

Introduction to the metaphysics of color

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Theories of the colors are attempts to explain what it is for an object to be colored. There are various ways of dividing up the space of theories of the colors, all of which seem to cut across important distinctions. We'll divide theories into the following four categories (though, as we'll see, there are lots of important distinctions within the categories as well):

- *Subjective-relational theories*: theories according to which the colors of surfaces are defined in terms of their relations to the experiences of some class of perceivers. These theories are sometimes called 'dispositional theories' or 'subjectivist theories' or 'secondary quality theories.'
- *Reductive physicalist theories*: theories according to which the colors are specifiable in physical terms, without explicit mention of color properties; e.g., the view that colors are dispositions to reflect certain wavelengths of light.
- *Primitive realist theories*: theories according to which colors are simple properties which can't be further analyzed, and are exemplified by material objects.
- *Eliminativist theories*: theories according to which no external objects are colored. (Obviously, these theories might substantially agree with non-eliminativist theories; for example, the eliminativist might think that for objects to be colored they would have to instantiate a primitive color property, but doubt whether objects ever do instantiate such properties.)

1 Subjective-relational theories

1.1 Versions of the standard dispositional theory

The most common subjective-relational theory is the dispositional theory, according to which colors are dispositions to produce certain sorts of experiences in certain conditions.

1.1.1 The disposition to cause red* experiences

Versions of the dispositional theory differ on which disposition they take to define the colors. One version of the view is that colors are dispositions to cause experiences with certain intrinsic phenomenal properties (which are properties of experiences, and hence, on this view, distinct from colors, which are properties of objects). There are various ways of filling this out. One might take the properties to be properties of sense data, or of portions of the visual field (Peacocke (1983)).

- A natural worry here is a metaphysical one: a worry about the things that instantiate red*. Talk of ‘visual fields’ seems a short step from sense data, and lots of people are queasy about letting these sorts of mental particulars into the picture.
- There is also a transparency worry (Boghossian and Velleman (1989)). The properties instantiated by portions of my visual field just are the properties that colors seem to have. So, if my experiences represent objects as colored, red=red*. This would be bad because it would lead to circularity and because, if there are such things as visual fields/sense data, it is not easy to see how the same sorts of properties could be instantiated by them as by external objects.

1.1.2 The disposition to cause experiences which represent the object as red

One might, alternatively, think of the relevant disposition as the disposition to bring about experiences with a certain content: namely, the content that the object in question is red.

- One might worry that the account is circular (Boghossian and Velleman (1989), 88 ff.) on the grounds that it explains the nature of a property in terms of that very property.
Reply: Go Fregean. One might defend this in the grounds that sometimes response-dispositional analyses seem appropriate, e.g. the view that funny things are things disposed to be regarded as funny in certain circumstances. Why it is not obvious that this helps avoid the circularity, at least if we assume that Fregean sense determines reference.
- A related worry (Boghossian and Velleman (1989)) is that the account leads to a regress. If red=the disposition to cause experiences which represent an object as red, then an experience represents an object as red iff it represents the object as disposed to cause experiences which represent it as red iff it represents the object as disposed to cause experiences which represent it as disposed to ...

Reply: Fregeanism again.

Reply: deny that analyses of properties yield property identities. The example of analyses of knowledge.

1.1.3 General objections

- Colors don't look like dispositions.

Reply: Shoemaker on 'to the left of.'

- After-images seem to have colors. But after-images do not seem to be such that they are disposed to cause certain experiences in standard conditions; they only appear in non-standard conditions, and only seem as though they would appear in those conditions (Boghossian and Velleman (1989), 87).
- We can imagine a possible world in which conditions standard for us would involve us having phenomenally different color experiences of the world around us. Thus, in that world, the objects around us would be disposed to cause different experiences in the conditions standard in that world. But the objects needn't for that reason have different colors in that world.

Reply: rigidify. The conditions of manifestation which define the relevant dispositions might be the actual standard conditions (conditions standard in @), rather than the conditions standard in the world at which the color of the object is being evaluated. (Johnston (1992))

- For an object to be disposed to cause red* experiences in *C* is for the following counterfactual to be true: were *C* the case, the object would caused a red* experience. But an object can be green but such that, were it placed in standard viewing conditions, it would produce red* experiences. (This is the shy but powerfully intuitive chameleon of Johnston (1992).)

