

Parsing the rainbow

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Abstract

Navigating the ontology of color used to be a simple affair. There was the naive view that colors really are in objects the way they appear, and the view that they are secondary qualities to cause certain experiences in us. Today, there are myriad well-developed views but no satisfactory taxonomy of philosophical theories on color. In this article, I first examine the two newest taxonomies on offer and argue that they are inadequate. In particular, I look at Brogaard's taxonomy and then Cohen's. One of the reasons I am displeased with Brogaard and Cohen's taxonomies is that I find it implausible that dispositions are relational properties. I provide an argument against this way of classifying dispositions. Having learned from the vices and virtues of Brogaard and Cohen's taxonomies, I provide what I believe is a much-enhanced way of taxonomizing philosophical views on color. My taxonomy rules out certain views, clarifies others, and shows that there is an unnoticed view worthy of consideration.

Parsing the rainbow¹

Is the world really the way it appears? A negative answer to this question (or at least more negative than not) has had a huge impact on the ontology of color since Galileo. He thought that we cannot conceive of a material substance without also imagining it as having a certain shape and size, as being located in space and time, as moving or not, as being in contact or not with other bodies, and as having a number. Because of this, Galileo thought that the world really is the way it appears with respect to these properties. However, he went on to argue that we can conceive of a material substance without also conceiving of it as having a taste, making an odor, or having a color. Thus, he thought “[t]astes, odors, colors, etc., so far as their objective existence is concerned, are nothing but mere names for something which resides exclusively in our sensitive body, so that if the perceiving creature were removed, all those qualities would be annihilated and abolished from existence” (Galileo, 1960, p. 28).

Galileo’s argument that tastes, odors, and colors are mind-dependent had a powerful impact on subsequent generations. It appears that we can conceive of a world full of tasteless, odorless, and colorless objects, but we cannot imagine a world full of shapeless ones. This distinction in what can be conceived influenced modern era philosophers like Locke to believe that having a taste, having an odor, and being colored are secondary qualities (Hacker, 1991, p. 1-12). The reasoning may have gone like this. The explanation for why we experience objects as having tastes, smells, and colors even though they do not really have these properties is that the geometrical and numerical qualities of objects somehow cause us to have these experiences. Hence, an object’s appearing red, for instance, is really just an effect of that object’s having

¹ I am especially grateful to Philip Percival for helping me to think through the contents of this paper. I am also thankful to Stephen Barker and Benjamin Smart. Their 2012 article inspired some of what I say in section 3. In addition, I am thankful to Harold Noonan and Jonathan Tallant for their helpful advice. Last but not least, I would like to thank two anonymous referees for their insightful comments.

certain geometrical and numerical properties. So, if redness is anything at all, it is merely a secondary quality of objects to cause us to have certain experiences.

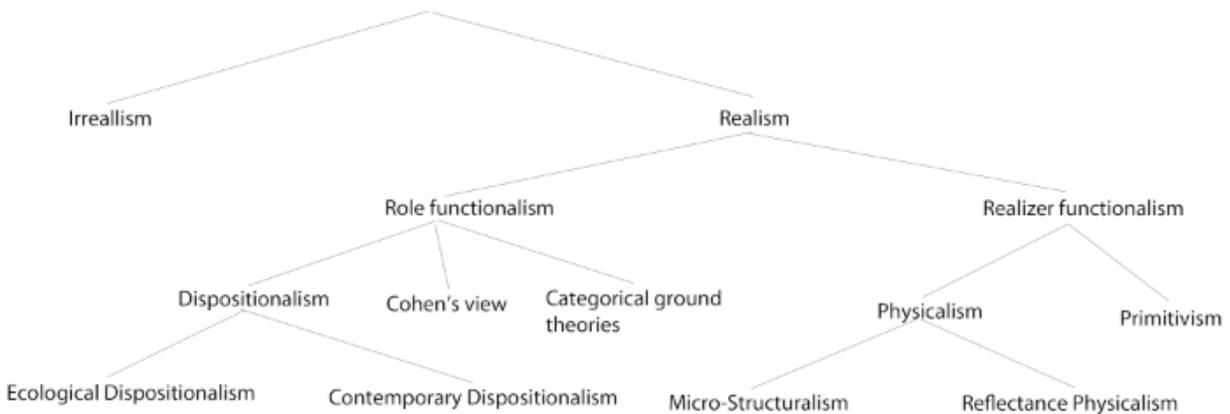
This view that external objects are not *really* colored, or at least not really colored in the way that they are really square, was orthodoxy for a long time. However, it is no longer so obvious that such a secondary quality view about color is correct. There has been a revolution happening in the ontology of color over the last few decades the result being that the secondary quality view now has many contenders. There are currently myriad realist views on color from Byrne and Hilbert's (2003) reflectance physicalism to the increasingly popular simple view on color supported by Campbell (1993). Like all revolutions, the present one has been disorienting. It used to be easy to navigate the ontology of color: There was the naive view that colors really are in objects the way they appear and the "enlightened" view that things are not as they seem; the colors are merely secondary qualities to cause certain experiences in us.

If things were only this easy today! Unfortunately, there is no going back. So, it is important that we understand the space of options now available. Regrettably, none of the attempts to do this have been successful. Without an adequate taxonomy, the inquiry into what the colors are is going to be much harder and more prone to confusion than it would be otherwise. So, in this article, I first examine the two newest taxonomies and explain why they are unsatisfactory. Specifically, I look at Brogaard's (section 1) and then Cohen's (section 2). One of the reasons I am unsatisfied with Brogaard and Cohen's taxonomies is that I find it implausible that dispositions are ipso facto relational properties. I provide an argument against this way of classifying dispositional properties (section 3). Having learned from the vices and virtues of Brogaard and Cohen's taxonomies, I provide a much-improved way of taxonomizing

philosophical views on color (section 4). My taxonomy rules out certain views, clarifies others, and shows that there is an unnoticed view worthy of serious consideration.

