Unknowable Color Facts

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Abstract

It is common for an object to present different color appearances to different perceivers, even when the perceivers and viewing conditions are normal. For example, a Munsell chip might look unique green to you and yellowish green to me in normal viewing conditions. In such cases, there are three possibilities. Ecumenism: Both experiences are veridical. Nihilism: Both experiences are non-veridical. Inegalitarianism: One experience is veridical and the other is non-veridical. Perhaps the most important objection to inegalitarianism is the ignorance objection, according to which inegalitarianism should be rejected because it is committed to the existence of unknowable color facts (e.g., facts about which objects are unique green). The goal of this paper is to show that ecumenists are also committed to unknowable color facts. More specifically, I argue that, with the exception of color eliminativism, all major philosophical theories of color are committed to unknowable color facts.

1. The puzzle of normal variation

Norma and Norm look at a Munsell chip. To Norma, the chip looks unique green—a shade of green without any admixture of yellowishness or blueishness. To Norm, the chip looks yellowish green. Both Norma and Norm qualify as normal perceivers according to standard tests of color vision, such as the Munsell-Farnsworth 100 hue test, and both are viewing the chip in normal perceptual conditions. This is a case of 'normal variation'—variation in color perception among normal perceivers in normal viewing conditions—and cases of this kind are surprisingly common. In any such case, it's natural to wonder: whose experience is veridical? The following possibilities partition logical space:

Ecumenism: Both experiences are veridical.

Nihilism: Neither experience is veridical.

Inegalitarianism: One experience is veridical and the other is non-veridical.

Each option comes with *prima facie* costs. The main problem with ecumenism is that it evidently contradicts the plausible color exclusion principle that nothing can be both unique green and yellowish green (all over at the same time). At least, ecumenism is inconsistent with this exclusion principle given the following attractive principle connecting the look of an object to the notion of a veridical experience:

> If *x* looks unique green (yellowish green) to *S*, then *S*'s visual experience is veridical only if *x* is unique green (yellowish green).

The main problem with nihilism is its apparent commitment to color eliminativism, the thesis that nothing is colored. For it is reasonable to assume that some normal perceiver would accurately perceive the chip's determinate color if it has one, so if neither experience is veridical, that is presumably because the chip has no determinate color.[1] And if the object has no determinate color, then presumably it lacks the determinable property *being colored*, for a thing cannot have a determinable property without having any of its determinates.[2] And if the chip isn't colored, that is presumably because nothing—at least, no external material thing— is colored, in which case color experience is a massive illusion. This is not an incoherent view, but I assume on general anti-skeptical grounds that we have reason to trust the testimony of experience in the absence of sufficiently strong countervailing considerations. There are, then, at least *prima facie* grounds for rejecting nihilism.

That leaves us with inegalitarianism. One common objection to inegalitarianism is the *systematic-error objection*: like nihilism, inegalitarianism evidently implies that most people,

[1] For simplicity, I assume there are only two determinate colors the chip is disposed to present to normal human perceivers in normal conditions. This assumption is unrealistic, but nothing philosophically significant hangs on it. We could drop the assumption by considering a scenario involving a larger class of normal perceivers—one for each of the many determinate colors the chip is apt to present to normal perceivers in normal conditions, but this would burden our discussion with needless complications.

[2] Or so it is generally supposed (Funkhouser 2006, p. 549; Cutter 2019), though see Wilson (2013) and Gert (2017).

most of the time, misperceive the determinate colors of objects.[3] Still, the systematic misperception to which inegalitarianism is committed is far less radical. The inegalitarian can hold that typical experiences of determinate color are *approximately* veridical. Moreover, the inegalitarian can hold that our experiences of *determinable* colors (e.g., green) are typically veridical, as are our color *judgments*, since these are usually only concerned with relatively determinable colors. The inegalitarian can take further comfort from the fact that our visual perception of determinate *spatial* properties evidently involves small but systematic errors. For example, it has been known for over a century that objects visually appear to stand in patterns of spatial relationships that subtly but systematically violate Euclidean geometric principles (principles that are, of course, satisfied by those objects' *actual* spatial relationships, ignoring negligible relativistic effects), and there is abundant experimental evidence that perceived angle size is distorted in systematic ways by factors like orientation and tilt.[4] We therefore have independent reason to reject what seems to be an underlying assumption of the systematic-error objection: that experiences of normal perceivers in normal conditions are always, or at least usually, perfectly (not just approximately) veridical.

Another common objection to inegalitarianism is the *arbitrariness objection*: because there is no evident reason to privilege Norma's experience over Norm's, or Norm's over Norma's, any answer we might give to the question of whose experience is veridical would be arbitrary.[5] The premise is very plausible. It would indeed be arbitrary to declare that Norma's experience is uniquely veridical, and it would be equally arbitrary to declare that Norm's is

[3] See, e.g., Byrne and Hilbert (1997, pp. 272-4), Block (1999, p. 46), Shoemaker (2000), Kriegel (2009, p. 86).
[4] For a summary of the empirical literature on visual geometric distortions, see Wagner (2006). For relevant philosophical discussion, see McLaughlin (2016) and Masrour (2017).
[5] See, e.g., Jackson and Pargetter (1987, p. 134) Hardin (1988, ch. 2), Kalderon (2007, p. 566), Cohen (2009, ch. 2), Kriegel (2009, p. 86).

uniquely veridical. Fortunately, the inegalitarian can avoid arbitrariness by making neither declaration. She claims only that exactly one of the two experiences is veridical. She needn't (and shouldn't) claim to know which. 'God knows', as Michael Tye remarks in his defense of inegalitarianism, but we may have no way of knowing (Tye 2006, p. 177).

This brings us to what is perhaps the most important objection to inegalitarianism, and the primary concern of this paper: the *ignorance objection*. According to the ignorance objection, inegalitarianism should be rejected because it leads to irremediable ignorance of this kind.[6] Put another way, it should be rejected because it is committed to something like the following claim:

> **CHROMATIC IGNORANCE:** Some color facts are unknowable (e.g., facts about which things are unique green).

As Hardin puts the objection, given inegalitarian forms of color realism,

> […] the spectral locus of unique green must be a matter of fact. If it is a matter of fact, there ought to be some way of determining what it is. It is clear enough that the just by looking principle will not suffice, unless we can be given some reason why the looking of some normal observers is to be preferred over the looking of others. The brute fact is that, to date, no color realist has offered even a plausible suggestion of how one might go about making this determination. (Hardin 2003, p. 199)

Inegalitarians generally concede that their view leads to CHROMATIC IGNORANCE.[7] But, they ask, so what? What's so objectionable about unknowable color facts? After all, we shouldn't assume that *all* truths are knowable (and not only because, as Fitch (1963) showed, this assumption

[6] See, e.g., Hardin (1988, ch. 2; 2003, p. 199), Averill (2003, p. 22), Dennett (2003, p. 788), Triplett (2007), Brogaard (2015, pp. 142-3), Gert (2017, p. 58), Morrison (forthcoming, pp. 4-6),
[7] See, e.g., Byrne and Hilbert (2003; 2007), Tye (2006), Allen (2016).

entails that all truths are known). The universe seems mostly indifferent to our practical ambitions; why should it be so accommodating to our epistemic ambitions?

