest Gatzia's colour variation case should be handled. See below.

well and grandma visually inspected him to arrive at a belief as to his wellness, she would not, via visual inspection, believe that he was well (Nozick 1981, p. 179).

Gatzia's colour variation case seems to me to be more analogous to Nozick's Grandma case than it is to standard barn façade cases. S has a visual experience that represents *x* as pure green. But S's visual system might have located pure green somewhere other than 515 nanometers. It is false that: if *x* were not pure green, then S wouldn't have believed that *x* is pure green. Nonetheless, one might argue that this does not defeat S's knowledge, since his unreliable colour vision constitutes a different method from the one he actually used. S actually used the visual capacities he has, not visual capacities that he has at some close possible worlds or even visual capacities S will have later in life. At the time of his looking at *x*, S satisfies (C3): if *x* were not pure green and S exercised his actual visual capacities to arrive at a belief whether (or not) *x* is green, *x* would not have believed, via those capacities, that *x* is green.

I have assumed that S's method of coming to believe that *x* is green is an exercise of S's actual visual capacities. I find this assumption extremely plausible, but you might feel uneasy about it. Nozick and other externalists have notorious difficulties in individuating and counting methods (Nozick 1981, p. 184). Suffice it to say that these problems appear irrelevant here. No matter how they are individuated, methods are the same only if they give rise to the same inner experiences in the same conditions. If S had had visual capacities that located pure green somewhere besides 515 nanometers, then he would not have been in a position to use the method he actually used.

It might be argued that metameric objects threaten the idea that Gatzia's case is more analogous to the Nozick's grandma case than to the standard fake barn case. S, one might claim, could have been looking at a metamer of *x* rather than *x* itself. A metamer of a surface or object *x* is a different surface or object such that it would appear the same colour as *x* in a given situation to a specific perceiver, even though the reflectance properties of *x* and the metamer differ. (For example, some pink surfaces and some light grey surfaces are metamers under moonlight: both look the same shade of grey to certain perceivers under moonlight.) Surely, if S had been looking at a metamer of *x* that was not green, then S would not have known that the metamer was green (since by hypothesis, it is not green). But how does this show

that S does not know that green x is green? Similarly, if the grandma had seen a visual simulacrum of her grandson, then she would not have known the person before her is her grandson. Certainly, she could have seen such a simulacrum (a cleverly disguised cousin perhaps). It does not follow that she does not know her grandson is before her in the circumstances she is actually in, since the likelihood of her seeing a simulacrum is low. By the same token, S is in a position know that x is green even granting that S would not have known this if S had been confronted with a metamer of x instead of x. The bare possibility of S seeing a metamer does not obviously make it impossible for S to know that x is green. This is especially so if the likelihood of his seeing a metamer is low.

Perhaps, however, the likelihood of S seeing a metamer of x is high. If that is right, then perhaps Gatzia can generate counterexamples to condition (C3) involving metamers. Such cases would show that S does not know that x is green. Since metamers are pretty commonplace, you might think the likelihood of S seeing a metamer is high. So, you might think, Gatzia can make a case against (CS) and, more broadly, against a truth-tracking theory of colour knowledge.<sup>5</sup>

More broadly, you might remain suspicious of the idea that our true colour beliefs often track the truth. So if Nozick's truth tracking account of knowledge is correct and perceptual variability holds, then we lack colour knowledge because they do not track the truth. Even when our colour beliefs themselves are true, they are true as a matter of luck. This makes intuitive sense. If Gatzia is right, then there are near-by possible worlds at which S believes that x is green on the basis of his actual method (visual experience) and where his actual method is itself unreliable. At such worlds even though x is not green, S believes that x is green. So S's belief that x is green cannot actually constitute knowledge if Nozick's truth tracking theory is right.

If Byrne and Hilbert were to adopt Nozick's analysis of knowledge, then Gatzia seems right that they would not be able to maintain – at least very easily – that that some of us, some of the time, know the determinate colours of things. This may not be much of a problem for them. Nozick's truth-tracking account of knowledge has met with substantive criticism by Keith DeRose and others (DeRose 1995, p. 2). On the one hand, DeRose points out that on Nozick's account I do not know that I am not a handless brain in a vat being fed all of my current experiences. If I were such a

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<sup>5</sup> This line of argument was suggested to me by some comments made by a reviewer for this journal.

brain, I would falsely believe myself to be a human being with hands. On the other hand, I do know that I have hand, since if I did not have hands, I would not believe that I did. However it seems extremely implausible to claim, as Nozick must, both that I do not know that I am not a handless brain in a vat and that I know that I have hands.

Even granting that colour knowledge cannot be had on Nozick's account, it does not follow that Byrne and Hilbert's colour physicalism is inconsistent with holding that there is perceptual variability and that some people know (on some accounts of knowledge) the determinate colours of things by looking at them. And in fact I will now show that there are Neo-Moorean safety accounts of knowledge that are quite compatible with the idea that we sometimes know the colours of things even though perceptual variability is widespread. Happily, this seems like the right result anyway. Most canaries are yellow, not orange or greenish yellow. And although snow often appears yellowish or bluish, most of snow is white. Even granting widespread perceptual variability, it seems fairly obvious that we know that most snow is white, that most canaries are yellow, that black paint is black, and so on.

Safety accounts of knowledge are compatible with knowledge of things' colours, as I will now argue. Problems with Nozick's account of knowledge have caused some epistemologists sympathetic to "externalism" to replace his third condition with a safety condition (Pritchard 2005, 2009; Sosa 1999). For example, on an account set forth by Duncan Pritchard, *S's* belief is safe iff in *nearly* all (if not all) near-by possible worlds in which *S* continues to form her belief about the target proposition in the same way as in the actual world the belief continues to be true (Pritchard 2007, p. 283). According to Pritchard, who sees himself as refining the broad anti-luck tradition of Dretske and Nozick, a subject *S's* belief regarding a contingent proposition constitutes knowledge iff that belief is safe and true. Is this account of knowledge compatible with the proposition that Smith knows the target proposition that the chip before him is pure blue?