Section 1: Brogaard's taxonomy

Brogaard (2010) provides what she calls “a category scheme for the colors.” Her category scheme suggests that order, family, genus, and species relations hold between positions on color. Brogaard's category scheme can be interpreted as follows:²



One can see from this figure that Brogaard (2010) divides views on what the colors are into two orders: “irrealism” and “realism.” I understand realism to be the view that the colors are properties that are actually instantiated by external objects, and irrealism to be the view that the colors are properties that are not actually instantiated by external objects (Hardin, 1988; Chalmers, 2006). Under the realism node, Brogaard is best interpreted as holding that there are two families of views on color: role functionalism and realizer functionalism. The way I understand these nodes is that role functionalism holds that the colors are second-level properties of having properties that realize the appropriate roles, and that realizer functionalism is the view

² Brogaard (2010) does not consistently stick to her category scheme, but she has confirmed via written correspondence that the taxonomy I attribute to her captures her scheme.

that the colors are the first-level properties that realize the appropriate roles. Brogaard would prefer to call the relevant nodes “relationalism” and “non-relationalism” respectively. I understand relationalism to be the view that the colors are relational properties and non-relationalism to be the view that they are non-relational properties. So, these terms cannot be substituted for the others, because there can be relational properties that are not role properties, for example, the property of being part of the device, the property of being identical with phosphorus, the property of being west of London, etc. I regard the nodes immediately under realism as being captured by my definitions of role and realizer functionalism.

Brogaard specifies three role functionalist views: “dispositionalism,” “Cohen’s view,” and “categorical ground theories.” Dispositionalism has historically been intricately linked with the secondary quality view on color. Brogaard seems to understand dispositionalism in this narrow historical way. Roughly, she says that dispositionalism is the view that the colors are dispositions to give rise to phenomenal effects. However, given that today there are dispositional views like Byrne and Hilbert’s reflectance physicalism (see below) which differ substantially from the secondary quality view, it is preferable to understand dispositionalism in a broader sense. I understand dispositionalism broadly to be the view that the colors are dispositional properties akin to being fragile. Understanding dispositionalism in this way allows for one to see similarities and differences that would otherwise go unnoticed between views on color.

Cohen’s view, as I understand it, is that the colors are relational properties that construe the colors as being constituted by relations to subjects (possibly also amongst other things) (Cohen, 2004; 2009, p 9-10).³ More specifically, Cohen’s view can be hashed out as one according to which it is constitutive of (or essential to) any color L that there is a relation R such

³ Cohen (2004; 2009) does not clearly differentiate between relations and relational properties. Relations are not the right type of things to be the colors. Objects can have colors, but they can only stand in relations. So, to be charitable I interpret Cohen as holding the view that the colors are relational properties not relations.

that for any object x , x is color L iff there exists an observer y (which need not be the same for different x 's) such that x bears R to y (2004; 2009, p. 8-12, 24-36). (In section 4, I distinguish between two different species of Cohen's view.) Cohen's view is best captured as relationalist not role functionalist. It is first and foremost obviously a relationalist view on color, and, as I said, there can be relational properties that are not role properties.⁴

Categorical ground theories hold that the colors are the categorical grounds of dispositions to cause certain phenomenal effects in perceivers if viewed (Jackson, 1996). In other words, categorical ground theories do not hold that the colors are dispositions to cause certain phenomenal effects but the categorical properties that ground or realize these dispositions. This view is most naturally understood as realizer functionalist not as role functionalist, because it says that the colors are the grounds or realizers of certain dispositions. A role functionalist understanding would require that one accept that the categorical grounds of the relevant dispositions are role properties, but role properties, unlike categorical ones, are understood in terms of causal powers. Notice that if we interpret the role functionalist node to be a relationalism node, this would result in Cohen's view being better categorized but would not ultimately improve things for two reasons: First, categorical ground theories neither fit well under a role functionalism node nor a relationalism node. As I said, categorical ground theories are best categorized as realizer functionalist. Second, I think it is implausible that dispositions are ipso facto relational properties (see section 3), and so it would be wrong to place a dispositionalism node (especially given my understanding) under a relationalism node.

It appears that Brogaard believes that there are two species of dispositionalism about color: "contemporary" and "ecological" dispositionalism. I understand contemporary

⁴ Cohen (2009) ends up endorsing a role functionalist view, but this view is not identical with what is called "Cohen's view." According to Cohen, his role functionalist view is a *species* of what he calls "Relationalism." Cohen's view captures the idea of "relationalism" given in part 1.3 of Cohen's (2009) book.

dispositionalism to be the view that for any color C, C is identical with the disposition to cause certain experiences if viewed by a certain kind of perceiver in certain conditions (usually qualified “by normal observers in normal viewing conditions”) (McGinn, 1983; Johnston, 1992). This view is the modern version of the secondary quality view famously endorsed by Locke amongst others. Ecological dispositionalism includes a series of views that are based on the ecological approach to zoology that insists the animal cannot be studied independently of its environment (Thompson, 1995; Noë, 2004). The most developed view of this kind is Noë’s (2004) theory that the colors are dispositions to modify how an object appears with respect to its color as the relevant conditions change.⁵ Thompson (1995, p. 242-250) also argues for an ecological view, although his view is poorly developed and has been argued to collapse into contemporary dispositionalism (Byrne and Hilbert, 2003, p. 7-8).

Brogaard specifies two genres of realizer functionalism: “physicalism” and “primitivism.” I understand physicalism to hold that the colors are physical properties like being H₂O or being atomic element 12. I understand primitivism to hold that the colors are non-reducible or sui generis (Yablo 1995; Westphal, 2005). That is, in contrast with the property of being water, which is often thought of as being reducible to the property being H₂O, primitivism holds that the colors are properties such as being square, which is thought of as being irreducible. It is important to emphasize that the sense of “primitive” I just characterized is such that “primitive” is not synonymous with “simple.” Primitive properties in my sense can be complex. The way I understand things, the property of being a square is a primitive property even though it is composed of four sides of equal length. The property of being square is primitive in that it

⁵ The view I cite to Noë above is similar to the one Brogaard cites to him. However, Noë’s view is far from clearly presented, so unsurprisingly, the view that Allen (2009) cites to Noë is not unambiguously the same view that I cite to him. Allen’s interpretation can be considered Noë’s view*. What is Allen’s interpretation? He says that according to Noë the colors are patterns of organization in how things look (p. 648-649).

cannot be reduced to any other property. The sense of “primitive” under which it means non-reducible better maps onto how primitivists about color comprehend their view than the understanding under which the term means simple. Primitivists about color have never felt the need to deny that binary colors, unlike unitary colors, are composed out of other colors.