These are reasonable questions, and in my view, they have not been adequately answered by opponents of inegalitarianism, but I will not pursue them here.[8] Here I take a different approach to defending inegalitarianism against the ignorance objection: I shall argue that, whether or not there is anything objectionable about unknowable color facts, it is not only the inegalitarian who is committed to them. The ecumenist is too. The ignorance objection therefore cannot be used to support ecumenism over inegalitarianism. A bit more specifically, I shall argue that, with the exception of color eliminativism, every major philosophical theory of color leads to CHROMATIC IGNORANCE. First, however, I must say a few words about how CHROMATIC IGNORANCE is to be understood.

2. Chromatic ignorance

To a first approximation, the ignorance thesis under consideration says:

CHROMATIC IGNORANCE: Some color facts are unknowable.

The thesis requires clarification. First, it should be read as implicitly restricted to facts about objects that are, in some reasonable sense, *available to us* for investigation. Perhaps we are irremediably ignorant of the colors of objects in far-off galaxies, or the colors of items that are too small or short-lived to be reliably observed or measured. But no one in this debate is

[8] For attempted answers, see Brogaard (2015), Triplett (2007), and Morrison (forthcoming). Brogaard's answer relies on the verificationist principle that '[h]ypotheses that are empirically untestable are typically regarded as meaningless' (Brogaard 2015, p. 143; cf. Hardin 2003, p. 200). But as Byrne and Hilbert remark, 'This tune from Old Vienna, it goes without saying, does not sound convincing' (Byrne and Hilbert 2007, p. 88). Triplett's and Morrison's answers are less clear, but they seem to think that we should reject unknowable color facts on Occamist grounds. I find this motivation puzzling. It's hard to see how Occamist considerations would tell against views that reductively identify unknowable color facts with physical facts of a kind that everyone accepts (e.g., reflectance facts). Of course, there may be an Occamist objection to *irreducible* unknowable color facts, which some color primitivists accept, but here the problem is surely their *irreducibility*, not their *unknowability*. After all, even if everyone's perceptions agreed about which things are unique green, this wouldn't blunt the force of the Occamist objection to the view that unique green is an irreducible property.

concerned with this type of ignorance. The type of ignorance relevant to the ignorance objection is ignorance of the colors of nearby, medium-sized items that can be investigated and manipulated by scientific instruments at our leisure. We should understand the thesis of CHROMATIC IGNORANCE to be implicitly restricted to color facts of this kind.

Beyond these banal qualifications, I want to clarify the thesis by laying down two constraints on what it would take to *avoid* commitment to CHROMATIC IGNORANCE. In formulating these constraints, my guiding assumption is that we should understand CHROMATIC IGNORANCE in such a way that inegalitarians can plausibly be said to be committed to it. (There are, after all, *some* ways of understanding the notion of 'unknowable color facts' on which the inegalitarian isn't committed to them. To take a silly example: in a very weak sense of 'possible', it is possible that we will be visited by an omniscient oracle who will tell us which experience is veridical. In a correspondingly weak sense of 'knowable', all color facts are knowable. We therefore shouldn't understand the notion of knowability in this very weak sense, at least if we want to maintain that inegalitarians are committed to CHROMATIC IGNORANCE.) After formulating the two constraints, I shall argue in §§3-4 that ecumenists are unable to meet them.

Here is the first constraint:

> **The Chromatic Guise Constraint:** To avoid CHROMATIC IGNORANCE, it must be possible to know all relevant color facts *under a guise that involves color concepts* (rather than, say, co-referring scientific concepts, such as reflectance concepts).

To see why this constraint is needed, consider the inegalitarianism of Tye (2000; 2006) and Byrne and Hilbert (2003; 2007). Setting aside some complications that are irrelevant for our purposes, Tye, Byrne, and Hilbert accept *reflectance physicalism* about color, the view that colors are identical to surface reflectance types. It arguably follows that color facts are identical

to reflectance facts. For example, if unique green is reflectance type *R*, then the fact that a certain object is unique green is presumably identical to the fact that it has reflectance type *R*. But reflectance facts of this sort are knowable by scientific means. So, even an inegalitarian can hold that all color facts are in some sense knowable, at least if reflectance physicalism is true.

The point of the chromatic guise constraint is to block this escape hatch. We may choose to individuate facts in such a way that the identity of unique green with reflectance-type *R* implies the identity of the fact that *o* is unique green with the fact that *o* has reflectance type *R*. But in that case, it will be possible for one and the same fact to be known under one 'guise'—one structured collection of concepts, if you like—but unknown under another, just as a fact about Venus can be known under a guise involving the concept *Hesperus* without being known under a guise involving the concept *Phosphorus*. To avoid CHROMATIC IGNORANCE on its intended reading, it is not enough for the relevant fact to be knowable under a guise involving scientific concepts. It must be knowable under a guise involving color concepts—for example, the guise one would naturally express with the sentence, 'the chip is unique green'.

I wish to remain neutral about the nature of color concepts. The only assumption I make is that color concepts, unlike reflectance concepts and most other scientific concepts, have some close connection to color experience. This modest assumption is compatible with many different views about what this connection looks like. According to some theorists, color concepts are functional concepts that pick out colors in terms of the experiences they cause. Thus, the concept *red* might be something like the concept: *the property that causes reddish experiences*.[9] According to others, color concepts are dispositional concepts, such as: *the disposition to cause reddish experiences.*[10] Still others hold that color concepts are unanalyzable concepts that

[9] See, e.g., Jackson and Pargetter (1987), McLaughlin (2003), Chalmers (2012).
[10] See, e.g., McGinn (1983), Peacocke (1984), Levin (2000).

directly pick out the qualities presented in color experience.[11] On this view, color experience doesn't figure in the analysis of color concepts, though it plausibly plays an enabling role in allowing us to have and use color concepts. Although I personally favor the latter view, the arguments in this paper are compatible with any of these views.

To introduce the next constraint, it will be helpful to consider another potential response to the ignorance objection: the *perfect-psychosemantics response*. Inegalitarians—especially those of a reductionist bent, like Tye, Byrne, and Hilbert—might argue that all relevant color facts could be known once we discover what Jonathan Cohen calls 'the One True Psychosemantics' (Cohen 2009, p. 59). The One True Psychosemantics is the correct and complete theory of how mental states represent the world. Such a theory would tell us exactly which external properties are represented by an organism's brain states, at least given all relevant (intrinsic and extrinsic) physical and functional facts about the organism. We could therefore figure out, at least in principle, exactly which external properties are represented by the relevant states of Norma's and Norm's visual systems. (Given reflectance physicalism, we could also figure out which reflectance type is identical to unique green: it would be whichever reflectance type is represented by Norma's brain state.) From here we could determine whose experience is veridical by straightforward scientific means, simply by determining which of the two represented properties actually belongs to the chip.[12]

I think it should be conceded that, given inegalitarianism, knowledge of the One True Psychosemantics could put us in a position to know whose experience is uniquely veridical, and also whether the chip is unique green. Thus, anyone who maintains that inegalitarianism leads to CHROMATIC IGNORANCE must say that the One True Psychosemantics is somehow epistemically

[11] See, e.g., Moore (1903), Byrne and Hilbert (1997), Tye (2000), Chalmers (2006), Allen (2016).
[12] Cf. Byrne and Hilbert (2003, p. 8).

inaccessible, at least if inegalitarianism is true.[13] The latter claim isn't totally implausible. Suppose that tomorrow someone comes up with a psychosemantic theory that implies that only one of the two perceivers—say, Norma—is accurately perceiving the chip. Cohen suggests that, in virtue of making this contentious prediction, 'this imagined psychosemantic story would be no less controversial than the disputed matter of color ontology; since many who have considered these matters believe that such a prediction would be erroneous, they would regard any psychosemantics that licensed that prediction as *ipso facto* unacceptable' (Cohen 2009, p. 61).