I think that Pritchard's safety account is compatible with Smith's knowing the target proposition that the chip before him is pure blue. Smith believes that the chip before him is pure blue and, we are assuming, it is pure blue. And at nearly all nearby possible worlds at which Smith continues to form his belief in the proposition that the chip before him is pure blue in the same way as he forms it in

the actual world that belief remains true. This is because the way in which Smith formed his belief in the actual world was by way of his visual capacities functioning as they actually do function. At almost all nearby possible worlds at which Smith forms a belief regarding the proposition that the chip before him is pure blue by way of visual capacities functioning as they actually do function his belief continues to hold true.

Of course, there will be some nearby possible worlds at which Smith's belief that the chip is pure blue is false. But these worlds do not make it so that the safety condition is not met. At most nearby possible worlds Smith is looking at the very same chip he is actually looking at and his visual capacities function just as they actually function and the chip looks the same colour to him as it actually looks. For example, there are worlds exactly like the actual world except for that the chip is two inches to the right of where it actually is, or where the lighting is moderately brighter than it actually is, or where the spectral composition is slightly different from how it actually is. Colour constancy dictates that at such worlds the pure blue chip looks pure blue to Smith.

One might object that even if the chip is pure blue, it seems like pure luck that it looks pure blue to Smith. The peak sensitivity curves of Smith's short and medium wavelength retinal cones just happen to be such that he experiences the chip as pure green. Had they been slightly different, he would have experienced the chip as greenish blue or as some other colour. It seems like pure luck that Smith's cones are as they are. Moreover, it seems like pure luck that the chip's surface is as it is. If the chip had been greenish blue and surrounded by a red material, Smith would have mistakenly thought it was blue. It is pure luck that the chip is blue and has a surround that allows its blueness to appear. Surely, you might suspect, these possibilities undermine Smith's putative knowledge. Lucky knowledge is impossible.

The objection is a red herring. It trades on conflating veritic luck with benign forms of epistemic luck (Pritchard 2005, chapters 5 and 6). Of course, some kinds of luck are incompatible with knowledge. However, many forms of luck are quite irrelevant to knowledge possession (Pritchard 2005, chapter 5).

Consider a case of what Pritchard calls 'veritic luck', a kind of luck incompatible with knowledge. If Jones believes that the fair roulette wheel is going to come up

black and it is going to come up black, Jones still does not know this. In such cases at the nearest possible worlds at which the wheel is not going to come up black, Jones stubbornly believes, via his actual method (guessing), that it is going to come up black. Jones' belief is not knowledge. This case, of course, is quite unlike Smith's: Smith's true belief, unlike Jones's true belief, never had less than a 50% probability of being true.

But there are varieties of luck that are compatible with knowledge (Pritchard 2005, chapter 5; 2007). Jones has an uncanny ability to spot mountain goats from far away. From great distances, he can distinguish mountain goats from patches of snow, climbers, and various moving objects. Jones believes, on the strength of visual experience, that there is a mountain goat roughly ten miles away on a ridge. His belief is true. At the near-by possible worlds at which he continues to believe that there is a mountain goat on the ridge there is one there. Jones, I think it is fair to say, knows that there is a mountain goat on the ridge. Yet his knowledge is in some sense lucky. He is lucky to be able to spot mountain goats so well.

The general idea behind this is that knowledge does not require the complete absence of luck (Pritchard 2005, § 5.2). The existence of the fact (or the truth) that a subject knows may be a matter of luck in that at many nearby possible worlds that fact or truth does not exist. In other words, one can know a proposition even if it is lucky that the proposition happens to be true. Moreover, the existence of one's abilities or faculties and their functioning as they do may be a matter of luck. One may be lucky to have the evidence one has. There may be many nearby possible worlds where a knower lacks the evidence she has or where her faculties function less well they actually do. In short, it is lucky that the knower meets the preconditions for knowledge in the situation (for an careful discussion of the notion of a precondition for knowledge, see Hookway 2006). Absence of luck is only required to hold of the relation between the subject and the fact believed if the subject is to know that fact.

It seems to me that if Jones can be lucky in being able to spot mountain goats, then Smith can be lucky in having visual capacities that allow him to know that the chip is blue. Smith is lucky that the blue chip before him is not surrounded by a red surface that makes it look more greenish than it actually looks. Smith is lucky that he is not facing a metamer. Smith is lucky that his visual system isn't slightly different.

But Smith can still know that the chip before him is blue. Similarly, S can be lucky in knowing that it is pure green. S and Smith are lucky to have visual capacities of the kinds they have and to be in the circumstances in which they are set. Such luck is compatible with knowledge.

I conclude that it is quite possible, on popular safety based accounts of knowledge, for a subject to know the determinate colour of a chip before him. The conclusion generalizes. If it is true that the desk before me is brown and my belief regarding the proposition that that desk is brown is safe, then I know that it is brown. If roses are red, then you know that they are red for similar reasons. These things can be so, even if perceptual variability indicates that we make more mistakes regarding the determinate colours of things than we first might have thought. For these reasons, Gatzia has not presented a convincing case for holding that perceptual variability creates a problem for colour physicalism. More specifically, she has not shown that perceptual variability makes knowledge of objects' determinate colours impossible for the colour physicalist. A problem of perceptual variability may lie in wait for colour physicalism. But if one does, Gatzia has not yet identified it.<sup>6</sup>

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