A concern at this point is that Brogaard only places physicalism under the realizer functionalist node. However, there can be physical role properties (e.g. the property of being a transistor, the property of being a magnet, the property of being a jet engine, etc), at least under any broad conception of the physical like supervenience physicalism (Jackson, 1993; Chalmers, 1996). Brogaard divides the physicalism node into two species of view: “micro-structuralism” and “reflectance physicalism.” Micro-structuralism is the view that the colors are identical with particular micro-structural properties (Smart; 1963; Armstrong, 1968). Reflectance physicalism is the view that the colors are identical with dispositions to reflect certain proportions of incident light at each wavelength of the visible spectrum (Tye, 2000; Byrne & Hilbert, 2003; 2004). An obvious concern here is that reflectance physicalism is a dispositional view on color as well as a physical view, but because of Brogaard’s narrow conception of dispositionalism her taxonomy forces us to put it on the physicalism node. It would be preferable if a taxonomy of views on color could express that reflectance physicalism is a dispositional view.⁶

Perhaps this issue has made explicit a problem I have so far left implicit: Many of Brogaard’s same-level nodes are *prima facie* compatible with each other. Brogaard has a unique primitivism node, but there can be primitive physical properties as well as non-physical primitive

⁶ Brogaard’s taxonomy differentiates between reflectance physicalism and the views under her dispositionalism node like this. Reflectance physicalism holds that the colors are realizer functionalist, whereas the views under the dispositionalism node holds that the colors are role functionalist. This is an odd way of differentiating these views given how I understand them, because reflectance physicalism being dispositionalist is not naturally understood as a first-level view. Dispositions are naturally understood as second level. One could distinguish between different stages of the second level, but this seems as if it would get confusing fast.

properties. Also, Brogaard has a unique categorical ground theories node, but this view neither rules out physicalism nor primitivism. The categorical grounds of the relevant dispositions can be physical or primitive properties. Third, Brogaard has a unique physicalism node, but one can have physical primitive properties and physical dispositional properties, at least under any broad conception of the physical. Some of these problems, along with the issue of placing physicalism only under the realizer functionalist node, could be addressed by providing a narrow definition of “physical.” Brogaard seems to have some narrow sense of the physical in mind. However, it is unclear whether a narrow definition of “physical” could draw a principled distinction between views on color. An underlying problem is that the notion ‘physical’ is difficult to get a handle on (Hempel, 1969; Crane & Mellor, 1990; Gocke, 2009). For this reason, it is best not to taxonomize views on color using the concept (Cohen, 2009, p. 6-7).

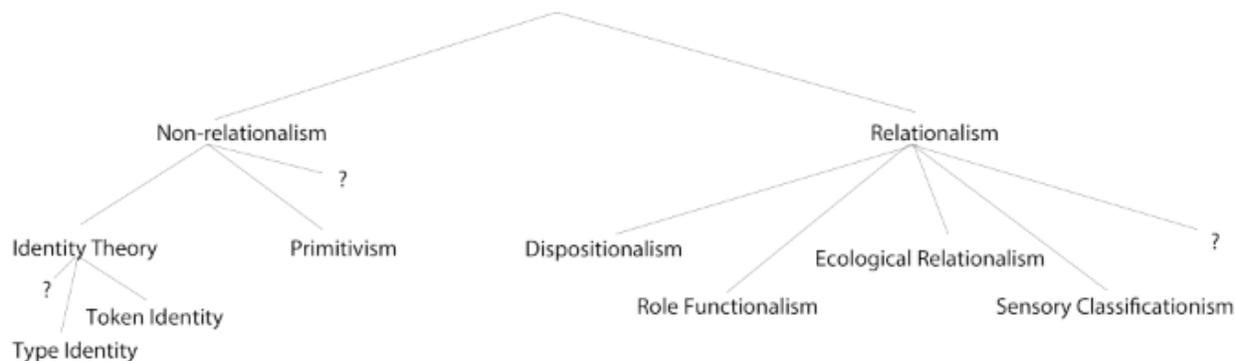
There are three more problems with Brogaard’s taxonomy worth mentioning. First, Brogaard does not metaphysically justify her taxonomic hierarchy. What would metaphysically justify Brogaard having role functionalism and realizer functionalism as her penultimate nodes instead of primitivism and non-primitivism, or what would metaphysically justify her having primitivism and non-primitivism over dispositionalism and non-dispositionalism? Perhaps answers to questions like these are of little practical importance, which is likely why Brogaard did not engage with them. However, this just goes to show that one should not accept the added complexity of hierarchical models without metaphysical support. Second, although I am unsure whether Brogaard intended her taxonomy to be exhaustive of logical space, it would be better if a taxonomy made it clear that there is logical room for undefended views.

Third, Brogaard’s taxonomy suggests that all the views that fall under the realist node are incompatible with irrealism, but this is wrong. It is coherent to hold that being red is a primitive

property or a physical property, perhaps micro-structural, that nothing actually has. The reason why these views are compatible with irrealism is that the enquiry into what the colors are can be understood as one into the properties we have experiences as of things having when having visual experiences as of things being colored, and there can be an answer to what we are having experiences as of even if nothing is actually colored (see section 4). Another way of looking at this is that the colors are the properties that could make our experiences as of things being colored veridical, and there can be an answer as to what could do this even if nothing is actually colored. With this being said, when one considers that objects appear colored to us, Cohen's view and contemporary dispositionalism *prima facie* look to be incompatible with irrealism. For Cohen, roughly, if an object appears red, then it is (see section 4), and for contemporary dispositionalism, if an object appears red to a certain kind of perceiver in certain conditions (usually qualified "normal observers in normal viewing conditions"), then it is.

