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Eliminativism[1]

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0. Introduction

Color eliminativism denies that color is a real property of physical objects.[2] According to eliminativism, basketballs are not orange, stoplights are not red, snow piles are not white, and filter gels used to correct tungsten lighting to daylight are not blue. Nor are these objects any other colors. Thus eliminativists convict our everyday experience, in which color looks to be a ubiquitous feature of the world around us, of massive and systematic error. However, by and large color eliminativists are not in the business of

[1] A debt of thanks is owed to Kimberly Jameson and A. Kimball Romney for much enlightening and engaging discussion about some of the issues treated in this chapter. I am also grateful to the editors of this volume for their useful feedback on an earlier draft of this chapter.

[2] This characterization of color eliminativism is narrower than that sometimes found in the literature; see, for example, Cohen (2011). On some taxonomies of theories of color, eliminativism amounts to the claim that nothing – physical or mental – is actually colored. The focus here is on color and physical objects, although mentalism about color comes up in the final section. **XXX**'s entry in this volume addresses mentalist views of color.

telling us that we would be better off if we ceased carrying on in our daily lives as if objects are colored. Indeed, eliminativists have stressed various benefits of seeing, thinking, and talking as though we live in a color-filled world (Boghossian and Velleman 1989/1997; Hardin 1992; Maund 2006).

Color eliminativism has deep historical roots. It goes back at least as far as Democritus, whose atomistic metaphysics granted a "merely conventional" existence to sensible qualities such as color. Galileo, Descartes, Newton, Locke, and Hume are among the luminaries who expressed sentiments in the vicinity of eliminativism, although some of these figures, properly interpreted, are more likely dispositionalists than eliminativists. Contemporary eliminativists claim that there is no place for color when we take stock of our currently best accounts from fields such as physics, chemistry, neuroscience and psychology. No known property of objects is apt for identification with color. Plus, while there are gaps in the scientific story about color vision, none look suited to be filled by the addition of colors to the inventory of properties that objects have. Unless one is willing to base one's ontological commitments entirely on extrascientific considerations, it follows that there are not any colors "out there."

This essay sets out the main motivations for and realist responses to color eliminativism, and examines the broader significance of eliminativism to our picture of how we are connected to the world. Along the way, some new considerations will be introduced.

1. Motivations

Color eliminativism is a minority position within philosophy, but is plausibly viewed as widely endorsed by scientists working on color phenomena. Of course, caution is in order when attempting to discern stances on philosophical disputes from scientists' remarks, as there is always the risk that philosophers and scientists frame issues and options in different ways. In any event, as already noted, the case for eliminativism made by philosophers is grounded in the apparent empirical inadequacy of all available realist views. The empirical orientation of the contemporary color realism debate is largely due to the fact that the philosopher most responsible for launching what is now over a quarter-century of scientifically informed philosophical discussions about color, C.L. Hardin (1988), is a resolute advocate of eliminativism. Hardin's efforts on behalf of eliminativism form a challenge that any realist hopeful must face. Other philosophers who have recently supported color eliminativism include Boghossian and Velleman (1989/1997), Chalmers (2006), Maund (1995, 2006), and Pautz (2006).

One can begin to get a sense of what is supposed to make eliminativism appealing by considering metamerism (Hardin 1988, p.64) and the structural relations that are thought to hold necessarily amongst the colors (ibid., p.66). Metamers are physically different stimuli that are perceptually indistinguishable in some viewing circumstance, with some metameric pairs having pronounced physical differences. Crucially, two stimuli that are indistinguishable in one situation might be quite distinguishable in another setting. The basic problem metamers pose for realism is that metameric stimuli do not have an underlying shared objective nature. Rather, all that metameric color stimuli have in common is that a perceiver's visual system treats them equivalently in some circumstance(s). This holds whether we consider reflectance properties of surfaces, spectral power distributions of lights, scattering properties of tiny particles, or any other physical property; see Churchland (2007) for an attempt to provide a physical unification of metameric reflectances and Kuehni and Hardin (2010) and Wright (2009) for criticism of that proposal. Furthermore, there is variation amongst "normal observers" (designated as such by tests used by researchers and clinicians) when it comes to color perception; e.g., two stimuli that are judged to match in color by one observer might not be a match for another observer. Also significant is that no set of viewing conditions (e.g., illuminant spectrum, surround configuration, perceiver's state of adaptation) merits being singled out as normative (Hardin 1988, pp.67, 76; Wyszecki and Stiles 1982, p.172). Thus even if a realist were tempted to identify a given color with a metameric set of physically diverse (say) surface reflectances by appealing to a specific class of perceivers and privileged viewing conditions to pick them out, she could not make a principled choice of which reflectances to include (Hardin 1988, p.81)