I think it would be too quick to conclude that the One True Psychosemantics is absolutely unknowable. Perhaps the true theory, once formulated, will be seen to exhibit such elegance and simplicity, and to get so many of the uncontroversial cases right, that any reasonable person would trust its verdicts on the controversial cases (even if that means revising previously held opinions) instead of rejecting the theory. Still, it can plausibly be said that knowledge of the One True Psychosemantics is in some sense 'infeasible' for us, at least in our current epistemic situation. Let's say that knowledge of a fact is *infeasible* if the fact cannot be known without some major philosophical or scientific breakthrough, perhaps of a kind that's currently hard to even imagine. Knowledge of a fact is feasible, then, only if it is possible to achieve this knowledge given something like our current scientific and philosophical understanding, or non-revolutionary extensions thereof. In light of the perfect-psychosemantics response to the ignorance objection, those who maintain that inegalitarianism leads to CHROMATIC IGNORANCE should understand CHROMATIC IGNORANCE in terms of infeasibility: a color fact is unknowable, in the relevant sense, when knowing it is infeasible. For without something like this

[13] A proponent of the ignorance objection might, of course, argue that we have independent grounds for thinking that the One True Psychosemantics won't yield an inegalitarian result. But then all the argumentative work would be done by those independent grounds. The appeal to unknowable color facts would be otiose.

understanding of an unknowable color fact, it's hard to see how defenders of the ignorance objection could sidestep the perfect-psychosemantics response. This gives us the following constraint on what it would take to avoid CHROMATIC IGNORANCE, properly understood:

> **The Feasibility Constraint:** To avoid CHROMATIC IGNORANCE, attaining knowledge of relevant color facts must be *feasible.*

With these clarifications out of the way, we can now turn to the central project of this paper, which is to argue that all major realist theories of color are committed to CHROMATIC IGNORANCE. Color realism, as I use the term, is the view that colors belong to ordinary external objects, such as tomatoes, carrots, and Munsell chips. Realist theories of color can be divided into two groups: *subjectivist* theories and *objectivist* theories. Subjectivist theories hold that colors are response-dependent properties of external objects—that is, properties of external objects, such as a tomato's disposition to produce reddish visual sensations, whose instantiation depends on the subjective responses of perceivers. Objectivist theories hold that colors are response-independent properties of external objects, properties whose instantiation does not depend on the subjective responses of perceivers. The objectivist/subjectivist distinction crosscuts the inegalitarian/ecumenist distinction. Hereafter, I take for granted that any inegalitarian view will lead to CHROMATIC IGNORANCE, so in the coming sections, I focus on ecumenist versions of subjectivism and objectivism. My strategy is to divide and conquer. In §3, I argue that ecumenist versions of subjectivism lead to CHROMATIC IGNORANCE. In §4, I argue the same for ecumenist versions of objectivism.

3. Why subjectivism leads to chromatic ignorance

To a first approximation, the subjectivist holds that what it is for an object to *be* (say) red is for it to be disposed to *look* red, where an object's 'looking red' is a matter of its causing (non-

deviantly) a certain type of mental state. The relevant mental state is commonly taken to be a phenomenal state (a 'phenomenally reddish' experience, we could call it), but some versions of subjectivism characterize the mental state in representational terms (say, the state of perceptually representing an object as red). For now, I'll focus on the phenomenal version of subjectivism, the version that identifies colors (roughly) with dispositions to cause certain phenomenal states. After arguing that this version of subjectivism leads to CHROMATIC IGNORANCE (§§3.1-3.2), I'll argue that the same goes for the representational version of subjectivism (§3.3).

Subjectivism standardly comes with a commitment to the perceiver-relativity of color. For, as McGinn notes, once we accept that being red is a matter of being disposed to look red, 'the question arises, to *which* perceiver or perceivers the red object is disposed to look red' (McGinn 1983, p. 9). Subjectivists commonly emphasize that, in many cases of perceptual variation, there is no principled basis for favoring one perceiver over the others. Therefore, to avoid arbitrariness, they typically conclude that we should reject the absolutist idea that redness is a monadic property, a property that objects have or lack *simpliciter*. Rather, redness is *polyadic*: nothing is red *simpliciter*, but only red relative to (or red 'for') this or that perceiver. (Subjectivists typically also relativize color to a circumstance of perception, but we'll ignore this parameter for simplicity.) The only monadic properties in the vicinity are the many 'plugged' properties of the form *red for S*, which receive analyses along the following lines:

An object *x* is red for a subject *S* iff *x* looks (or is disposed to look) red to *S*.

In what follows, I take for granted that my subjectivist opponent endorses biconditionals of this kind, and I assume she holds that looking red is a matter of causing (in an appropriate way) a certain type of phenomenal state. More generally, I shall assume that the subjectivist accepts something like the following picture: for each color *K*, there is a type of phenomenal state *Q* such

that an object is *K* for *S* iff it produces or is disposed to produce (in an appropriate way) state *Q* in *S*. Admissible values of *K* include ordinary mid-level colors (e.g., red, purple, green) as well as highly determinate colors (e.g., red_{17}, unique green) and the maximally determinable color property *being colored*. Corresponding values of *Q* will then have a corresponding level of specificity or determinacy.[14]

A distinct but closely related view of color is 'realizer functionalism'.[15] Realizer functionalists endorse claims along the following lines as conceptual analyses for our color concepts:

> 'Redness for S in C [...] is the property which causes (or would cause) objects to look red to S in C' (Jackson and Pargetter 1987, p. 134).

Since the property that occupies this functional role is generally taken to be an objective physical property, this view technically qualifies as a form of objectivism, though it holds that colors are picked out by way of functional descriptions that make reference to the subjective responses of perceivers. I won't discuss realizer functionalism explicitly in the arguments below, but it should be clear how these arguments, if successful, would equally show that realizer functionalism leads to CHROMATIC IGNORANCE.

My argument for the claim that subjectivists are committed to CHROMATIC IGNORANCE relies on the following thesis:

PHENOMENAL IGNORANCE: Some relevant phenomenal facts are unknowable.

Phenomenal facts are facts specifying (partially or fully) what it's like to be an individual at a given time. *Relevant* phenomenal facts are facts about an individual's color phenomenology.

[14] Subjectivist theories of color along these lines are defended by McGinn (1983), Peacocke (1984), Levin (2000), and Cohen (2009).
[15] See, e.g., Jackson and Pargetter (1987), McLaughlin (2003), Chalmers (2012).

PHENOMENAL IGNORANCE is compatible with the assumption, which I will grant for the sake of argument, that all *physical* facts about color vision are knowable (under physical concepts). For there is, famously, an 'epistemic gap' between the physical facts and the phenomenal facts. In other words, there is no *a priori* or conceptual entailment from the physical facts to the phenomenal facts.

The existence of an epistemic gap is nowadays widely accepted, even among physicalists, and I shall assume its existence in this paper.[16] What is more controversial is whether the epistemic gap has any metaphysical significance—in particular, whether it entails or provides grounds for accepting a corresponding *ontological* gap between the physical and phenomenal domains. Here I remain neutral on the legitimacy such inferences, as well as on the existence of an ontological gap. Note that I do not claim that the epistemic gap *entails* PHENOMENAL IGNORANCE. My present claim is much more modest: given the epistemic gap, PHENOMENAL IGNORANCE is *not ruled out* by the assumption that all physical truths concerning color vision are knowable.