Section 2: Cohen's taxonomy

Cohen (2009) proposes what he considers to be a refined taxonomy of positions on what the colors are. His taxonomy says that order, family, genus, and species relations hold between philosophical views on color as follows (2009, p. 13):



Cohen splits views on color into two orders: “non-relationalism” and “relationalism.” Cohen’s relational node is narrower than the role functionalist node used in Brogaard’s taxonomy, at least as I understand her node. This is because Cohen says a view falls under the relationalism node iff it says that the “colors are constituted in terms of relations to subjects [possibly *inter alia*]” (2009, p. 10). Thus, Cohen’s relationalism node seems to be (basically) identical with “Cohen’s view” as I understand it in Brogaard’s taxonomy. In addition to this disparity in terms, two more disparities are worth mentioning. First, what Cohen (p. 13) calls “ecological relationalism” is the same as “ecological dispositionalism” with one caveat: Cohen only talks about Thompson’s (1995) ecological view and does not mention Noë’s (2004) view. Second, what Cohen calls “dispositionalism” is the same as “contemporary dispositionalism.” This use of “dispositionalism” has the immediate anomalous consequence that reflectance physicalism is not dispositionalist. Cohen seems to be using the term “dispositionalism” in a historically narrow way, but, as I suggested in section 1, I think that this use is outdated given the assortment of views now available.

Physicalism, micro-structuralism, reflectance physicalism, and categorical ground theories are not nodes in Cohen’s taxonomy. Cohen agrees with me that the notion ‘physical’ should be avoided, because it is unclear what condition a property has to satisfy to be physical (2009, p. 6-7). Cohen would place categorical ground theories under the non-relationalism node of his taxonomy (p. 187). Cohen describes his “identity theory node” as involving views that say the colors are identical with microphysical properties or with non-subject involving functional kinds (p. 12). Cohen’s “type identity” node includes views that hold the colors to be microphysical types (p. 3). “Token identity” views according to Cohen hold that “there is no one physical constitution type that is shared by all instances of a given color [...], but every token

instance of a given color is a member of some or other physical type that affects light in the requisite way” (p. 3). Given the analogy that Cohen (p. 3) draws with token identity views in the philosophy of mind, I interpret the above quote as saying that a token identity view on color holds that for every particular instance of a color ‘having a color x ’ there is a particular physical instance ‘having a property y ’ such that having $x =$ having y , but there is no one physical property type that all having’s of x share in common. Cohen places reflectance physicalism under the token identity node and micro-structuralism under the type identity node.

In addition to the above differences, Cohen adds two more nodes that are not to be found in Brogaard’s taxonomy. Cohen calls the first such view “role functionalism.” Despite the fact that Brogaard also has a node by this name, Cohen’s role functionalism node is narrower than how I understand Brogaard’s: Cohen defines the C role as the functional role of disposing the bearer of the functional property to look red to a subject in a circumstance (2009, p. 178), while I understand Brogaard’s node to leave the C role open. The second new node that Cohen adds he calls “sensory classificationism.” He attributes a view of this kind to Matthen (2005). Cohen (2009, p. 229) says, “sensory classificationism construes colors in terms of relations between [...] objects [and] the sensory classifications made by subject’s visual systems.” He says the appropriate classifications are those according to a telos given by Matthen (2005, p. 230). I am unsure whether this is the correct interpretation. Cohen seems to think that Matthen’s view is that colors are relations which hold between objects and sensory classifications. However, Egan (2008, p. 408) says the view is that the colors are dispositions to “produce [...] ‘epistemic actions,’ [where] epistemic actions include coming to have a perceptual belief, or making further classifications or generalizations.” Perhaps there are also other interpretations.

Cohen's taxonomy avoids some of the issues with Brogaard's, because it does not have a high-level split between realism and irrealism and does not have a physicalism node or a categorical ground theories node. Also, it is worth mentioning that Cohen's taxonomy makes it clear that there are possible unspecified views. Unfortunately, it should be obvious that Cohen's taxonomy makes at least two mistakes that are similar to errors discussed previously. First, Cohen provides no metaphysical justification for his taxonomic hierarchy over the many alternatives. What would metaphysically justify his having non-relationalism and relationalism as his top-level nodes instead of non-primitivism and primitivism, or what would metaphysically justify his having non-primitivism and primitivism over non-dispositionalism and dispositionalism? We should not accept the added complexity of a hierarchical model without metaphysical justification for it. One can give the non-relationalism/relationalism distinction a prominent role in a taxonomy on color like Cohen wants without using a hierarchical model.

Second, Cohen places contemporary and ecological dispositionalism (or "dispositionalism" and "ecological relationalism" given Cohen's terms) under the relationalism node of his taxonomy, but this placement is unintuitive. Certainly contemporary dispositionalism is not a relational view on color. One may retort that this view construes the colors as constituted by relations to subjects (Cohen, 2009, p. 11), but this would be misguided. Either something can be disposed to cause experiences as of yellow if viewed by a certain kind of perceiver in certain conditions if no perceivers exist or it cannot. Intuitively, something can be so disposed even if no perceivers exist. If this is right, contemporary dispositionalism cannot construe the colors as constituted by relations to subjects. Noë's view also seems as if it is non-relational. The view certainly cannot be understood to construe the colors as constituted by relations to any conditions. Something can be disposed to change how it appears with respect to color as certain

conditions change even if the relevant conditions do not happen to obtain (i.e. exist). If Thompson's view collapses into contemporary dispositionalism, it too would intuitively not be a relational view. I further support the intuition that these dispositions are not relational in section 3 by arguing that dispositions are not ipso facto relational properties.

There are four other problems with Cohen's taxonomy that are best discussed at this juncture in some depth. The first problem results from failing to realize that there can be primitive relational properties, given the sense of 'primitive' under which the term means non-reducible that I endorse and Cohen (2009, p. 4) seems to endorse. Cohen only places primitivism under the non-relationalism node of his taxonomy, but there is no obvious reason why there cannot be relational views on color that are also primitivist (whether relational views are understood in Cohen's restricted sense or not). After all, there can certainly be primitive properties that are also relational. For example, the property of being in love is plausibly a primitive relational property. Likewise, the relation 'in love with' is probably also primitive. Even if being in love and the relation 'in love with' are reducible, this is not obvious. The same goes for other relational properties like being west of London, being above the sink, etc. So, there is no clear reason why the colors cannot involve primitive relational properties (whether or not they involve subjects). Hence, Cohen's taxonomy ought not to rule out such views.