As for the structural relations amongst the colors, key here are the binary/unique distinction, similarity, and opponency.[3] The eliminativist's argument hinges on these

[3] As is often done, matters are being simplified by attending mostly to hue. Also, in listing opponency among the essential structural features, experimental results suggesting that it is possible to experience "forbidden" combinations of opponent colors

structural relations being essential to the nature of the hues (Hardin 2003, p.198). Phenomenological reflection is said to reveal that perceived hues contain "amounts" of component hues, with some hues admitting of unique variants; i.e., they have only one component hue. Green, blue, red, and yellow are thought to be the only four hues that can be experienced uniquely; Matthen's entry in this volume offers in-depth examination of unique hues. All other hues are experienced as weighted binary mixtures of these primary hues; e.g., there is no unique orange, as all instances of perceived orange involve red and yellow components (Kuehni 2004, p.158). Moreover, the primary hues stand in opponent (exclusionary) relations to one another. For example, red is opposed to green in that no hue can be experienced as a combination of them, and the same is supposed to hold for blue and yellow. Lastly, there are claims about the apparent similarities of the hues, such as that aqua green is more similar to unique blue than it is to unique yellow.

Hering's (1920/1964) opponent colors theory has it that the perceived hues are organized around red/green and yellow/blue cardinal axes, with an achromatic neutral point at the origin. This perspective has broad acceptance amongst contemporary researchers and it is thought by many to account for the just-noted structural features of the hues. Psychological research on hue cancellation and hue scaling agrees with the preceding phenomenological observations and Hering's opponent colors theory; see

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(e.g., reddish greens) are being set aside; see Crane and Piantanida (1983), Hardin (1988, pp.123-127), and Macpherson's chapter in this volume.

Hurvich and Jameson (1957) and Abramov and Gordon (2005). Hering's theory picked up neuroscientific support in the middle of the twentieth century with the discovery of opponent-processing cells in the lateral geniculate nucleus (De Valois et al 1966). It turns out, though, that the response functions of the opponent cells discovered so far fail to neatly correspond to the Hering primaries (MacLeod 2010).

Eliminativists argue that the highlighted structural characteristics do not obtain for any perceiver-independent property. For example, consider the reflectance profiles of green and red surfaces. Reflectance spectra for many (certainly not all, which only complicates things for color realists) biological and artificial green surfaces are bell-shaped with a peak in the 500 to 550 nm region of the spectrum, whereas those for red surfaces tend to be step-like functions, with low reflectance at short and middle wavelengths and a pronounced rise in the middle-long region that levels out in the vicinity of 600 nm (Maloney 2003; Wright 2009). While there are many qualitative and quantitative differences between such reflectance spectra, there are also commonalities. One would search in vain for an opponency relation in whatever patterns one might find. For much the same reason, the similarity relations that hold amongst the hues are not evident in reflectance spectra (Byrne and Hilbert 2003, p.13), nor is the distinction between unique and binary hues; e.g., orange spectra frequently have the same sigmoidal shape as red spectra, only somewhat shifted toward shorter wavelengths. Similar examples involving spectral power distributions could be provided for lights. Since these structural relations are essential to color and they lack physical counterparts, color cannot be identified with a physical property. That is, color physicalism is false. For more on color physicalism, see Byrne & Hilbert's essay on reductive objectivism in this volume.

Of course, physicalism is not the only available realist option. Dispositionalists claim that objects really are colored and that we are not massively in error when it comes to color experience, cognition, and discourse. They do this by identifying colors with dispositions objects have to cause certain kinds of color experiences; e.g., redness is the disposition to cause red experiences. The relevant dispositions (presumably) have a physical categorical basis, but the dispositionalist relies on the responses of (say) the human visual system to individuate colors without regard for the physical properties that give objects their color experience-causing powers. This maneuver is supposed to allow the dispositionalist to side-step the above-noted problems stemming from metamers and structural properties. Dispositionalism has been criticized in various ways, but here attention is limited to an already-introduced issue that is at the heart of eliminativism's general opposition to color realism.