The argument below will focus on two kinds of phenomenal ignorance: *general* and *specific* phenomenal ignorance. The first refers to irremediable ignorance of whether a given creature enjoys any color phenomenology at all. The second refers to irremediable ignorance of the specific phenomenal character of a creature's color experience (for example, ignorance of whether a creature is undergoing a phenomenally reddish experience). In what follows, I argue that both types of phenomenal ignorance are actual and each leads the subjectivist into a corresponding type of chromatic ignorance–general chromatic ignorance (irremediable ignorance of whether an object is colored for a given creature) and specific chromatic ignorance

[16] For physicalist endorsements of the epistemic gap, see, among many others, Hill and McLaughlin (1997), Papineau (2002), Block (2006), and Balog (2012).

(irremediable ignorance of what specific color an object has for a creature). Let us consider these in turn.

3.1 General ignorance

Our epistemic position is sometimes characterized by *general* phenomenal ignorance—irremediable ignorance of whether certain creatures have any color phenomenology at all—or so I shall argue here. Philosophers who are especially impressed with the problem of other minds may think we are subject to this kind of ignorance with respect to other human beings, perhaps because they hold that we cannot know whether our fellow humans are phenomenally conscious at all. But I don't want to defend general phenomenal ignorance by relying on any extreme form of skepticism about other minds. Perhaps it is a consequence of the epistemic gap that we can never achieve *certainty* about the existence of other conscious minds. But, at least for the sake of argument, let's agree to be good fallibilists and allow that knowledge is sometimes possible even where certainty is unwarranted.

Even on generous fallibilist assumptions, however, there are many real-life cases in which there is no feasible way to determine whether a creature is phenomenally conscious. Consider insects. Many insects, such as ants, butterflies, and bees, have color vision, at least in a purely functional sense involving visual capacities for responding differentially to different wavelengths of light, and we can assume they have color experiences of some kind if they have experiences (i.e., phenomenally conscious states) at all. But do they? I have no idea. To begin with, the behavioral evidence for insect consciousness is far from conclusive. On the one hand, insects fail to exhibit many forms of behavior associated with consciousness in the human case. Most obviously, they don't issue verbal reports, and they don't exhibit anything like the degree of behavioral flexibility and sophistication that human consciousness enables. They similarly fail

to exhibit many of the behaviors associated with specific conscious states like pain, such as moving to protect injured body parts.[17] On the other hand, insects *can* learn to avoid noxious stimuli, which might be taken as evidence that they feel pain. Moreover, there are several experiments showing that insects injected with morphine behave as we would expect if the morphine had the effect of diminishing their experience of pain.[18]

The evidence for insect consciousness is no less ambiguous when we turn from behavior to the brain. On the one hand, insect brains lack many of the structures and functions associated with human consciousness. Their brains do not include anything like the mammalian neocortex, and consequently they lack many specific cortical functions that have been proposed as neural correlates of consciousness in the human case, such as recurrent activity connecting low-level and high-level cortical sensory areas,[19] or prefrontal cortical functioning associated with higher-order awareness.[20] On the other hand, as Klein and Barron (2016) emphasize in a recent defense of insect consciousness, insect brains seem to support a behavioral 'core control system' that is functionally analogous to integrated midbrain structures associated with consciousness in vertebrates. This core control system integrates information from multiple senses to construct an action-guiding egocentric model of the environment and the organism's changing position within it. Klein and Barron maintain that the integrated midbrain structures in vertebrates that perform analogous functions are *sufficient* for phenomenal consciousness, from which they conclude that insects are probably phenomenally conscious as well. The inference is plausible enough, but its key premise—the sufficiency thesis—is extremely controversial. They cite the work of Bjorn Merker (2007) to support the sufficiency thesis, but the evidence Merker offers is far from

[17] See Eisemann et al. (1984), Tye (2016, pp. 137-8).
[18] Balderama et al. (1987).
[19] Lamme (2006).
[20] Lau and Rosenthal (2011), Odegaard, Knight, and Lau (2017).

conclusive. For example, much of Merker's argument is based on evidence that interfering with midbrain functioning can impair or eliminate consciousness. But as Hill (2016) notes, evidence of this kind only supports a necessity thesis, not a sufficiency thesis.

A full review of the evidence for and against insect consciousness is beyond the scope of this paper, but the points above should convey some of the difficulties involved in answering the question. As to the general question of which animals are conscious and which are not, our epistemic situation is nicely summarized by Christof Koch, who reports that 'we have literally no idea at what level of brain complexity consciousness stops' (Fox 2007).

Granted, if we had in our possession the One True General Theory of Consciousness, a detailed specification of exactly which physical/functional properties are necessary and sufficient (at least nomologically) for a creature to be conscious, we could determine empirically whether any given creature is conscious. Speaking for myself, I doubt we'll ever know the One True General Theory of Consciousness, even to a reasonable approximation—enough to know whether, say, ants are conscious. One difficulty is the sparsity of the data concerning the distribution of consciousness in nature. After all, we can only directly check whether consciousness is present in the human case. Because the introspective data are so sparse, there will be many hypotheses about the necessary and sufficient physical/functional conditions for consciousness that fit the data. These include physical/functional properties that always come and go together in the human case and only diverge in the non-human case, such as pairs of properties that make slightly different demands on the type of cognitive architecture their bearers must possess, but where both demands are satisfied by the human cognitive architecture. This can happen because the human cognitive architecture, like everything in the universe, falls under indefinitely many distinct types, some of which are more abstract or inclusive than others (e.g.,

types that require only subcortical functions vs. those that require cortical functions as well, or types that require a capacity for higher-order awareness vs. types that permit but don't require such a capacity). In addition to the sparsity of the data, another significant difficulty is that the usual abductive methods by which we extend our scientific knowledge beyond the data are particularly impotent in this domain. For unless interactionist dualism is true, every explicable physical phenomenon can be explained in terms of prior physical or functional states that are, at least in principle, describable in wholly non-phenomenal terms.[21]

Maybe it would be too quick to conclude from these difficulties that the One True General Theory of Consciousness is absolutely unknowable. Perhaps the correct theory, once formulated, will be seen to exhibit such elegance and simplicity, and to get so many of the uncontroversial cases right, that we would be rationally warranted in accepting it, and doing with such a high degree of confidence that our acceptance might amount to knowledge. Still, pinning one's hopes on the eventual discovery of the One True General Theory of Consciousness is relevantly like pinning one's hopes on the eventual discovery of the One True Psychosemantics. Knowledge of either would require a revolutionary scientific or philosophical breakthrough of the sort relevant to our feasibility constraint. Given subjectivism, knowing whether things are colored for (say) ants requires that we know whether ants are phenomenally conscious. If knowledge of whether ants are phenomenally conscious requires knowledge of the One True General Theory of Consciousness, then the subjectivist ecumenist, like the inegalitarian, fails to satisfy the feasibility constraint.

A color subjectivist with a physicalist view of consciousness might try a different response. She might say that what it is to have color phenomenology *just is* to be in a certain

[21] Cf. Chalmers (1996, pp. 156, 158, 163-5) on the 'explanatory irrelevance of experience'.

physical or functional state. We can know empirically, at least in principle, what physical/functional states are produced in any given creature by any given object. Therefore (the response continues), all facts about color phenomenology are empirically knowable, and given color subjectivism, all color facts are thereby knowable as well.

The problem with this response is that it violates the chromatic guise constraint. Suppose we know that an object causes ants to instantiate physical property *P*. And suppose that *P* is identical to the phenomenal property *having color experience*. Still, if we are ignorant of this psychophysical identity, then we will not know that the object is disposed to produce color experience in ants. Thus, even given the generous assumption that subjectivism can be known, so we can know that

> The object is *colored* for the ant if and only if it is disposed to produce color experience in the ant,

this knowledge wouldn't put us in a position to know (under the appropriate color concept—the concept *colored*) that the object is colored for the ant.