The second problem results from failing to realize that one of the nodes in Cohen's taxonomy is not exclusive. Specifically, the issue is that Cohen places his role functionalism about color on one of his lowest level nodes, but this view, as far as I can tell, can be true as well as contemporary dispositionalism. Cohen defines the functional role relevant to his role functionalism as that of disposing the bearer of the functional property to look red to a subject in a circumstance. However, under this definition of the C role, the second-level property of having

some or other first-level property that realizes this role looks a lot like the (constituted) disposition to appear red if viewed by a subject in a circumstance. Hence, as far as I can tell, Cohen's role functionalism is at the very least a species of contemporary dispositionalism. Thus, Cohen's version of role functionalism appears as if it should not be placed on a taxonomy as a separate species of view from contemporary dispositionalism.⁷

The third problem results from not properly understanding reflectance physicalism. Cohen (2009, p. 3) says that micro-structuralism is a type identity theory but claims that reflectance physicalism is a token identity view. He is right about micro-structuralism. However, assuming that Cohen understands token identity views analogously to the philosophy of mind literature, he is wrong about reflectance physicalism. Byrne and Hilbert, the main proponents of reflectance physicalism, hold that the colors are dispositions to reflect incident light at each wavelength of the visible spectrum (2003, p. 9). This is a type identity view; it says, for example, that the property being red is identical with the disposition to reflect R proportions of light at each wavelength of the visible spectrum. Byrne and Hilbert later retreat to the position that the colors are types (or sets) of dispositions to reflect certain proportions of incident light, or as they say, "[...] Both determinable and determinate colors are reflectance types" (2003, p. 11). However, this view is also not a token identity view (in the philosophy of mind sense); it says that the property red, for instance, is identical with a *type* of disposition to reflect certain proportions of incident light rather than the specific dispositions to reflect light themselves. A token identity view, on the other hand, implies the falsity of such type identity claims.⁸

⁷ To be fair, Cohen (2009, p. 11, footnote 18) says that contemporary dispositionalism may collapse into role functionalism. If there is such a collapse, it seems to me that it would go in the opposite direction, because contemporary dispositionalism provides a more fundamental answer to "what are the colors?" than role functionalism. Role functionalism provides a rather indirect way of saying what the colors are.

⁸ Notice that contrary to what Cohen (2009, p. 3, footnote 4) thinks, whether reflectances are physical types is irrelevant to whether reflectance physicalism is a token identity view. Reflectance physicalism proposes a type

The fourth problem with Cohen's taxonomy results from not properly distinguishing between the questions "what are the colors?" and "what are the particular instances of the colors?" Assuming Cohen understands token identity views the way I think he does, he should not place them on a taxonomy of views on what the colors are. Token identity views do not tell us what being red is but only what each particular instance of redness is. So, token identity views (in the philosophy of mind sense) should not be on a taxonomy of views on what the colors are. One may retort that a token identity view implicitly provides a response to the question "what are the colors?" to the effect that it cannot be answered. In reply, we are taxonomizing positions on what the colors are. Thus, a rejection of this question is a view to be considered but not taxonomized. One should not underestimate the importance of this point: If token identity views are understood to reject the question "what are the colors?", then putting them on a taxonomy of views on what the colors are is likely to lead to serious confusion in the future.

Section 3: Dispositions are not relational properties

When assessing Brogaard and Cohen's taxonomies I claimed that it is implausible that dispositions are ipso facto relational properties. This may be controversial, because many have failed to differentiate between these properties (McGinn, 1983; 1996; Thompson, 1995; Byrne & Hilbert, 2003; Noë, 2004). We have already seen some hints of such a failure when discussing the taxonomies above. Now, let us look at some very salient examples. First, Thompson (1995, p. 242-250) when talking about his ecological view vacillates between saying that the colors are dispositional properties and saying that they are relational properties with no sign that he recognizes a distinction. Second, Byrne and Hilbert (2003, p. 8) seem to agree with Thompson

reduction of the colors. So, if reflectance dispositions were not physical types, then this would only imply that reflectance physicalism is a non-physical type identity view. It would not imply that it is a token identity view.

that dispositions are relational properties. Finally, Noë, like Thompson, moves between saying that the colors are dispositions (2004, p.144) and saying that they are relational properties (p. 144, 149) with no sign that he is aware that these properties are different in nature.

I shall now argue that dispositions are not ipso facto relational properties. Roughly, my argument goes like this. (a) It is essential to relational properties that an object having one bears a relation to something(s), and (b) it is not essential to dispositional properties that an object having one bears a relation to something(s). To present my argument, I shall first explain why (a) is true and then (b). There are positive and impure relational properties (Khamara, 1988). The property of being married is an example of the former. This property is biconditionally dependent on the relation ‘married to’ such that a person x is married at time t iff x is married to someone at t . The property of being married to Tom is an example of the latter. This property is such that a person x has the property being married to Tom at time t iff there is an individual Tom and x is married to him at t . (Notice that Cohen’s view discussed in section 1 is that the colors are positive relational properties like being married.)

A general analysis of both these kinds of relational properties seems prima facie to run as follows (Humberstone, 1996, p. 211):

General analysis: A property P is relational iff there is some relation R such that for all x , x has P at t only if for some thing(s) $y_1...y_n$, $Rxy_1...y_n$ at t .

However, Humberstone (1996, p. 211-212) argues correctly that there are some issues with this general analysis. The conditional ‘if x has P at t , then for some thing(s) $y_1...y_n$, $Rxy_1...y_n$ at t ’ comes out as vacuously true for impossible properties, and all objects regardless of their

properties bear the identity relation to themselves. These issues with the general analysis can be addressed easily enough by rewriting it as follows:

Improved analysis: A property P is relational iff there is some relation R such that it is essential to P that for all x , if x has P at t , then for some thing(s) $y_1...y_n$, $Rxy_1...y_n$ at t .⁹

If the improved analysis is correct, then (a) follows. That is, it follows that it is essential to relational properties that an object having one bears a relation to something(s).