The simple statement above that "redness is the disposition to cause red experiences" is incomplete. Whose red experiences? In what conditions? One might be tempted to appeal to "normal perceivers" and "normal circumstances" to nail down the missing details. As was noted when discussing metamers, however, perceptual variation across normal color perceivers is empirically well-established; we can set aside related complications that might also arise from consideration of the color experiences of non-human animals. Studies in which subjects select samples (or make settings) that they see as exemplifying the unique hues vividly illustrate this point (Kuehni 2004).

Most notorious is the high degree of inter-observer variability for unique green. In some studies one subject's unique green stimulus turns out to be another subject's unique blue, while there are also observers whose unique green stimuli are unique yellow for someone else. Which normal perceivers have it right? Since we lack an independent objective standard for color by which we might evaluate the choices made by different normal perceivers, it is unclear why we should think that any of them are correct. Moreover, considering that our epistemic access to color begins with color experience and there is so much variation across perceivers regarding the unique hues (which are supposed to play an anchoring role in our color experience), one might doubt that there is anything at all about which color perceivers might be right or wrong.

As for how to specify the relevant viewing context, even small changes to conditions can have significant effects on perceived color. The Cornsweet effect can be nullified by placing a thin object over a pair of opposing luminance gradients in a picture, making two much larger regions immediately switch from looking markedly different to looking identical in color (Purves & Lotto 2011, p.32, fig.2.11). Changing illumination conditions (e.g., tungsten versus fluorescent lighting, the phases of daylight) can affect color appearance and alter what stimuli are indistinguishable from one another (e.g., the oft-cited disagreements between how clothes look in a store and how they look at home). Because of contrast effects, a patch's color appearance is liable to vary when it is viewed against backgrounds that are differently colored from one another. Some colors, such as black and brown, cannot be seen except in specific contrast conditions; e.g., something that looks brown when viewed against a brighter surround will look dark orange when seen against a darker surround. Of all the different variables of viewing conditions that might vary, we are unable to say which, if any, reveal the true colors of objects.

Many more examples of such problems could be produced. We lack a legitimate basis for singling out some specific class of perceivers and some particular set of circumstances, as the “normal” or “standard” ones that would allow a realist to fill in the rest of the statement of what it is for something to be green (or some specific shade of green). There are plenty of practical matters that could justify favoring some formulation of conditions over others, just as practical considerations drove the construction of the CIE standard observers (Wyszecki & Stiles 1982, pp.131-143; for criticism of the principles guiding the CIE system, see Fairman et al 1997, p.21 and Thornton 1999, pp.155-156). However, it would be arbitrary to choose any single set of practical considerations as the basis for the normative details required by a realist theory of color. Hence, like physicalism, dispositionalism fails to satisfy an important desideratum for a realist theory of color: it cannot tell us what color an object really has.

Some physicalists (Byrne and Hilbert 2003; Tye 2000), in recognition of these difficulties, have eschewed trying to identify what combination of perceivers and viewing conditions provides for access to the real colors of things. They insist that such perceivers and circumstances exist but are “unknowable” (Byrne and Hilbert 2003, p.21n.50). This maneuver has met stiff resistance, largely on the grounds that unless one is already working with a commitment to color physicalism, there is nothing to recommend the idea that there are epistemically inaccessible standards of veridical color perception (Cohen 2010; Hardin 2004; Wright 2010). A dispositionalist trying the same gambit would fare no better.

One could attempt to defuse the worries about normal perceivers and normal circumstances by giving up the goal of being able to specify the color of an object. The idea here is to relativize color properties to perceivers and circumstances and to speak of (for example) unique-green-for-subject-S-in-circumstances-C rather than unique green simpliciter. This leads to objects having multiple colors (pluralism). This strategy could be worked out in different ways and it is beyond the scope of this essay to consider the details of particular views along these lines. See Cohen's essay in this volume for discussion of both dispositionalism and relativization, and Kalderon's essay for discussion of pluralism.

Eliminativists are liable to find certain common flaws across theories that relativize colors to perceivers and contexts; Cohen (2010) replies to objections from Hardin. Particularly troubling is that relativizing generates a limitless horde of color properties. From the perspective of constructing a scientifically relevant theory of color, this unconstrained multiplicity of colors is unwelcome (Hardin 2004, pp.35-36). Rather than offering insight into how and why color vision works the way it does (e.g., facilitating general conclusions about the nature of color and color perception), such a conception seems to muddy the waters. For example, relativizing to perceivers and circumstances risks making all color perception veridical, thereby greatly straining the notion of veridicality. Seeing as it is reasonable to expect color realism to support meaningful assessments of veridicality, that result is no more palatable than the positing of standards of veridical perception that are epistemically closed off to us. While it is understandable that one might be troubled by eliminativism rendering all color perception illusory, realists struggle to provide a robust, serviceable notion of veridicality.