Alternatively, one might concede that subjectivist ecumenism leads to unknowable color facts for the reasons given above, but respond that, nonetheless, the ignorance to which the subjectivist ecumenist is committed is importantly different from, and somehow less objectionable than, the kind to which the inegalitarian is committed. It might be said that CHROMATIC IGNORANCE is especially problematic for the inegalitarian because the existence of unknowable color facts stands in tension with the typical inegalitarian commitment to the *objectivity* of color. If colors are 'out there', waiting to be studied, why would we be prevented from acquiring knowledge of these properties? By contrast, if colors are essentially tied to mental states, as the subjectivist maintains, then knowledge of color is necessarily tied to familiar

epistemic problems about other minds. Thus, it might be argued that the chromatic ignorance to which the subjectivist ecumenist is committed is both expected (given standard epistemic worries about other minds) and linked to broader epistemic limitations, while the chromatic ignorance to which the inegalitarian is committed is novel and unexpected.[22]

Upon closer examination, however, the two kinds of chromatic ignorance turn out to be more similar than they initially appear. Consider first the claim that the chromatic ignorance associated with subjectivist ecumenism is linked to broader epistemic limitations concerning other minds. This is true, but the same holds for the chromatic ignorance associated with many inegalitarian views. For the subjectivist ecumenist, chromatic ignorance is linked in the following way to ignorance of certain phenomenal facts:

> Assuming that subjectivism is both true and knowable, all relevant color facts would be knowable *if only we were given full knowledge of the phenomenal facts*, e.g., knowledge of whether ants have color phenomenology. (Alternatively: if we were given suitably detailed knowledge of the way in which phenomenal facts depend on the empirically available physical/functional facts—'the One True Theory of Consciousness'.)

Likewise, for the inegalitarian reflectance physicalist, chromatic ignorance is linked to ignorance of certain *representational* facts, as we saw in our discussion of the 'perfect-psychosemantics response' in §2. Indeed, the link takes the very same form:

> Assuming that reflectance physicalism is both true and knowable, all relevant color facts would be knowable *if only we were given full knowledge of the representational facts*, e.g., facts about which reflectance properties are represented by which brain states (Alternatively: if we were given suitably detailed knowledge of the way in which

[22] Thanks to an anonymous referee for raising this concern.

representational facts depend on the empirically available physical/functional facts—'the One True Psychosemantics').

Thus, while it is true that, for the subjectivist ecumenist, chromatic ignorance is connected to broader epistemic limitations concerning other minds, the same holds for many inegalitarians.

Still, this doesn't entirely answer the charge that, if colors are *objective* properties—'out there', waiting to be studied—it is mysterious why the fine-grained colors facts would be epistemically inaccessible to us. But this epistemic limitation is no more mysterious than the parallel epistemic limitation regarding the phenomenal states of other creatures. Although the phenomenal states of other creatures are 'subjective' in one sense, they are nonetheless 'objective' or 'out there' in the sense that they don't depend on the attitudes that *we, the inquirers,* take toward those creatures. (In the same sense, of course, the fact that an object is disposed to produce a certain phenomenal state in another creature is an 'objective' fact. Hence, even for the color subjectivist, there is a perfectly good sense in which colors are 'out there', waiting to be studied.)

In my view, these two epistemic limitations have similar explanations. As we've seen, the existence of irremediable phenomenal ignorance is explained, at least in part, by the existence of an *epistemic gap* between the physical/functional facts and the phenomenal facts. If there were an *a priori* conceptual link from physical/functional facts to phenomenal facts, there would presumably be no irremediable phenomenal ignorance. We could simply deduce that a creature is conscious, or has a certain kind of color experience, from the relevant physical/functional facts (after achieving knowledge of the latter by ordinary scientific means). But given the epistemic gap, even complete physical knowledge about a creature doesn't guarantee knowledge of its phenomenal states. (This holds even if its phenomenal states are

identical to some of the physical states that we discover through third-personal scientific investigation, since the *epistemic* gap, which has to do with our physical and phenomenal *concepts*, is consistent with the absence of any corresponding *ontological* gap between the referents of those concepts.)

Now, as several philosophers have noted, there appears to be a similar epistemic gap between the physical facts and the chromatic facts (Shoemaker 1996, p. 248; 2003, p. 256; Johnston 2004, p. 146; Byrne 2006, pp. 230, 237-8; Cutter 2018, p. 46; Allen 2016, pp. 77-82). Find a bright yellow object, and attend to its yellowness, the quality you perceive to be spread across the object's surface. For any purely physical description ϕ that the object satisfies, it seems we can coherently conceive of something that is ϕ without having *that quality*.[23] This epistemic gap can explain, at least in part, why certain chromatic facts are unknowable. If there were no such epistemic gap, there would presumably be no chromatic ignorance. We could simply deduce that a color chip is (say) unique green from its physical description (after achieving knowledge of the latter by ordinary scientific means). But given the physical-chromatic epistemic gap, even complete physical knowledge doesn't guarantee knowledge of fine-grained color facts. (Again, this holds even if colors are *identical to* some scientifically discoverable physical properties, since the epistemic gap is consistent with the absence of any ontological gap.)

[23] Nor, in my view, would the epistemic gap be closed if we added phenomenal truths to the inferential base. Even if subjectivists are right, and colors are just dispositions to produce certain phenomenal states, this does not seem to be a *conceptual* truth. More generally, there does not seem to be any *purely conceptual* entailment from objects' having certain phenomenal effects to their having a certain color. If there were, then color eliminativists, who hold that nothing is yellow while acknowledging that (for example) lemons are disposed to be *experienced* as yellow, would be making a *conceptual* error instead of a mere factual error. This is implausible. As Pautz remarks in response to a similar suggestion, 'while such a version of Eliminativism might be false, we cannot rule it out *a priori*' (Pautz 2006, p. 560).

Given the epistemic gap between the scientifically discoverable physical facts and the facts about color, it is not terribly surprising that scientific inquiry would fail to settle all questions about the precise colors of objects. In cases of normal variation, inegalitarians typically concede that we cannot know an object's precise color just by *looking*, since it's plausible that our perceptual justification to believe that the object has a given precise color is undermined by our knowledge of the existence of normal variation. But if we cannot know an object's precise color just by looking, and we cannot know its precise color by deducing it from the object's scientifically discoverable physical properties, then it is unsurprising that we cannot know it at all. The objector may be correct that, for the subjectivist ecumenist, chromatic ignorance is in some sense 'expected', or unsurprising, at least when we are reminded of the familiar epistemic difficulties concerning other minds. But chromatic ignorance is also unsurprising for the typical inegalitarian, at least when we are reminded of the epistemic gap between the physical facts and the chromatic facts. The objection therefore fails to establish any philosophically significant disanalogy between the kind of chromatic ignorance to which the subjectivist ecumenist is committed and the kind to which the typical inegalitarian is committed.

3.2 Specific ignorance

We are not only subject to general phenomenal ignorance. Sometimes our epistemic position is characterized by *specific* phenomenal ignorance, irremediable ignorance about the specific phenomenal character of a creature's color experience.