I now want to argue for (b) that it is not essential to dispositional properties that an object having one bears a relation to something(s). Intuitively, dispositional properties like the disposition to cause experiences as of red if viewed by a certain kind of perceiver in certain conditions are not relational properties. It does not seem essential to an object being disposed to cause experiences as of red if viewed by a certain kind of perceiver in certain conditions that it bear a relation to anything. It certainly does not seem that an object being so disposed requires any perceivers to exist. Conversely, it is essential to something having the relational property being west of London, for example, that it bear the relation ‘west of’ to something, namely London. So, why would anyone hold that dispositions are ipso facto relational properties? The only motivation I can think of is to explain why an object x having the disposition to M in C gives it the connection it has with the counterfactual ‘if x were in C, x would M’.¹⁰ The relationalist about dispositions answers this question as follows:

⁹ Khamara (1988) gives analyses of positive and impure relational properties using the notion of ‘consisting in.’ The improved analysis could be stated with this notion as well. Humberstone (1996) provides a way of understanding the notion of ‘consisting in’. The improved analysis could also be stated using the notion of ‘constitution.’ Cohen (2004; 2009) holds that relational properties are constituted by relations.

¹⁰ As the simple conditional analysis of dispositions is unpopular, it is unclear how exactly dispositions are related to counterfactuals. See Johnston (1992), Bird (1998), and Martin (2008) for arguments against the simple conditional analysis. However, even though the simple conditional analysis is unpopular, basically everyone agrees that there is some connection between dispositional properties and counterfactuals.

Relational option: For any object x , its having a disposition to M in C gives it the connection it has with the counterfactual ‘if x were in C , x would M ,’ because for every disposition to M in C there is some relation R such that it is essential to that disposition that any object which has it bears R to something(s).

There are two versions of the relational option: One in which R is a first order relation and one in which R is a second order relation. A relation R is second order iff at least one of R 's relata is a property and first order otherwise. The first order relationalist will say that for every disposition to M in C there is a first order relation R^1 such that it is essential to the disposition that any object which has it bears R^1 to the states of affairs x having M and x having C . The second order relationalist will say that for every disposition to M in C there is some second order relation R^2 such that it is essential to the disposition that any object which has it bears R^2 to the properties M and C . (As an object cannot bear a relation to something that does not exist, these options commit one to some heavy duty metaphysics about non-actual states of affairs and uninstantiated properties. I ignore this issue here, because I take it that anyone who is willing to accept one of these options will also be willing to accept such consequences.)

An excellent concern is that these relational options are not relational in the right way. The improved analysis understands ‘relational property’ partly in terms of a relation holding between some things(s). The first relational option understands dispositions as involving relations to states of affairs, and the second relational option understands dispositions as involving relations to properties. Thus, more specifically, the worry is that states of affairs and properties are not things in the relevant sense; that is, they do not fall within the scope of the first order quantifier (used in first-order logic). This worry shows that the two relational options

above are not relational in a strict sense. Even if one of the options turned out to be correct, dispositions could not be said to be ipso facto relational in the strict sense that, for example, the property of being married can be said to be. Nevertheless, if one of the options were correct, dispositions could be said to be ipso facto relational in a more liberal sense.

I think that both relational options are problematic even when understanding ‘thing’ in the liberal sense required by them. The distinction between the two versions of the relational option is not relevant to my argument, so I will just talk of a relation R , and of M and C . My argument is that the relational option should be rejected, because it fails to explain the relevant connection. The reason is that the relation postulated by the option does no explanatory work: There is no reason why R holding between x , M , and C should metaphysically determine that an object x having the disposition to M in C bears the connection in question to the counterfactual ‘if x were in C , x would M .’ Why is it that $R(x, M, C)$ being essential to an object having the disposition to M in C metaphysically determines that the object has some connection with the counterfactual ‘if x were in C , x would M ’? There certainly does not appear to be anything in R ’s internal makeup that ensures that it would have this power. So, what is it that keeps the counterfactual ‘if x were in C , x would M ’ glued to $R(x, M, C)$?

Those who believe that dispositions are ipso facto relational properties may try to answer this question in one of two ways. First, one may say that it is just a brute fact that $R(x, M, C)$ gives an object x the connection it has with ‘if x were in C , x would M ’. The problem with this answer is that it is the brute fact that is doing the real work not $R(x, M, C)$. So, the relation postulated by the relational option is explanatorily superfluous. Second, one may try to explain what keeps ‘if x were in C , x would M ’ glued to $R(x, M, C)$ by positing a relation R^* that holds over R and (x, M, C) . The problem with this answer is that, similarly with R , there is no reason

why $R^* \{R, (x, M, C)\}$ should metaphysically determine that $R(x, M, C)$ should metaphysically determine that if an object x has the disposition to M in C , then it has some connection with the counterfactual ‘if x were in C , x would M .’ One can just rinse and repeat all the way up so to speak. So, this second way of trying to address the problem, just like the first, does nothing to tackle the concern: The relation postulated by the relational option fails to do the work that it was postulated to do. Thus, the relational option should be rejected. So, we should accept (b) that it is not essential to dispositions that an object having one bears a relation to something(s).

A corollary of this is that the following must be true:

Non-relational option: Whatever the explanation is for why it is the case that for any object x , its having a disposition to M in C gives it the connection it has with the counterfactual ‘if x were in C , x would M ,’ the answer is *not* that for every disposition to M in C there is some relation R such that it is essential to that disposition that any object which has it bears R to something(s).

One salient way of choosing this option is given by Bird’s view. Bird (2007) would say that what explains the connection is that dispositions are constituted by the modal role endowing stimulus-responses relations that they bear to other properties. To be clear, dispositions are constituted by relations for Bird, but it is not the case for him that it is essential to an object’s having a disposition that it bear a relation to something(s). So, Bird’s view is a non-relational option.

Armstrong (1983) would also choose the non-relational option by saying that the connection is explained by his second order necessitation relation that holds between properties.¹¹ Another option would be to say that the Simple Conditional Analysis (SCA), or something like it,

¹¹ There is a concern that arguments similar to the second one I raised against the relational option (i.e. the argument to the effect that the relation postulated by the option does no explanatory work) will apply to Bird and Armstrong’s views (Barker & Smart, 2012; Barker; 2013), but such discussion is outside the scope of this article.

explains the connection: Necessarily, x is disposed to M in C iff if x were in C , then x would M .

The SCA is unpopular today, so this option is unlikely to have many supporters. However, it is *an* option. There is room for other versions of the non-relational option, but it would take us too far afield to explain them in depth or any of the versions for that matter.