Relativizing colors to perceivers and circumstances also comports poorly with a natural way realists might explain the evolution of our color vision systems (Wright 2010; this is an extension of an intra-personal example from Byrne & Hilbert 2003, p.58). The colors I experience are not the same ones experienced by my ancestors, as those colors were relativized to them and their circumstances. Thus the forces of selection could not have favored creatures whose visual systems provided experiences of the colors that my visual system provides experiences of. So, we are left wondering how it is that I have come to experience the colors that I do, in the circumstances that I experience them. As a final point, considering the substantial role color experiences play in individuating colors and the massive, seemingly fractured inventory of colors we are left with, one might doubt that any account that relativizes colors in such a prolific way qualifies as realist.

The final realist view to consider is primitivism; the pairing of eliminativism and a non-realist form of primitivism is discussed later. Primitivism takes colors to be <u>sui generis</u>, simple (i.e., non-reductive and non-relational) properties of objects. These properties are distinct from both dispositions to cause color experiences and physical properties like surface reflectance, and they stand to one another in the structural relations that are said to be essential to colors. Primitivism has met with a number of objections, including the now-familiar concerns based on perceptual variation. One complaint that merits mention is that positing primitive color properties is empirically unmotivated. They do not appear anywhere in our best scientific account of color perception and there is no causal work for them to do that would justify trying to shoehorn them into it (Chalmers 2006, p.67; Hardin 1988, p.61). Gert's essay in this volume goes into much greater detail about primitivist realism.

Granting for the moment the success of the criticisms of physicalism, dispositionalism, and primitivism (those presented here and others made elsewhere), it looks like eliminativism wins by defeating all known realist challengers. Perhaps, though, since so much of the case for color eliminativism is made via negativa, we should proceed more cautiously. There might be an as-yet unconceived realist view for which eliminativism lacks an answer. However, the general message suggested by the specific problems eliminativists find in extant realist theories is that there is, at best, very little room for further maneuvering. The eliminativist's challenge to realists is to identify a property that (i) plays an appropriate role in the causal chain leading up to color experience, (ii) accounts for the essential structural features of the colors, and (iii) allows us to make useful theoretical statements pertaining to how and why color vision works as it does (including which color experiences are veridical). Condition (i) is a plausible requirement on any theory of color being worthy of the appellation "realist" and violating it would likely also compromise what one does with (iii). Condition (ii) is tough to meet without appealing to facts about color perceivers, which would potentially complicate how one deals with either (i) or (iii). The variability of color appearance across perceivers and contexts makes condition (iii) particularly imposing and likely a threat to any realist view that might be proposed.

Eliminativism clearly demands an answer from color realists. The main moves available for realists are to creatively refine the details of their views in response to eliminativist objections, undermine the empirical support for eliminativism, or change the terms of the debate. The first two options are considered in the next section, with the last one taken up in the section after that.

2. Responses to Eliminativism

Some ways in which realists might revise or elaborate their accounts in response to the challenge from perceptual variation have already been noted, such as relativization and arguing that the variability of color experience justifies only an epistemic (not metaphysical) conclusion about the real colors of things. Color physicalists have also confronted the objection from phenomenal structure. To do so, Byrne and Hilbert (2003) combine a thesis about color experience with the prevalent beliefs that Hering opponent colors theory is true and that the opponent relations amongst the hues are rooted in neural mechanisms in the visual system; see also Bradley and Tye (2001). The claim about color experience is that it represents objects as having color properties. Hering's theory is used to help spell out just what those represented properties are. According to Byrne and Hilbert, color experience represents objects as having <u>hue magnitudes</u> of reddishness, greenishness, yellowishness, and bluishness. For example, a purple object is represented as having balanced or nearly balanced magnitudes of reddishness and bluishness. The hue magnitudes are given a physical pedigree by linking them to hue-opponent neural mechanisms that compare outputs from the short, middle, and long wavelength sensitive cones in the human retina. Reddishness is the degree to which a surface tends to reflect more light at longer wavelengths than at middle wavelengths (vice versa for greenishness). Yellowishness is the degree to which a surface tends to reflect more light at middle and long wavelengths than at short wavelengths (vice versa for bluishness). Consequently, unique yellow surfaces reflect more light at middle and long wavelengths than at short wavelengths and are balanced (i.e., at a null point) in how much light they reflect at middle and long wavelengths.