Reply: dispositions are not equivalent to the corresponding counterfactuals, as examples independent of the case of color show. See Johnston (1992) on altering, mimicking, and masking.

An opponent of the dispositional theory might, however, say that this only delays the problem: until we get a satisfactory account of dispositional properties, we can't be sure that dispositionalism about color is not open to some counterexample like the counterexample of the chameleon.

- The problem of correlative dispositions (Johnston (1995a)). The disposition to produce red* experiences in me in certain conditions may be redescribed as my disposition to be appeared to in a red* way by the object in question. If colors are dispositional properties, then my experience of colors is just as much an experience of my own dispositions to be appeared to as of the dispositions of other things to appear a certain way. But to concede this is to abandon the 'outerdirectedness of perception.'

1.2 Perceptual variation and standard conditions

The dispositionalist about color must, in explaining what the relevant dispositions are, explain what the manifestation of that disposition would be. But she must also explain what the conditions of manifestation are (a point touched upon in the discussion of rigidification above).

It was commonplace to simply solve this by mention of 'standard viewing conditions' or some such phrase, but it is clear that specifying such standard or normal conditions is far from easy, so long as we endorse what might be called 'color absolutism,' the view that objects have colors simpliciter, rather than relative to perceivers or perspectives.

'Standard viewing conditions' can be thought of as a conjunctive notion: we have to specify both a class of normal observers, and the conditions under which their responses are to be definitive

of color. Here are some examples to bring the difficulties faced by the dispositional theorist who is also a color absolutist in explaining either of these notions:

- As Hardin (1988) (68 ff.) notes, there can be no set of standard conditions appropriate to every type of object. He quotes the following candidate for normal conditions from the *Munsell Book of Color*: colors should be arranged under North daylight with a color temperature of 6500-7500 degrees Kelvin, illuminated at 90 degrees, and viewed at 45 degrees. But could these really be the standard conditions for viewing the colors of rainbows (which can't be seen under these conditions), stars, the moon, or bioluminescent fish? This indicates that standard conditions need to be relativized to objects. It is not easy to imagine a way of doing this which would not make the selection of standard conditions objectionably arbitrary.
- The color an object visually seems to have often depends on the colors with which it is surrounded. (See examples.) So what should the contrast be for purposes of normal conditions? One idea is to eliminate contrast by viewing the color through a tube; but then it will turn out that nothing is brown, since visual representation of brown depends on contrast. (Brown objects when viewed through a tube that eliminates contrast look yellow or orange.) (Hardin (1988), Cohen (2004))
- Many objects can't be distinguished in respect of color in incandescent light, but can be distinguished in sunlight. Since we think of sunlight as 'normal conditions', we think of these as differing in color. But some surfaces look the same in respect of color in sunlight, but different in incandescent lighting. One wants to say that they must be different colors; but they cause the same visual experiences in standard conditions.
- What resolution is appropriate for normal conditions? Blood is red, but does not look red when viewed through a microscope. Does this mean that our experience of the color of blood through a microscope is illusory?
- One way to bring out the problem with 'normal observers' is by variation in determination of 'unique colors.' Normal observers differ on which color chip they choose when they are asked to identify the one which is unique green — that green which does not look at all bluish or at all yellowish. This seems to indicate that their visual systems attribute different color properties to different color chips. But which chip really is unique green? It seems arbitrary.

Note that there is a sense in which this sort of objection to dispositional theories assumes the truth of intentionalism. More on this sort of example, and variation in perception of unique colors, when we discuss Block (1999).

These examples have led some subjective-relational theorists to reject dispositional theories of color and endorse instead color relativism.

1.3 Color relativism

According to (one sort of) color relativist, when we attribute color properties to objects, we are really attributing to some object, subject, and set of viewing conditions the three place relation expressed by

--- looks red to --- in ---

(See, e.g., Cohen (2003).) Why this helps with the ‘standard conditions’ problem.