Section 4: My taxonomy

Having learned from the virtues and vices of both Brogaard's taxonomy as well as Cohen's, I propose the following taxonomy:

Dispositional	Relational	Reductive	Views on what the colors are
No	No	No	Non-relational primitivism
No	No	Yes	Micro-structuralism, Type (or set) reflectance dispositionalism, ???
No	Yes	No	Relational primitivism
No	Yes	Yes	Cohen's view 1 and 2, ???
Yes	No	No	Not available
Yes	No	Yes	Appearance dispositionalism, Reflectance dispositionalism, ???
Yes	Yes	No	Not available
Yes	Yes	Yes	???

The question marks illustrate the logical space for undeveloped views.

I do not think that there is good metaphysical reason to accept the added complexity of a hierarchical taxonomy. So, according to my taxonomy, views on color are grouped according to three characteristics: dispositional/non-dispositional, relational/non-relational, and reductive/non-reductive. Dispositional properties connect objects with counterfactuals in a special way that non-dispositional properties (also called "categorical properties") do not. So, if

the colors are dispositions, one must hold that they give objects a special connection with counterfactuals. The reflectance dispositionalist, for example, must say that a colored object has a special connection with ‘if it were illuminated, it would reflect certain proportions of incident light at each wavelength of the visible spectrum’. Although categorical properties may not all be structural like shape properties are, it is natural for a color categoricist to understand the colors similarly to shapes and say that what it is to be colored is to have a certain structure. A categorical primitivist could point to the structure of the familiar color solid, and a categorical reductivist, for instance, to some micro-physical structure described by physics or chemistry.

A view is relational iff it says that the colors are relational properties. I presented my improved analysis of relational properties in the last section. Further, I argued that dispositions are not ipso facto relational properties. So, one cannot say that dispositional views are relational views. This will be a surprising consequence for those who have conflated these properties. However, absent a good response to my argument in the last section, one should accept its conclusion. Also, it should be clear from what I have said that some relational properties are not dispositional. Being west of London, for example, is clearly not a dispositional property of any kind. Hence, it is possible for there to be relational views on color that are also categorical. This shows that, although arguments for dispositional monism (Mumford, 2004; Bird, 2005a; 2005b; 2007) may count against certain relationalist views, arguments for categorical monism (Armstrong, 1997) need not rule out relationalism about color.

A view is reductive iff it says that a property picked out in one domain of enquiry is identical with a property in another and non-reductive (also called “primitivist”) otherwise. In the case of color, the domain of enquiry comprises the properties that we have experiences as of objects having when having visual experiences as of objects being colored. Given this way of

defining the domain, the reductivist says that the colors are identical with properties in a domain like that of the physical sciences or any other domain separate from the phenomenological one we are accustomed to in visual experience, while the non-reductivist denies this. Notice that given how I define the domain of enquiry there is no issue with there being an answer to “what are the colors?” even if nothing is colored. There can be an answer to what the properties are that we have experiences as of even if we are under a persistent illusion. Also, it is important to note that any respectable non-reductivist will hold that discovering what the colors are (their natures) requires arduous philosophical investigation. All that is meant is that according to the non-reductivist the answer to “What are the colors?” has been hiding in plain sight.

My taxonomy implies that there can be no non-reductive, dispositional views on color. Watkins’ (2002) says that he holds a “non-reductive,” dispositional view. What Watkins means by this is that the colors are dispositions that are neither reducible to their realizers nor to relational properties (p. 137). However, as one can see from what I wrote above, my definition of “non-reductive” is entirely different from this. My argument against there being non-reductive, dispositional views is based on the premise that we do not experience what dispositions are. It goes like this. Given how I defined “reductive” and “non-reductive” as well as the domain of enquiry, it follows that non-reductive views on color hold that we experience what the colors are in our visual experiences as of colored objects. A property P is dispositional =df for some manifestation M and circumstances C, P is identical with the disposition to M in C. So, if there could be non-reductive dispositional views on what the colors are, we would have to experience the relevant M and C’s for the dispositions said to be identical with the colors in our visual experiences as of colored objects. I see no way around this. I think that it is somewhat plausible,

at least *prima facie*, that we experience the relevant M's. For example, the relevant M for the property red could be said to be *that* (pointing to the redness of an object).

However, we do not experience any circumstances C in our visual experiences as of objects being colored. For my argument, one need merely reflect on one's experiences as of the colors so as to establish whether in these experiences any circumstances are experienced. I cannot recall ever being phenomenally presented with a circumstance(s) during an experience as of an object being colored. I only experience an object as being like *that* (pointing to a red object) or like *that* (pointing to a green one), and so on. In fact, I cannot even conceive of being phenomenally presented with a circumstance during an experience as of an object being colored. Of course, I can conceive of having an experience as of an object being colored and of a circumstance(s). Perhaps the object is also fragile, and I am experiencing it dropping. However, this would not be an experience as of an object being colored but of it being colored and dropping. Hence, this is irrelevant to my argument.¹² Thus, it should be clear that dispositions cannot satisfy what is required of a non-reductive view. If I am correct, then no one, including Watkins, can be a non-reductive, dispositionalist about color (in my sense).

Reflectance dispositionalism is the same view called "reflectance physicalism" in Brogaard's taxonomy. The view that colors are types (or sets) of reflectance dispositions that Byrne and Hilbert eventually retreat to is best categorized alongside micro-structuralism. I define appearance dispositionalism broadly as the view that the colors are dispositions to appear certain ways if certain generally specified conditions are met. Appearance dispositionalism divides into

¹² My argument is neither an argument that we cannot see dispositions (McGinn, 1996, p. 540) nor an argument to the effect that colors do not look like dispositions (Boghossian and Velleman, 1989, p. 86; 1991). It is only an argument that we do not experience any circumstances in our visual experiences as of colored objects, and so if colors are dispositional properties, we do not experience what they are (their natures) in our visual experiences as of colored objects. Thus, there can be no non-reductive dispositional views given how I understand "reductive" etc. This would only imply that the colors are not dispositional properties if one assumes that we experience what the colors are (their natures) in our visual experiences as of colored things. Johnston (1992) thinks that something like this is a core belief about the colors. If he is right, there is reason to be worried about all reductive views.