Although hypothesized features of human visual processing are used to pick out the hue magnitudes (on the basis of an account at the psychological level of structural features of color perception), the hue magnitudes are perfectly objective and physical properties. The response functions of the cones are specified in terms of wavelength and the hue-opponent neural mechanisms simply make comparisons between the levels of response in the different cone classes. All the details of visual processing used to isolate the hue magnitudes can be stated in physical and mathematical terms. We would have no interest in hue magnitudes if we did not perceive color as we do, but that does not make hue magnitudes non-physical.

The hue magnitude proposal is not without difficulties. Chiefly, as was previously observed, there are no known neural mechanisms that neatly correspond to the Hering opponent color axes. In fact, there is good reason to think that opponent processing mechanisms at the neural level are altogether functionally irrelevant to opponency and uniqueness at the psychological level (MacLeod 2010, p.160). Byrne and Hilbert (2003, p.55) chalk this up as merely a problem for the simplified example they provide in terms of cone responses and opponent processes, with no deeper consequence for their view. Their example is intended to illustrate how it is that hue magnitudes could be physical properties, but nothing about the nature of the hue magnitudes themselves is supposed to depend on cone responses or opponent processing (ibid., p.14). It is important to note, however, that Byrne and Hilbert's example proceeds from a starting point that takes to be true both color physicalism and the hue magnitude proposal about the content of color experience (ibid., p.55). They are well aware of the need to spell out in useful detail the physical bona fides of the hue magnitudes, in order to make good on their claim that the color physicalist can overcome the objections from phenomenal structure (ibid., p.15). Without a compelling, workable example that provides insight into just what sort of physical property a hue magnitude actually is, it is far from clear that there is any reason to believe that they are real, physical properties of objects; Broackes (2003) pursues a similar line of criticism. From the eliminativist's perspective, the situation on this score looks similar to that regarding the idea that the challenge from perceptual variation can be met by positing unknowable standards of veridical color perception.

Rather than try to show how the structural features highlighted by eliminativists can be accommodated within a realist framework, one might question the eliminativists' take on the structural features that they claim necessarily hold amongst the colors. In particular, concerns have been raised about the unique/binary distinction and the special status accorded to the Hering primaries. For example, some researchers contend that use of the "unique" designation has been overly restricted. According to them, when employing the usual perceptual purity criterion to assess the uniqueness or binariness of hue percepts, there are (for example) orange and purple samples that are just as unique as the four Hering primary hues (Koenderink 2010, p.579; Wright 2011, p.633n.2). That is, they claim that there are hues intermediate between the canonical unique hues that are not experienced as perceptual mixtures, but as wholly orange (purple, etc.). It also has been suggested that empirical results that seem to bolster the claims that the unique hues have a special role in color experience and that the binary hues are in some sense dependent on or subordinate to them, are an artifact of task instructions and experimental design (Jameson 2010, pp.190-194).

These heterodoxies are not mere unconfirmable phenomenological musings or idle speculation, as they have empirical support. For one thing, the received picture of the unique hues (which draws on the Hering opponent colors theory) makes predictions that are not borne out; Jameson and D'Andrade (1997) are followed closely here. Every mixture of unique red with unique green that yields a non-reddish, non-greenish percept, appears yellowish, not achromatic. Scaling of color similarity judgments produces a space that does not have a red/green axis. The result instead is a Munsell-like space with red sitting across from blue-green while green resides opposite a reddish purple. Significantly, hues that lie opposite one another in this Munsell-like space <u>are</u> (or are very close to) additive complements; i.e., they can be mixed to produce an achromatic percept. Some recent studies have found that red, green, blue, and yellow do not stand out (in comparison to hues standardly thought to be binary) in several of the ways one might expect, given the significance attached to them; see Bosten and Boehm (2014), Bosten and Lawrance-Owen (2014), Malkoc and Webster (2005), Witzel and Franklin (2014). Since the unique hues play such a prominent role in the eliminativist critique of color realism – for example, Hardin (1992, p.371) casts the absence of physical counterparts for the unique hues as the central reason for rejecting physicalism – perhaps these concerns about the unique hue construct provide an opening realists can exploit.