Let’s consider some objections to this sort of view:

- There is the same worry about circularity as above. It explains redness in terms of looking red; we’ve already seen above the potential problems with this sort of view. For discussion of this kind of worry, see Cohen (2003), §1.3.
- The view is at odds with our ordinary talk about the colors. We say that tomatoes are red, full stop – any view which makes this sort of claim come out false (or worse nonsensical) can’t be right.
- Reply: appeal to hidden indexicality. (See Cohen (2004), §4.) The rough idea is that we think of color ascriptions in the same way that we think about sentences like ‘Bob is ready’ or ‘Muffy is tall.’ Arguably, being ready is a relation — one is always ready for something — and being tall is a relation — between an object and some ‘reference class’ with respect to which the thing is tall. But we attribute relations of this sort without always mentioning the second relatum, because in the context it is clear what this relatum is. One might therefore think of the logical form of a sentence of this sort as something like the form of the open sentence

Bob is ready for x

where the proposition expressed by the sentence in a context depends on the value assigned by the context to the free variable. One can say the same thing about color ascriptions. Often we have in mind some hazy view of normal viewing conditions and observers; other times we mean that the object is that color for me right now.

- It makes color illusions impossible; objects always really do look to me in C the way they look to me in C , so it is impossible to get the colors of objects wrong. But this is surely a mistake. (One way to press this point would be via the principles about fallibility discussed before.) In a way, this is the reverse of the charge brought by the relativist against the absolutist: that charge was that absolutism leads to too much error, this that it leads to too little error.

Reply: the relativist can make room for at least some error. Cohen (2007) argues that color relativists can make room for at least three types of error in color perception:

1. Hallucination.
2. Color experiences caused by deviant causal chains (like the ‘telekinetic tomato’). One might be a relationalist and define colors in terms of the colors that they cause in me via the activation of my visual system in these conditions, for example.
3. Recall the above discussion of ordinary language. Just as the sentence ‘ o is red’ can express different contents depending on the subject and conditions implicitly invoked, Cohen thinks that a perceptual experience (of mine, in C) might represent not just that the object is red to me in C but also that it is red to most observers in standard conditions. And this further proposition might well be false. This kind of error might be quite pervasive.

Reply to reply: I am not sure that this is convincing; this looks to me like a difference at the level of judgement rather than at the level of perceptual representation. Of course it is one thing to say this and something else to argue for it. Two tentative arguments for this conclusion: (a) there would seem to be no phenomenal difference between such experiences, and (b) there would seem to be no way to explain what it is for an experience to have one kind of content vs. the other without saying things about what the subject judges in the relevant case.

- Color constancy seems to pose a problem for the view; subjects will often report that an object visually seems to be constant in color even when, e.g., lighting conditions are changing. The natural relativist view, however, will be that these visual experiences will have different contents: one will represent the objects as light-blue-for-me-in- C , whereas the other will represent it as darker-blue-for-me-in- C^*

Reply: One might make the same move as above. That is, one might say that color constancy involves perceptual representation of an apple as looking a certain way to normal perceivers in both cases.

But can we really visually represent that normal perceivers stand in a certain relation to an apple when the apple is the only thing in our visual field? This seems to me like a stretch.

- The central argument for color relativism is an argument from perceptual variation. But this argument shows too much; there is also perceptual variation in shapes, for instance. Are shapes also just relations to perceivers in certain circumstances?

Reply: the cases are not analogous, since there are principled ways of setting ‘standard conditions’ for perception of shape. See Cohen (2004), §2.3 for discussion.

(How about 3D shape? It is less obvious that there are standard conditions there.)

- Byrne and Hilbert (2003) (§R3) object that relativism cannot give the simplest explanation of many behavioral responses to visual experiences, e.g. treating two pieces of fruit which are both represented as red as equally apt targets for eating. According to relativism, the experiences will after all represent different color properties.

Reply: one answer would lean on perceptual representation of various non-relative color properties, as above.

- On this view, objects all have infinitely many colors.

Reply: bite the bullet.

- There’s also the residual phenomenological worry that in color experience we really seem to be seeing properties of external objects, not relations between those objects, ourselves, and circumstances. But it is difficult to know how much weight to place on this sort of thing.

