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Perceptual variation and access to colors

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Abstract: To identify the set of reflectances that constitute redness, the authors must first determine which surfaces are red. They do this by relying on widespread agreement among us. However, arguments based on the possible ways in which humans would perceive colors show that mere widespread agreement among us is not a satisfactory way to determine which surfaces are red.

Byrne & Hilbert (B&H) defend their reflectance physicalism against two perceptual variation arguments: One uses variations in normal perceivers (sect. 3.4), the other uses inverted spectrum variations (sect. 3.5). However, there are more powerful perceptual variation arguments.

Let us grant the authors, for the sake of argument, that a determinable color – red, green, blue, and so on – is identical to a set of spectral reflectance curves. (To simplify things, I ignore productance.) How can we determine which set of spectral reflectance curves constitutes redness? The authors point out, in section 3.4, that there is no test for determining the colors of things that is independent of the colors that objects appear to have to a majority of us. (In this way, colors are unlike shapes.) So, presumably, the authors assume that the red surfaces are the surfaces that contemporary humans generally agree are red, because they look red to us under good viewing conditions. For example, ripe tomatoes are red. Redness is the set of reflectance curves of those surfaces we agree are red. The reflectance curves for the other determinable colors are to be identified in a similar way. Let us grant that widespread agreement exists among us as to which surfaces are red, although there will be disagreement about borderline cases. The assumption I want to challenge is this: The surfaces that contemporary humans agree (or would agree) are red, really *are* red. An implication of this assumption is that, if another group of observers were to identify a different set of surfaces as red (there was widespread agreement among these observers as to which surfaces are red and which are not red), then that group would be wrong. Consider such a group.

Suppose some humans were to evolve so that the pigment of the M-cone cells in their retinas had a slightly different absorption curve. More specifically, suppose the M-cone cells were to become less sensitive in the 540-nm to 600-nm range, but otherwise their eyes were like ours. The M-different humans would see some objects that look yellow to us – such as gold (the impure gold used in jewelry) – as red. Like us, the M-different humans would reach widespread agreement as to which surfaces were red, and which were not, based on the way that these surfaces look to them under good viewing conditions. If the M-different humans were to use the authors' assumption that the determinable colors are sets of spectral reflectances, they would identify redness as a set of spectral reflectances, not the set that we identify as redness. For example, the M-different humans would say that the spectral reflectance curve of gold is in the set that constitutes redness. Who is right? I submit that there is no principled reason for saying that one group is correct and the other is wrong. (For other versions of this point, see Averill 1992 and Matthan 1999.)

Perhaps some arguments that appeal to a possibility get undermined if the possibility is either physically impossible or remote. The possibility just imagined seems to be physically possible, but how remote is it? If humans were to survive for another 10 million years (a remote possibility?), is it likely that some of the pigments in their cone cells would change so as to cause them to see some things as having a different color from the color we see those things as having? If it were likely, would the possibility of M-different humans, or something like them, still be remote? Even if it would still be remote, does this undermine the above argument? I think not. The fundamental point is this: Given the assumption that redness is identical to a set of spectral reflectances, we have no access to redness that allows us to compare the surfaces that we agree are red with the surfaces that really are red. For this reason, we do not know whether the surfaces we agree to be red are really red. Or, if we do know that the surfaces we agree are red really are red, then redness is not identical to a set of spectral reflectances. The possibility of M-different humans brings out these points about our access to redness. The remoteness of the possibility is irrelevant.

The authors seem to take a somewhat different tack with determinate colors than they do with determinable colors. In section 3.4, they point out that, because there is no common agreement about what surfaces are unique green, there is no way we can determine which surfaces are unique green – and similarly for many other determinate colors. Are they claiming that there is no way "at present" or "no way in theory" to accurately identify the determinate colors? The authors liken the situation to a detective not knowing who murdered Professor Plum, which suggests that there is, in theory, a way of finding out which reflectances constitute unique green. If this is right, then they owe us an account of how the nature of unique green could be established in theory. Again, it seems to me that the authors do not take seriously the problem of explaining how we either know, or could find out, what the sets of reflectance curves are for the different colors.

A satisfactory realism with respect to *X*s (material objects, colors, universals, etc.) must either set out an account of how we do (or could in theory) have access to *X*s, or explain why it is rational to believe in *X*s that we cannot have access to. The authors appear to embrace the first alternative, although somewhat differently for determinable and determinate colors. My objection is that they do not fully address the access problem in either case. Of course, it is open to the authors to hold that there is no way of finding out the true nature of the colors. This would be color realism without access to the real.

Perceptual objects may have nonphysical properties

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Abstract: Byrne & Hilbert defend color realism, which assumes that: (a) colors are properties of objects; (b) these objects are physical; hence, (c) colors are physical properties. I accept (a), agree that in a certain sense (b) can be defended, but reject (c). Colors are properties of perceptual objects – which also have underlying physical properties – but they are not physical properties.

Byrne & Hilbert (B&H) argue that colors are properties of physical objects and hence, that colors are physical properties. I agree that colors are properties of objects having physical aspects, but this does not mean that colors are physical properties. A crucial issue neglected in B&H's considerations is the distinction between various levels of description.

Any given event may be described by referring to various levels of description, such as the physical, chemical, biological, psychological, and sociological. At each level there are self-contained

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emergent wholes that have their own properties and parts. Each level of description has both unique properties and properties common to a few other levels. Although the division of the world into various levels depends to some extent on our cognitive system, it is not necessarily arbitrary. The differences between the various levels are real.