A relevant consideration is that there is a great deal of systematicity in the relationship between color experience and color-relevant physical properties. Spectral reflectances that differ from one another only slightly tend to elicit similar color experiences, while continuous variation in the light signal reaching the eye is met with continuous variation in color experience (Isaac 2014, p.494). Additionally, numerous studies using dimensionality reduction techniques have found that natural and artificial surface reflectances can be approximated to a high degree of precision in as few as three dimensions. A plot of the Munsell chips in three-dimensional reflectance space bears a qualitative resemblance to their locations in Munsell color space and linear transformations enable a mapping between the space of approximated surface reflectances and Munsell color space (Romney 2008).

Several issues need to be dealt with in order to properly assess the significance of such results for the color realism debate (Wright 2010). Additionally, some phenomena cited by eliminativists (e.g., contrast effects) are not addressed by the findings regarding dimensionality reduction. However, if the eliminativist's objections based on unique hues can be neutralized by some of the points raised above, that removes a major obstacle to attempts to motivate some form of realism on the basis of the systematic relations between physical properties and color experience. As far as phenomenal similarity is concerned, the structural relations between reflectance space and Munsell color space would go a long way toward accounting for it. The same looks to be true for opponency; e.g., the reason red and green exclude each other is that they are so far apart from one another in both reflectance space and Munsell color space. To be clear, the suggestion is not that the (potential) downplaying of the importance of the unique hues ensures a realist victory, only that realism's prospects look much less dim with the unique hues taken off the table.

3. Standards of reality

A different approach for realists is to undermine the conception of reality the eliminativist employs. As was noted earlier, some realists, in response to eliminativist objections, appeal to facts about (individual or a special class of) perceivers as part of their account of the nature of color. This is supposed to allow realists to unify collections of physically disparate properties and impose structure that matches that of phenomenal color. Such views are relationalist, as they consider colors to be constituted by relations that obtain between features of the mind-independent world and perceivers. As Cohen (2010, pp.239-240) discusses, Hardin finds relationalism lacking as a species of realism. Hardin's thinking is that that if realism were true, facts about color perception would depend on (be recoverable from, etc.) facts about the colors of objects, but relationalism has the dependence the other way around; Hardin (2003, p.198) offers a similar criticism of the physicalist hue magnitude account of phenomenal structure canvassed in the preceding section.

However, there are plenty of things that are considered real, in some significant sense, even though they depend on subjects or are not physically unified. Cohen (ibid.) gives the examples of being beautiful and being humorous. A different set of examples could be drawn from the special sciences; e.g., mating strategies, head-initial languages, market economies (Johnson and Wright 2006; Whittle 2003 makes related points). Regarding special science properties, the justification for counting such properties as real comes from the work they do in our best scientific theories (Johnson and Wright, p.153). As it happens, color plays an important role in explanations and generalizations in fields such as botany, ethology, and population biology, especially when it comes to mating behavior, camouflage, pollination, and foraging. Whatever account of color might emerge from careful study of the roles colors play in such scientific research is sure to depend on facts about color perceivers and may very well address few of the standard concerns about the metaphysics of color beyond saying that colors are real. Perhaps the most we can do is to treat colors as high-level statistical constructs. Importantly, though, that is often the case with kinds of the special sciences (ibid., pp.159-160).

Eliminativists are unlikely to be moved by these considerations. The colors we experience do not present themselves as needing us for their existence. They instead appear to be "stuck to" or "in" objects, all on their own (Boghossian and Velleman 1989/1997, p.93-94). As a prominent color physicalist puts it, not only are colors not experienced as relational properties, they look to be just as non-relational as shape is (Tye 2000, p.153). Taking this phenomenological observation to constrain theorizing about color does not require believing that the full nature of color is revealed in experience (Johnston 1992/1997), but only that some essential properties of colors are revealed in experience (Pautz 2006, p.538). Mind-independence, it might be claimed, is one of them. This is to treat the apparent mind-independence of the colors the same as the structural relations amongst the colors; see Hardin's (2003, p.201) remarks about the commitments of "common-sense realism." This makes a perceiver-dependent account of color guilty of changing the subject. Furthermore, according to this characterization of the phenomenology of color experience, relationalism yields a massive error theory: colors look like (are represented as, etc.) perceiver-independent properties of objects when they really are perceiver-dependent. Since avoiding a massive error theory is often thought to be an advantage of color realism, this is an unwelcome result. Much more could be said on this topic; e.g., Levin (2000) replies to the massive error theory charge, Pautz (2006) presses the phenomenological objection even against non-relationalist realist theories.