2 Reductive physical theories

So much for attempts to explain the colors in terms of relations to color experiences. The realist (i.e., non-eliminativist) alternatives to subjective-relational views all try to find some property of surfaces with which colors can be identified which are specifiable without mention of experiences. Perhaps the most widely held version of this view is the view that the colors or surfaces are *surface spectral reflectances* (SSR’s). To give the surface spectral reflectance of an object is to give, for each wavelength in the visible spectrum, the amount of light of that wavelength which the surface in question reflects. (See Byrne and Hilbert (1997), Hilbert (1987).)

It is important to be clear about one point at the start: the fact that two objects are indistinguishable in respect of color in standard viewing conditions does not mean that they have same SSR, or even one that is very similar. *Metamers* are pairs of objects which look the same in standard conditions, but have different SSR’s. Colors are thus identified with types of SSR’s. Green is the type of SSR that causes green-feeling experiences in standard conditions.

- Metameric pairs show that objects can have the same color but distinct SSR’s. So colors can’t be SSR’s.

Reply: Agreed; they have to be SSR-types, or sets of SSR's.

- Even if SSR's can handle the colors of opaque objects, they don't handle the colors of transparent objects, volumes of liquid, or light sources, since the colors of these things have little to do with their reflectance properties. Hence the account is objectionably incomplete.

Reply. It is a matter of controversy whether the reductive physicalist can extend his theory to handle these other cases. Byrne and Hilbert (2003) (§3.1.2) try to subsume the case of SSR's under a more general account of colors as dispositions to produce light of different wavelengths (whether this is emitting light, as in the case of light sources, transmitting light, as in the case of transparent objects, or reflecting it, as in the case of opaque objects). For criticism, see Jakab and McLaughlin (2003).

- Any theory of the colors should make it that case that we can be justified in our views about the colors of things solely on the basis of our color experience. But reductive physical theories violate this constraint, because these theories say that for some collection of objects to have the same color, they must share some microphysical property in common. But that they have such a property in common is not something which our color experience gives us any reason to believe. (based on Johnston (1992))

Reply: A reference-fixing version of reductive physicalism.

- We can know just on the basis of reflection on our experience that, e.g., turquoise is more similar to teal than either is to canary yellow, and that canary yellow could not turn out to be a shade of blue. But this would be impossible if colors were microphysical properties. (Johnston (1992))

Reply: we don't know this on the basis of our color experience. What we do know is that color experiences of orange objects are always more similar to color experiences of red objects than to such experiences of blue objects. One then has to explain what the similarity consists in. Here there are two main options.

1. The two relevant resemblance is resemblance in phenomenal character. For a thorough discussion and criticism, see Pautz (2006).
2. According to Byrne and Hilbert (1997), we can explain similarity on how things look on the basis of the determinable shades objects are perceptually represented as having. The idea is that in addition to a determinate shade of scarlet, an object is also visually represented as being scarlet, and as being red, and as being red-or-orange, and as being red-or-orange-or-yellow, and The idea is that X looks more similar to Y than to Z in respect of color if there are more color properties X and Y are represented as having in common than X and Z are represented as having in common.

But do color experiences really represent red objects as red-or-orange? Is there any more grounds for this than thinking that they represent them as red-or-green?

- Hardin (1988) objects that the reductive physicalist cannot explain the difference between unique and binary hues. The idea is that yellow is a unique color, because it does not seem to be a combination of two other colors, whereas orange is a binary color, because it appears to be a combination of red and yellow. And the physicalist can't explain this distinction, since nothing in the facts about SSR's can explain it.

Reply: the superdeterminables. Byrne and Hilbert (1997) claim that every (chromatic) color experience represents an object as having at least one of the following four properties: reddishness, yellowness, blueness, or greenness. An experience attributes to an object a unique color iff it attributes to that object exactly one of these four properties.

- We know the colors by acquaintance, and not just by description (as whatever properties underly certain sorts of experiences). But if reductive physical theories are true, we know the colors (prior to scientific investigation, at least) only by description.

(This is related to Russell’s idea that we know all that there is to know about the essence of color by examining our experience of it – the idea that Johnston calls *Revelation*.)