Specific phenomenal ignorance has many sources. To begin with, we can readily imagine cases in which we do not know whether an individual's color experience is phenomenally the same as our own (a form of specific phenomenal ignorance) because we do not know exactly which level of functional organization is relevant to determining phenomenal sameness and

difference. Imagine we've built an AI that is functionally isomorphic to you, but whose functional states are realized in silicon hardware. Like you, it has sensors that respond differentially to different wavebands of light. It also has mechanisms that process the signals from these sensors in ways that simulate the neurocomputational processes that occur in your visual system, using opponent channels to code stimuli along an R/G axis, a Y/B axis, and a brightness axis, for example. Suppose we present the AI with an object that looks red to you, like a ripe tomato. Does it look red to the AI? In other words, when the AI sees the tomato, does it undergo a color experience qualitatively like the experience you undergo when you see the tomato?

I say we don't know, and without a major theoretical breakthrough in our understanding of the physical basis of consciousness, we won't ever know. Part of the difficulty is that we may be unable to know whether the AI is conscious at all. But let's waive that difficulty and assume that it is. Assuming the AI is conscious, we might be able to know *something* about what the AI's experiences are like. For example, if the AI is functionally isomorphic to you, it's reasonable to believe that its experiences would resemble yours in *structural* respects. For example, its phenomenal quality space(s) would probably exhibit the same resemblance structure and dimensionality as yours. But intuitively, phenomenal structure underdetermines phenomenal character. That's why inverted-spectrum scenarios, in which phenomenal structure is held fixed while phenomenal qualities are inverted, or alien-spectrum scenarios, in which the same phenomenal structure is filled in with alien phenomenal qualities, are *a priori* coherent, at least *prima facie*. To know whether the AI's experiences are qualitatively the same as yours or radically different (perhaps utterly alien), we would need to know whether the material realizers of perceptual functioning are relevant to phenomenal character.

Moreover, even if we could know that some form of functionalism is true, such that phenomenal properties are insensitive to the ultimate material realizers of our mental functioning, this leaves unsettled the question of exactly which levels of functional description are relevant. Too many discussions in the philosophy of mind implicitly assume that there are just two options to choose from, the 'functional' level and the 'biological' level. But as Lycan (1987) emphasizes, this is a gross oversimplification. Brain processes can be characterized at many levels of functional description, and even paradigmatically biological processes are often multiply realizable with respect to lower chemical and microphysical levels. Presumably, to duplicate phenomenal properties, it's not enough just to duplicate the highest functional level (i.e., the input-output function computed by your brain). Do we need to duplicate neuron-level functioning? Sub-neuronal functioning? Or is it enough to duplicate the mid-level algorithms that, in us, are implemented by neural-signaling patterns. For each well-defined level of functional description, we can consider a possible AI that duplicates your functioning at that level while massively diverging from you at lower levels of description. Without a fully worked out theory of the physical/functional basis of consciousness, we will not be in a position to know whether these functional isomorphs duplicate your phenomenology. Thus, given subjectivism, we will not be in a position to know whether tomatoes are red for them.

It might be objected that this case is merely hypothetical: we don't (yet) have AIs that functionally resemble humans. But similar points hold for real-life cases. In fact, it's plausible that, given subjectivism, we cannot know exactly which colors things have for other humans in standard cases of normal variation. Consider a slight variation on our original case:

> You and Norma are normal perceivers who locate unique green at slightly different spectral locations. What you call unique green is described as blueish green by Norma,

and what she calls unique green, you describe as yellowish green. Right now, you and Norma are looking at *different* color chips. Both of you (sincerely) report your experiences with the words, 'The chip looks unique green'.

Question: is your chip exactly the same color for you as Norma's chip is for her? Given subjectivism, the answer is 'yes' if and only if the chip produces the same color phenomenology in you that it does in her. Does it?

I think we don't know. Perhaps this claim will strike many readers as overly skeptical. If we set aside radical forms of skepticism about other minds, one might think, *surely* we can be confident that you and Norma enjoy the same color phenomenology when you both report seeing 'unique green'. But we needn't entertain radical forms of skepticism about other minds to be unsure whether your 'unique green' experiences are qualitatively the same as someone else's, especially when the other person locates unique green at a different spectral location. After all, although you and Norma both report unique-green experiences, you nonetheless differ in many ways. It's far from obvious that color phenomenology is totally insensitive to these differences. It's far from obvious, for example, that color phenomenology is insensitive to the fine-grained functional differences between the neural realizers of your color experiences, such as the differences in the memory associations they are apt to trigger, or the roles they play in object classification. Suppose Norma is a botanist, so her perceptual state is implicated in recognitional capacities for, say, identifying types of leaves, but your perceptual state plays no corresponding functional role in you. Is it obvious that this functional difference wouldn't be associated with at least a small difference color phenomenology? Or consider the wide or 'long-arm' functional difference between your brain state and Norma's: they are caused by different external properties, corresponding to the different spectral locations you assign to unique green. Is it

obvious that long-arm functional differences of this kind are irrelevant to color phenomenology?[24]

Given subjectivism, the question of whether your chip is the same color for you as Norma's chip is for her depends, *inter alia*, on whether color phenomenology is sensitive to functional differences of this kind. Unfortunately, there is no straightforward way to know whether it is. More generally, there will be cases of specific phenomenal ignorance (and hence, given subjectivism, specific chromatic ignorance) unless we can somehow discover a correct and detailed theory of how color phenomenology depends on physical functioning. This theory would have to tell us (i) whether (and if so, how) color phenomenology depends on the material realizers of our mental functioning, (ii) exactly *which levels* of functional description are relevant to color phenomenology, (iii) exactly *how broad* the phenomenology-determining functional role is (e.g., does it extend outside the head?), and (iv) exactly how *fine-grained* the phenomenology-determining roles are. Discovering answers to these questions at the level of detail necessary for the subjectivist to avoid CHROMATIC IGNORANCE seems no more feasible than discovering the One True Psychosemantics or the One True General Theory of Consciousness.

One might respond that we can nonetheless know (at least by fallibilist standards) that your experience is *very similar* to Norma's. I don't dispute this. But given subjectivism, this would only give us knowledge of the relatively coarse-grained color fact that the chip has *approximately* the same color for you as it has for Norma. But the kind of ignorance at issue in the ignorance argument was ignorance of fine-grained color. That argument does not purport to

[24] As a sociological matter, those who hold that phenomenology depends on wide functional properties tend to endorse objectivist views of color (Dretske 1995; Lycan 1996; Tye 2000; Byrne and Tye 2006). But there is no barrier in principle to combining wide functionalism with color subjectivism.

show that the inegalitarian is committed to ignorance about coarse-grained color facts, such as that the chip is green or that it is *approximately* unique green.

Let me conclude this section by making the core claims of my argument a bit more explicit. We can say that a *general* theory of consciousness is a theory that specifies, in physical/functional terms, what it takes for an individual to be phenomenally conscious. And we can say that a *specific* theory of consciousness is a theory that specifies which physical/functional similarities and differences make for phenomenal similarities and differences. The argument of this section relied, in effect, on two central claims: (i) We are subject to general phenomenal ignorance—and hence, subjectivists are committed to general *chromatic* ignorance—because knowledge of a suitably complete *general* theory of consciousness is infeasible. (ii) We are subject to specific phenomenal ignorance—and hence, subjectivists are committed to specific *chromatic* ignorance—because knowledge of a suitably complete *specific* theory of consciousness is infeasible.

3.3 Representational subjectivism

A subjectivist might try to block the inference from PHENOMENAL IGNORANCE to CHROMATIC IGNORANCE by adopting a 'non-phenomenal' subjectivism, a form of subjectivism that analyzes colors without explicit reference to phenomenal states. As I've mentioned, the subjectivist could instead analyze colors in terms of something like color *representation*, as follows:

An object *x* is red for *S* iff *x* is disposed to cause *S* to visually represent *x* as red.