4. Color experience in a colorless world

This concluding section takes up how we should understand color experience, assuming that eliminativism is true. While eliminativism is a thesis about the furniture of the physical world and not an account in the philosophy of mind, it clearly has significant, counterintuitive implications for our understanding of the relationship between the mind and the world. Thus it is fair to expect the eliminativist to say something about what we encounter in color experience.

One option is to take colors to be mental in nature, as either properties of mental objects (such as sense data) or properties of experiences (qualia). Hume (1738/1992, III.I.I; p.469) declared that colors are "not qualities in objects, but perceptions in the mind." Boghossian and Velleman (1989/1997, pp.94-95) regard colors as "intrinsic sensational qualities of a [subjective] visual field" that are "projected" onto objects in experience. Vision scientists are also prone to making claims along these lines, such as Palmer's (1999, p.95) remark that "color is a psychological property of our visual experiences." Accounts that treat colors as mental properties that objects are seen as having threaten to convict color experience not only of massive error, but also a category mistake (Shoemaker 1994, p.25; Tye 2000, pp.165-166). On certain (plausibly straightforward) readings of the thesis that colors are mental in nature, colors are dubious candidates for being properties that could cover the surfaces of physical objects and so forth. One does not have to be a Cartesian about the natures of the mental and the physical to find it hard to understand how sensational (experiential, etc) properties might cover the surfaces of physical objects. Since colors certainly look like properties that physical objects could possess, taking colors to be essentially mental properties results in the phenomenology of color experience being grossly confused (or confusing) about the nature of color.

Mentalist accounts of color also take on the burden of accommodating the distinction between color and patently mind-independent properties such as shape and size; this is related to a long-standing objection to dispositionalism that traces back to Berkeley (Byrne and Hilbert 2003, p.7). There is the worry that once one has stated the nature of color in mental terms and adopted all the machinery that goes along with that, a commitment to shape (size, etc.) also being a mental property is unavoidable. It is hard to motivate a theory that turns the shapes we experience into mental qualities that no physical object can possess, although some are willing to embrace a robust idealism about the qualities we encounter in experience (Hoffman 2009). Of course, some have attempted to block the Berkeleyian objection, often by pointing to differences between the cases of color and properties such as shape; e.g., we have an account of objective shape while an account of objective color seems hopeless.

A more promising route for the eliminativist is to hold that there is not anything – physical or mental – that is actually colored, but visual experience presents us with color properties that objects could have, were circumstances different; it is worth noting that many mentalist views can plausibly be understood or re-cast in terms consistent with what follows (Maund 2006 illustrates this). Using the phenomenology of experience as a guide to the nature of these color properties, we end up with a primitivist understanding of them: across the vast bulk of our experience, the colors we encounter look to be simple qualities of objects themselves (Chalmers 2006; Maund 1995, 2006; Pautz 2006). In the actual world, these primitive properties are uninstantiated, but they can figure in experiential contents. Fortunately for us, experiences that represent these primitive color properties are systematically (but contingently) connected to disjunctions of physical properties. Thus although color experience is a pervasive illusion, it is "as if" we inhabit a chromatic world (Maund 2006). In a different world (e.g., Chalmers' Eden) objects would possess these primitive properties and they would play a role in the causal chain leading up to color experience suitable for facilitating genuinely veridical color perception.

The pairing of eliminativism and primitivism comes with complications. One is that the Berkeleyian objection might be developed against such an account to argue that it leads to primitivism about all perceptual qualities. There is also, of course, the usual apprehension about massive error theories. More fundamental (but related) issues stem from the fact that we, our evolutionary antecedents, and all other creatures have not had any causal contact with the hypothesized primitive color properties. It is difficult to make sense of just how it is that our visual systems evolved to represent, in a useful manner, a suite of properties that nothing in our world actually possesses (Byrne and Hilbert 2003, p.59). Moreover, we are left to wonder how to specify the conditions under which the representation of these primitive color properties takes place, if there are no actual instances of their veridical representation (Tye 2000, p.166). It is a measure of the vexatious character of color, that even with its potential to respect both phenomenology and science, this approach leaves us with further puzzles to address.

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