internal and external variants. Internal dispositionalism encompasses what is called “contemporary dispositionalism” in Brogaard’s taxonomy and “dispositionalism” in Cohen’s. Internal dispositionalism is the view that the appearances that the relevant dispositions are disposed to give are *internal* to us. Cohen’s role functionalism is a kind of internal dispositionalism. External dispositionalism holds that the appearances are *external* to us. Noë’s ecological dispositionalism is a kind of external dispositionalism, because Noë endorses what he calls “phenomenological objectivism” (2004, p.141-144) under which the appearances are in external objects. It is unclear whether Thompson’s (1995, p. 242-250) theory is an internal or external variant of appearance dispositionalism. If one accepts Byrne and Hilbert’s claim that the view is equivalent to contemporary dispositionalism, Thompson’s view is a kind of internal dispositionalism. Regardless, my taxonomy makes room for the view wherever it may fall.¹³

I have split Cohen’s view into two versions that are close to the surface in his (2004; 2009) work. I said in section 1 that Cohen’s view is one according to which it is constitutive of (or essential to) any color L that there is a relation R such that for any object x , x is color L iff there exists an observer y (which need not be the same for different x ’s) such that x bears R to y (2004; 2009, p. 8-12, 24-36). Cohen’s view 1 requires condition 1 below for when x bears R to y , and Cohen’s view 2 requires condition 2.

1. R holds of $\langle x, y \rangle$ iff y is a viewing subject who is having a perception as of x being L.
2. R holds of $\langle x, y \rangle$ iff if a viewing subject y were to view x , then he would have a perception as of x being L. (For both options the viewing subject could be constrained

¹³ Egan (2010) proposes that attributing the property being green to an object delivers the centered worlds proposition that is true at a world (w), time (t), and individual (i) iff the object is disposed to look green to i in the circumstances i occupies at t in w . This sounds like a relativist, internal dispositionalist view. If so, it could be placed in my taxonomy as a type of internal dispositionalism. However, as Egan states the view as one about when ‘being green’ is true using an ‘iff’, it is difficult to be sure exactly of what he is saying the colors are.

so he must be normal or constrained in some other way. Cohen would be very loose with his constraints on the viewing subject.)

A case could perhaps be made for Cohen's view 2 being a dispositional view on color, because it gives the colors a connection with counterfactuals. However, as I said, a property P is dispositional =df for some manifestation M and circumstances C, P is identical with the disposition to M in C. So, if Cohen's view 2 were a true dispositional view, one would think it would be expressible using the locution 'the disposition to M in C'. It is hard to imagine this being done effectively. So, I prefer to classify Cohen's view 2 as non-dispositional. If this is right, the view cannot give the colors the *special* connection to counterfactuals that a dispositional view would. It is also important to note that Cohen's view 1 and 2 have unintuitive consequences that quintessential dispositional views like contemporary dispositionalism do not. Namely, both versions imply that objects would lose their colors if no observers existed. This is because *x* cannot bear R to an observer *y* if there are no observers. Cohen's view 1 also has the consequence that an object is not colored unless an observer *y* is perceiving it.

Cohen (2009, p. 10, footnote 16) says that his view is reductive. I have done as he says and taxonomized his view accordingly.¹⁴ However, as I have said, there is no obvious reason why there cannot be non-reductive relational properties. One may argue that the colors do not phenomenally look like relational properties (McGinn 1996, p. 541; Tye, 2000, p. 152). If sound, such arguments would pose a special problem for there being non-reductive, relational views on color. If primitivism is true, the colors had better phenomenally look like the properties we are accustomed to in the phenomenological domain of visual color experience. Nevertheless, it is

¹⁴ There is a circularity in Cohen's view that is worrying to his opponents (Tye, 2012). Because of this circularity, one may reasonably doubt whether his view succeeds in giving a reduction of the colors.

unobvious whether the cited arguments work (Byrne and Hilbert, 2001). So, what I call “relational primitivism” is an important but unrecognized view worthy of serious consideration. Such a view would allow one to accept the intuition called ‘Revelation’ that the natures of the colors are fully revealed to us in perception (Johnston, 1992), while also allowing one to avoid Cohen’s (2004; 2009) worry about ad hoc stipulation in variation cases. Different versions of this view depend on the relation involved, its relata, and when it holds of its relata. For primitivists who find relationalism hard to stomach, there is also non-relational primitivism.¹⁵ All primitivist views must be species of either relational or non-relational primitivism.

Where do realism/irrealism, physicalism, categorical ground theories, Brogaard’s role and realizer functionalism, Cohen’s identity theory, and sensory classificationism fit in my taxonomy? Realism/irrealism are compatible with most of the views in my taxonomy. Cohen’s view and contemporary dispositionalism are *prima facie* exceptions. As I mentioned, I agree with Cohen that the notion ‘physical’ should be avoided, as it is unclear what condition a property has to satisfy to be physical. Categorical ground theories are compatible with all of the non-dispositional theories in my taxonomy. Brogaard’s role functionalism is compatible with any view that takes the colors to be second-level properties like appearance dispositionalism, and her realizer functionalism is compatible with all the views that take the colors to be first-level properties like micro-structuralism. My reductive characteristic subsumes Cohen’s identity theory node by encompassing reductive views. Because of issues of interpretation, I leave it open as to where exactly Matthen’s sensory classificationism belongs.

¹⁵ It is worth mentioning that there has been an attempt to develop a relativist, non-relational primitivism in order to better account for worries about ad hoc stipulation (Brogaard, 2010). According to this view objects can only have non-relational primitive color properties relative to a viewer in a normal condition.

Conclusion

Without an adequate taxonomy the ontology of color is going to be much more difficult and prone to confusion than it would be otherwise. So, in this article, I first distilled two of the newest taxonomies and explained why they are unacceptable. Namely, I looked at Brogaard's taxonomy (section 1) and then Cohen's (section 2). I then provided a comprehensive argument against classifying dispositions as relational properties (section 3). Having learned from the vices and virtues of Brogaard and Cohens' taxonomies, I provided a much-improved way of taxonomizing views on color (section 4). My taxonomy rules out certain views, clarifies others, and shows that there is an unnoticed view worthy of serious consideration.

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