Let's call this view 'representational subjectivism'. Because the representational subjectivist does not analyze colors explicitly in terms of phenomenal states, we cannot straightforwardly infer a commitment to CHROMATIC IGNORANCE from the truth of PHENOMENAL IGNORANCE.[25]

However, there are multiple reasons to think that representational subjectivism also leads to unknowable color facts. First, the move to representational subjectivism only helps if the cases of irremediable phenomenal ignorance discussed in §§3.1-3.2 are not also cases of irremediable *representational* ignorance. At a minimum, this would require that we have a grip on the notion of 'visually representing an object as red' (for example) that is suitably independent of visual phenomenology, such that we can know whether a creature is representing an object as red without knowing what its visual states are like in phenomenal respects. But it is not clear that we do. Return to the AI scenario above, in which we don't know whether the AI has reddish color phenomenology or alien color phenomenology. Apart from any general philosophical theory about the precise relationship between color representation and color phenomenology, the following claims seem intuitively correct:

(i) If the AI has reddish color phenomenology, then the object *looks red* to the AI.

(ii) If the object looks red to the AI, then the AI is visually representing the object as red.

(iii) If instead the AI has alien color phenomenology, then the tomato *doesn't* look red to the AI, but rather looks to have some alien color—a color outside human color space.

(iv) If the object looks to have some alien color to the AI, then the AI is visually representing the object as having an alien color.

[25] Thanks to an anonymous referee for suggesting this response.

(Note that it is a virtue of 'phenomenal' forms of subjectivism that they can easily accommodate claims like (i)-(iv), though of course many objectivist views can as well.) Now, if (i)-(iv) are true (or even epistemically possible, taken in conjunction) then the subjectivist cannot avoid commitment to CHROMATIC IGNORANCE by analyzing colors in terms of visual representation. For given (i)-(iv) (or just their epistemic possibility), as long as we don't know whether the AI has reddish phenomenology, we won't know whether it represents the object as red. Of course, there are controversies in the philosophy of perception about the exact relationship between visual representation and visual phenomenology, and I shall not attempt to settle all these controversies here. Nonetheless, the considerations above suggest that representational notions are quite plausibly tied to phenomenal notions in a way that leaves the representational subjectivist unable to block the move from PHENOMENAL IGNORANCE to CHROMATIC IGNORANCE.

Second, even if visual representation is suitably independent of visual phenomenology, there is still a plausible argument that representational subjectivism leads to CHROMATIC IGNORANCE. The argument is structurally similar to the arguments in §§3.1-3.2. Those arguments concluded that standard forms of subjectivism lead to CHROMATIC IGNORANCE because we cannot (feasibly) know all relevant *phenomenal* facts, even given complete knowledge of the physical/functional facts. Roughly, this is because knowledge of the One True (general and specific) Theory of Consciousness is infeasible for us. In the same way, representational subjectivism will lead to CHROMATIC IGNORANCE if we cannot (feasibly) know all relevant *representational* facts, even given complete knowledge of the physical/functional facts—for example, if we cannot (feasibly) know whether a certain creature is representing an object as red, or whether a certain creature is representing an object as colored. Now, just as our inability to

know whether certain creatures have certain phenomenal states is a natural consequence of our inability to know the One True Theory of Consciousness, presumably there will be cases of this kind if knowledge of the One True Psychosemantics is infeasible. But as I argued in §2, knowledge of the One True Psychosemantics does not appear to be feasible. Indeed, as we saw in §2, the charge that inegalitarians are committed to unknowable color facts *depends on* the assumption that knowledge of the One True Psychosemantics is infeasible (at least if inegalitarianism is true).

Of course, the representational subjectivist can simply assert that—somehow, someday—we will discover the One True Psychosemantics, a fully worked out theory that enables us to read off the representational facts from the empirically available physical/functional facts. We would then be in a position to know all the color facts, at least on the generous assumption that representational subjectivism is both true and knowable. But as we saw in §2, an inegalitarian can make the very same assertion. Unless some reason can be given for regarding the former assertion as more credible (and I cannot think what that reason might be), we should conclude that the representational subjectivist is no less vulnerable to unknowable color facts than a typical inegalitarian.

4. Why objectivism leads to chromatic ignorance

Let us next turn our attention to the objectivist version of ecumenism. According to this view, colors are mind-independent properties of objects, and in at least some cases of normal variation, both perceivers' experiences are veridical because the object has multiple mind-independent colors (e.g., unique green and yellowish green). I'll use the name 'selectionism' for the combination of color objectivism and ecumenism. The name, which I borrow from Kalderon (2007; 2011), is supposed to suggest an alternative to the subjectivist's conception of the

relationship between colors, perceivers, and circumstances of perception. For the selectionist, objects have whatever colors they have independently of the way perceivers respond to them. The role of the perceiver and perceptual circumstance is not to *give* color to the object, but to *select* one of the object's many colors to be perceived.[26]

Selectionists can be distinguished according to the form of color pluralism they accept. *Radical* selectionists hold, roughly, that everything has every color. ('Roughly', because 'everything' presumably needs a restriction to avoid absurd results, such as that the number 4 is turquoise. The question of exactly how to restrict the quantifier will turn out to be important and will be addressed shortly.) *Moderate* selectionists hold that objects have multiple determinate colors (within human color space), but not every color. (The restriction to human color space is needed because I am not here concerned with views according to which objects have only one determinate human color, but also have distinct colors from other color families, such as pigeon color space.)

The path from moderate selectionism to CHROMATIC IGNORANCE is fairly straightforward. Let's first consider the moderate physicalist selectionism defended (tentatively) by Byrne and Hilbert (1997), prior to their conversion to inegalitarianism. Byrne and Hilbert identify determinate colors with (disjunctions of the members of) sets of surface spectral reflectances (SSRs), where an SSR is a complex disposition to reflect a certain percentage of the incident light at each wavelength within the visible spectrum. Thus, Norma's experience, which represents the chip to be unique green, is veridical only if the chip has a reflectance that belongs to a certain set, $\mathbf{SSR_{ug}}$. And Norm's experience, which represents the chip to be yellowish green, is veridical only if the chip has a reflectance that belongs to a different set, $\mathbf{SSR_{yg}}$. Moderate

[26] In this section, I ignore realizer-functionalist forms of objectivism. As mentioned above, the arguments in §3, if successful, would show that realizer-functionalism leads to CHROMATIC IGNORANCE.

selectionism enters the picture with Byrne and Hilbert's suggestion that these two sets may partially overlap. If they do, then the chip could instantiate both unique green and yellowish green, so long as the SSR of the chip lies in the intersection of $\mathbf{SSR_{ug}}$ and $\mathbf{SSR_{yg}}$. In that case, both experiences would be veridical. Of course, this view violates the intuition that yellowish green and unique green are contraries. But Byrne and Hilbert do not regard this as a significant cost (at least not at this point, though in later work they give this intuition much more weight (Byrne and Hilbert 2003; 2007)). As they point out, this moderate selectionist view can at least accommodate the nearby claim that nothing can simultaneously *appear* unique green and yellowish green, as well as the claim that unique green and yellowish green are *distinct* properties, and perhaps that is enough.