In many discussions, "real" is identified with "physical" and "unreal" with "mental" (or "subjective"). Thus, B&H identify their color realism with the claim that colors are properties of physical objects. I believe that this identification is inadequate, as "real" and "unreal" are level-dependent (and even context-dependent) attributes: Something may be real on one level of description and unreal on another.

What is the ontological status of the perceptual environment? Naïve realism, or physicalism, assumes that perceptual qualities exist independently of the perceiver, whereas extreme subjectivism assumes they are properties of the perceiver. I believe that both views are inadequate (Ben-Ze'ev 1993).

A quantitative compromise between these views is to divide the perceptual environment into two parts: One in which naïve realism is correct, and one in which the subjectivist view holds true. The distinction between primary and secondary qualities is just such a solution. I consider it necessary to make a qualitative distinction between the viewpoint within the perceptual environment – this is the perceiver's viewpoint – and the viewpoint about the perceptual environment as a whole. From the perceiver's viewpoint, colors are real properties of objects; however, outside the perceptual environment, for example, in the physical world, colors are not necessarily properties of objects.

In an important sense, all perceived qualities are subject-dependent rather than being properties of an independent physical world. In the course of its progress, science is moving further away from perceptual content. The world described by physics is becoming less and less available to perceptual awareness. Physics does not copy perceptual properties, but rather substitutes them with physical entities. The physical world exists on a different level of description than the perceptual environment, but its existence does not make the perceptual environment less real.

When we speak of a perceptual environment, we presuppose a context involving a perceiver. B&H criticize the ecological approach to color perception, but it is not merely an accidental connection that caused color vision to co-evolve with the colors of plants – the connection is a necessary conceptual one. To paraphrase Kant's terminology: The *a priori* conditions of a possible perceptual experience in general are, at the same time, conditions of the possibility of perceptual objects (Kant 1787/1965, p. A111). Similarly, Gibson argues: "the words *animal* and *environment* make an inseparable pair. Each term implies the other. . . . an environment implies an animal (or at least an organism) to be surrounded" (Gibson 1979, p. 8). To be sure, organisms are "not in the environment as coins are in a box" (Dewey 1922, p. 272). The perceiver and the perceptual environment exist as a pair, just as a father and his son exist as a pair. The very same man existed before his son was born, but then another aspect was added to him: that of being a father. In the same way, the physical world existed before the emergence of perceptual systems, but then another level of description, the perceptual one, was added (Ben-Ze'ev 1993, p. 95).

This approach is a type of critical realism. Its realistic aspect is expressed in the assumption that there are objects whose existence is independent of any existing subject. This is not naïve realism, because it admits to the constructive nature of the perceptual environment.

B&H seem to argue that: (a) colors are properties of objects; (b) these objects are physical; hence, (c) colors are physical properties. It is true that colors are properties of objects, but those are perceptual, rather than physical objects. Perceptual objects can be also described on the physical level, and in this sense may be described as physical properties as well. However, not all properties emerging on the perceptual level are present on the physical level as well. Color, I believe, is one such property. Indeed, physicists do not use color terms in their explanations. This does not imply that colors are not real at a different level of description.

The relational, or subjective, nature of the perceptual environment does not imply – as B&H seem to fear – that veridical perception cannot be distinguished from perceptual illusions. When we ascribe some property to a perceptual object, this ascription can be mistaken. In this sense, it makes no difference whether these objects are physical or mental. The fact that Madame Bovary is a fictional figure does not imply that we can say anything we choose to about her; within the context of her story, there are certain claims that are true and others that are clearly false. Similarly, ascribing certain colors to a given perceptual object may be true or false. A context-dependent property is not tantamount to an arbitrary property.

Contrary to the B&H's claim that "Physicalism about color is compatible with practically any view about the nature of mind" (sect. 3.5), color physicalism is not compatible with views such as those of Kant, Gibson, and the one presented here, which assume that the cognitive nature of the mind in general, and the perceptual system in particular, implies the relational and constructive nature of the perceptual environment.

To sum up, perceptual objects are indeed colored as B&H say. These objects can also be described at a physical level of description. This, however, does not mean that colors are physical properties. Eliminating the perceptual, or more generally, the psychological level of description may make our explanations less problematic, but also less adequate.

"Color realism" shows a subjectivist's mode of thinking

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Abstract: Byrne & Hilbert (B&H) assert that reflectances embody the reality of color, but metamerism smears the authors' "real" color categories into uselessness. B&H ignore this problem, possibly because they implicitly adopt a sort of subjectivism, whereby an object is defined by the percepts (or more generally by the measurements) it engenders. Subjectivism is unwieldy, and hence prone to such troubles.

Byrne & Hilbert (B&H) defend the position that color inheres in the spectral reflectance of an object. This reflectance realism is a parody of the position taken by investigators into color constancy – and therefore needs a reply from that scientific quarter. Color-constancy theories all posit searches for illuminant-invariant quantities based on a restricted set of expected reflectances, but any such strategy must fail if *all possible* reflectances are allowed. The problem is especially acute for metameric reflectances, which have different spectra that match under one light but not under another. Color matches made under a particular light cannot be resolved into different percepts by visual computation. Thus, an object's color cannot depend only on reflectance, but must also depend on the incident light. Color constancy is at best an imperfectly realized goal.

How do B&H deal with metameric reflectances? In section 3.1.1, they "identify the determinable colors with reflectance-types (or sets of reflectances) rather than with the specific reflectances themselves. . . . As a bonus, this proposal also solves the problem of metamers . . . : both determinable and determinate colors are reflectance-types."

What do B&H mean by "reflectance type"? One might try to interpret a reflectance type as a metameric equivalence class of reflectances (i.e., all the reflectances that match under a particular light). But changing the light breaks some reflectance-matches (color matches of reflectance) and cements other ones. Thus, the

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