- A pair of experiences of a volume of water can each be veridical even if in one case it appears gray and in the other green. But it is hard to see how two experiences which are different in this way could represent the surface of the water as having the same reflectance property, for example. (Johnston (1995b))

3 Primitive realist theories

Primitive realists about color think that the colors are properties instantiated by colored external objects which are distinct from their reflectance properties and other relevant physical properties. Let’s suppose that the ‘relevant physical properties’ are the ones in terms of which the finished color science will explain the experiences of subjects looking at the relevant objects. Then we can raise the question: how are the colors related to those physical properties? There are two main answers to this question, both expressible as a kind of supervenience claim:

It is nomologically (but not metaphysically) necessary that any two objects alike in the relevant physical respects are also alike in color.

It is metaphysically necessary that any two objects alike in the relevant physical respects are also alike in color.

In the terminology of Byrne and Hilbert (2007), the first is NC-primitivism, and the second is MD-primitivism. We’ll begin with some objections to primitivism in general before turning to a few objections to these versions of the view.

- Colors are the causes of our visual experiences. We already know from color science that the causes of our visual experience must either be microphysical properties, dispositions to reflect light, or dispositions to cause certain experiences. Believing in the face of this that colors are simple properties involves believing in a ‘bizarre pre-established harmony of redundant causes of our visual experience.’ (Johnston (1992), 227)

Reply: this is no worse than the nonreductive physicalist’s view that mental states cause actions. Campbell (1993) (262) takes this line. But this by itself is somewhat unsatisfactory, since it is far from clear that the nonreductive physicalist’s view is a good one.

Reply: sometimes a realized property provides a better explanation than a more determinate realizing property because of its generality. See Campbell (1993), Byrne and Hilbert (2007).

- Imagine that the simple view were true, and that two subjects were content-inverted relative to each other. Now imagine that each looks at an object, like an apple. They represent it as having different primitive colors. But their abilities to get around in the world, etc., might be equal, and in general there seems to be no way of breaking the parity between them. But a realist primitivist has to say that (at least in some such cases) one is right and the other wrong. But this is arbitrary; hence we should restore the parity between them, and primitivists should also be eliminativists. (Chalmers (2006))

Reply: there needn’t be parity between them. The apple might really have the primitive color property one represents it as having, and not the one the other represents it as having.

- If the simple view were true, then we could just as easily have evolved to systematically represent the colors — we could have evolved to represent green things as red, and vice versa — and this would have had no adverse effects. So we have no particular reason to think that we have evolved so as to accurately represent the colors rather than to be one of the many, many ways in which we could have systematically misrepresented them. So we should not think that, on this sort of view, our color experience is veridical. Since it leads to color skepticism, realist primitivism should be rejected. (Chalmers (2006))
- The problem of animal visual experience. (Byrne and Hilbert (2007)) Goldfish color experience is sensitive to light wavelengths in the near-ultraviolet zone which human color vision is not; so, to goldfish, a pair of objects which differ with respect to reflectance of light in that zone will appear as different with respect to color, whereas to humans they will not. The worry is that it seems that any view of what's going on with goldfish seems to be in tension with the primitivist's commitments:
 1. *There are colors which goldfish represent which humans do not.* This would mean that there are colors which are nowhere on the color solid. But primitivists take the essence of colors to be revealed by color experience, and reflection on the objects of color experience seems to exclude the possibility of alien colors. The color solid seems complete in this respect.
 2. *Humans, but not goldfish, represent colors.* Goldfish represent color-like properties. This seems ad hoc; one also wonders if this forces an implausible view of the relationship between the vision of color blind and normally sighted humans.
 3. *Goldfish do represent color differences in these cases, but there are no color differences: goldfish experiences of this type are illusory.*
 4. *The wavelength differences represented by goldfish are represented as color differences, but this needn't mean that there are alien colors, due to the possibility of metameric pairs.* Byrne & Hilbert don't discuss this possibility; perhaps it is ad hoc, but it at least deserves to be considered.
 5. *The wavelength differences are represented as color differences; they just lead to more fine-grained color distinctions than humans are capable of.*
- Against NC-primitivism: the case of permuted earth (Byrne and Hilbert (2007)). Imagine a world in which the 'chromophysical laws' are different, but in which human vision works in just the same way. In that world, things would all have different colors than they actually have, but human color vision would represent them just as it actually does (since human color vision is sensitive to the physical properties, like SSR's, which underwrite the color properties). Hence many or all color experiences would be illusory. There are many different permuted earth stories that could be told; it then seems that the actual world exhibits a 'pre-established harmony' between the relevant physical properties, the colors, and color vision for which there could be no plausible explanation. (Either that, or we never see the true colors of things.)
- Against MD-primitivism: one of the central motivations for primitivism is a kind of transference of conceivability arguments from the philosophy of mind: just as we can imagine a certain neural configuration being a phenomenal-red rather than a phenomenal-green experience, we can imagine a certain SSR constituting redness rather than greenness. Hence the SSR's and colors cannot be identical. But this argument entails the falsity of MD-primitivism, and leads to NC-primitivism (or a weaker view about the relationship between the physical properties and the colors).