This view leads to CHROMATIC IGNORANCE just as surely as their later inegalitarian view. (They don't appear to be under any illusions about this point. For Byrne and Hilbert, the motivation for the 'overlapping sets' picture is that it avoids widespread illusion, not that it avoids CHROMATIC IGNORANCE.) The fundamental issue for both is that we have no feasible way to know exactly which SSRs are included as disjuncts within the real definition of unique green. Thus, there are bound to be cases in which we are unable to know whether an object is unique green, even given complete information about its reflectance properties, its effects on human perceivers, and so forth. Even if we assume (perhaps on general anti-skeptical grounds) that all normal perceivers have veridical color experiences in normal circumstances, this would only tell us that $\mathbf{SSR_{ug}}$ includes all the SSRs of objects that are experienced as unique green by at least some normal perceiver. But how far beyond that does $\mathbf{SSR_{ug}}$ extend, if at all? Moderate selectionism provides minimal guidance; it tells us that $\mathbf{SSR_{ug}}$ doesn't include the SSRs of *everything* (otherwise we'd have radical selectionism), but this very weak constraint leaves many

questions wide open. For example, does **SSR$_{ug}$** include the SSRs of things well outside the class of objects that look unique green to some normal perceiver, such as objects normally experienced as unique yellow?

It's hard to see how this question could be settled on empirical or conceptual grounds. The moderate selectionist might suggest that we can reasonably assume that **SSR$_{ug}$** includes, at least roughly, all *and only* the SSRs of objects that look unique green to some normal perceiver. However, in the setting of moderate selectionism, there is no reason to treat this as the default assumption. (If we *could* help ourselves to this assumption, we might still be left with some residual ignorance in borderline cases, such as objects that only look unique green to borderline-normal perceivers. But this would arguably be the sort of ignorance associated with vagueness more generally, and nothing distinctive to color. My claim is that moderate selectionism leads to a more interesting kind of ignorance, a kind not present generally in cases of vagueness. The ignorance at issue is not merely an inability to locate precise cutoffs or settle a few borderline cases, but an inability to know even roughly or approximately how broad the extension of unique green is.) Even if it's reasonable on anti-skeptical grounds to hold that objects that are experienced as unique green (by some normal perceiver) are unique green, the moderate selectionist has no clear justification for converse assumption that things that *aren't* normally experienced as unique green *aren't* unique green. In particular, the moderate selectionist is not entitled to reason from the premise that an object is (say) unique yellow to the conclusion that it's not unique green, since this reasoning relies on color exclusion principles of the very same kind she rejects elsewhere.

Essentially the same points hold for primitivist forms of moderate selectionism. Primitivists generally maintain that colors at least supervene in some fashion on underlying

physical properties, such as SSRs (Campbell 1993, Watkins 2005, Yablo 1995, Allen 2016). But just as moderate physicalist selectionists have no feasible route to knowing exactly which SSRs figure as disjuncts in the real definition of unique green, moderate primitivist selectionists would seem to have no feasible route to knowing exactly which SSRs metaphysically necessitate the instantiation of unique green. Nor would it help to deny supervenience. If anything, loosening the modal ties between empirically available physical properties and colors would make the selectionist's epistemic problems harder, not easier.

Let us turn to radical selectionism, the view, roughly, that everything has every color.[27] As far as I know, no one defends radical selectionism. Still, it is worth considering, partly for the sake of logical completeness, and partly because radical selectionism may seem less vulnerable to CHROMATIC IGNORANCE than other realist views. Given radical selectionism, there is no difficulty determining whether the chip is unique green, whether it's yellowish green, or for that matter, whether it is bright pink. Radical selectionism delivers the answers: yes, yes, and yes.

In my view, the main problem with radical selectionism is its intrinsic implausibility. It has *prima facie* absurd consequences, such as that blue jays are neon green, and it unabashedly flouts color-exclusion intuitions, like the intuition that nothing can be both bright pink and charcoal gray all over at the same time. The intrinsic implausibility of radical selectionism isn't entirely irrelevant to the question of whether its truth would allow us to avoid unknowable color facts. For suppose radical selectionism is true. It follows that charcoal is bright pink. Still, I probably cannot *know* that charcoal is bright pink except by *inferring* it from radical selectionism, or some closely related philosophical theory of color. (I certainly cannot know it in the ordinary way by sight.) And presumably I cannot know by inference that charcoal is bright

[27] Views in the neighborhood of radical selectionism are discussed in Price (1932, p. 41n) and Pautz (forthcoming, ch. 5).

pink unless I know the premise of the inference—radical selectionism. But the intrinsic implausibility of radical selectionism makes it harder to know it even if it happens to be true, for the same reason that achieving knowledge that a man rose from the dead is harder—requires more evidence and better arguments—than achieving knowledge that a man rose from a nap.

But let's set aside the intrinsic implausibility of radical selectionism. Let's even grant that we could somehow know that radical selectionism is true. Even so, we are *still* left with unknowable color facts, or so I shall argue. How could this be? Doesn't radical selectionism tell us that everything has every color? Well, as I've indicated, this claim clearly needs to be restricted. Surely the number 4 isn't colored. The question is: exactly *how* should the thesis be restricted? At a minimum, it should be restricted to concrete objects. But should we go further? For example, should our restriction include only material objects, or should we also allow empty regions of space (or spacetime) to be colored? Should we include only extended objects, or should we also include point-sized entities (e.g., spacetime points or point particles, if there are such things). Should we only include continguous objects, or scattered objects as well? Even if we knew that some radical form of selectionism is true, this wouldn't help us to know which *specific version* of radical selectionism is true. And without this knowledge, there will be things—specifically, things that fall under some but not all reasonable candidate restrictions, such as the spherical region of space in the center of my office—such that we cannot know whether they are colored. Thus, even the radical selectionist seems to be stuck with a kind of ignorance: ignorance about the range of entities that are colored. In some respects, this ignorance goes beyond the ignorance associated with other theories of color. For example, an inegalitarian reflectance physicalist needn't plead ignorance about which entities have some color or other. Presumably these will be just the entities that reflect and absorb light. But in other respects, the

ignorance associated with radical selectionism more limited. Given that an object has color, there is no ignorance about *which* colors it has. While the ignorance here is somewhat restricted, it's nonetheless noteworthy that even radical selectionism—a view that seems optimized for avoiding unknowable color facts, a view that has almost nothing to recommend it *besides* its apparent ability to avoid unknowable color facts—does not, in the end, manage to avoid them altogether.

Of course, if we adopt, and somehow come to know, some *specific version* of radical selectionism, then we could know whether any given thing is colored. But an inegalitarian can make an analogous claim. If we adopt, and somehow come to know, a *specific version* of (say) inegalitarian reflectance physicalism (one that not only endorses the general thesis that colors are reflectance types, but also specifies which reflectance types are identical to which colors), then we could know whether the chip is unique green. But just as there is no feasible route to knowing which specific version of reflectance physicalism is true (even if the general thesis of reflectance physicalism is true and knowable), it's hard to imagine a feasible route to knowing which specific version of radical selectionism is true (even if the general thesis of radical selectionism is true and knowable). Thus, even radical selectionism appears to be committed to CHROMATIC IGNORANCE.

5. Conclusion

I've argued that, with the exception of color eliminativism, every major philosophical theory of color leads to CHROMATIC IGNORANCE. The fact that inegalitarianism leads to CHROMATIC IGNORANCE therefore cannot be used to support ecumenism over inegalitarianism. Those who are convinced that there is something deeply objectionable about unknowable color facts may take my arguments to support color eliminativism. But I hope others will take my arguments as an

occasion to reevaluate the widespread assumption that all facts about color should be within our epistemic reach. If almost everyone is committed to unknowable color facts, perhaps they are not so bad after all.[28]

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