Reply: as Watkins (2009) notes, this would leave open the possibility that primitivism could be motivated by the possibility of a world in which objects are colored despite not instantiating any of the relevant physical properties.

4 Eliminativist theories

One might think of the central argument for eliminativist theories (sometimes called ‘projectivist’) as the collection of arguments against the three sorts of theories sketched above. Sometimes it is claimed (as in Boghossian and Velleman (1989)) that eliminativism is supported by color science. But what this really means is that color science shows why none of the theories sketched above is very good.

Other times, eliminativism is supported by an argument for primitivism, followed by an argument against realist primitivism. Most eliminativists are primitivists: they think that the colors are unanalyzable properties which no external object instantiates. Pautz (ms.) argues that primitivists should be eliminativists on grounds of theoretical economy.

Some objections:

- All things being equal, we should prefer a theory which does not make out color experience illusory.

Reply: why should we prefer this? It is far from obvious that, e.g., the evolutionary value of our color experience depends on objects being colored.

Reply: all things are not equal. The motivation for eliminativism is precisely that any realist theory of the colors ends up saying objectionable things.

- A material object with no color is not conceivable, and is therefore impossible. So eliminativism is necessarily false (or at least false in every world in which there are material objects).

The eliminativist might reply that what is inconceivable is not a material object which is not colored, but rather an experience of a material object which does not represent it as colored (or something to that effect). But would we ordinarily accept this sort of reply to an argument for the impossibility of something? Consider, e.g., an argument that a four-sided three-angled plane closed figure is impossible based on the impossibility of visualizing such a figure. Would we accept a reply which said that this shows something about the impossibility of a certain sort of visual experience rather than a certain sort of figure? Are the examples analogous?

- Eliminativists insist that colors must be objects which satisfy all of descriptions we associate with the colors; but our concepts don’t typically work this way. Something can count as an *F* even if it just plays most of the roles we associate with this property.

A test case: eliminativism about witches.

- Color properties are not instantiated by external objects; but are they instantiated by anything? If not, then we are related in perception to uninstantiated properties, which seems odd. But any candidate to instantiate color properties either plainly doesn’t – as in the case of neural states – or is otherwise objectionable – like sense data. (Byrne and Hilbert (2003))
- If nothing is colored, why would visual systems have evolved to represent properties that nothing has? (Byrne and Hilbert (2007))

Reply: our representing an object as having a certain color is a good indicator of the presence of certain survival-relevant properties of things. — But this can still seem a bit odd. Is there any other case in which an organism evolves to track certain properties of objects by representing them as having some other property, which nothing in fact has? — Maybe some error theories treat moral properties in something like this way, though of course the link to perception is not as tight.

- The slippery slope argument: whatever considerations motivate eliminativism about color also motivate eliminativism about perceived shape, et. al. But then we end up as eliminativists about all the properties our experiences represent as instantiated — an unattractive view. (Byrne and Hilbert (2007))

Reply: Pautz (ms.) argues that there is a relevant difference, namely that shape properties but not color properties give things causal powers which are relevant to survival. – It is less than obvious to me how this is a reply to the objection. Maybe it depends on which is taken to be the main argument for primitivism.

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