

color
perception:
philosophical,
psychological,
artistic and
computational
perspectives

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The Peculiarity of Color

Kathleen Akins and Martin Hahn

1. Introduction

Color perception, we can all agree, is distinctly peculiar. Take your favorite red shirt, which now hangs neatly in the closet, washed and ironed. Your shirt is colored uniformly by a single fabric dye, Crimson Red, a surface property that is stable through time and place. Nonetheless, your favorite shirt can still *appear* a variety of colors, none of which you think of as Crimson Red. Wear your shirt with a nice pair of green checked pants, and it will look, well, a significantly different hue. Walk out to the parking lot at night, under the lighting of low sodium lights, and it will look a sickly orange. Show your shirt to your spouse, and he or she may comment that Crimson Red is really not *exactly* your favorite shade of red. Color, we all know, is a tricky property, ever-changing with the circumstances, with both the conditions of viewing and the viewer.

Yet despite this acknowledged variability, at least *prima facie*, in our everyday dealings with the world, we treat color as an objective property of physical objects. As Frank Jackson says, when questions of color arise, “we look out, not in”: in determining color, we examine physical objects, not our own inner sensations, the properties of our phenomenological experiences (Jackson, 1998). Moreover, we treat questions about color as having answers that are independent of our present perceptions: you can discover, in mid-afternoon, that your socks do not match, and yet hold, without contradiction, that this morning when you put them on, they certainly seemed to match. Similarly, we treat questions about color as having correct or incorrect answers (either the socks match or they do not), which can be profitably discussed with other people (for even though we acknowledge that some people are more sensitive observers of color than others, this in itself presupposes that there must be something about which those judgments are less or more accurate) and for which certain conditions of observation are more likely to provide veridical judgments (we hold the two socks up to the sunlight and rotate them this way and that). In other words, we treat color as an

objective property of objects – as a property that exists independently of us, to which we (normally) have visual access and about which we can make correct or incorrect judgments. This, at least, is how we behave.

In this commentary, the question we wish to pose is about the nature of objectivity: what would it be to “vindicate” the apparent objectivity of color? Here, the question is not whether color is, as a matter of fact, an objective property of physical objects. Rather, the question concerns the nature of the debate. What are these philosophers arguing about – or rather, what ought they to be arguing about? What, exactly, are the conditions of objectivity? Despite the fact that Frank Jackson, David Hilbert and Evan Thompson have very different views about the nature of color, there are commonalities to their views about objectivity, commonalities we will draw out.¹ What we wish to show is that these criteria for objectivity – the criteria commonly accepted by most philosophers who are interested in color – could not be correct. We will begin, though, with a brief sketch of the three authors’ views about the nature of color, and a fuller account of what each believes objectivity in perception entails.

2. Three Views of Objectivity

A. Frank Jackson

Frank Jackson wishes to defend a strong, “Australian” form of property realism with respect to colors, the view that colors are properties in the world which figure in the causal explanations offered by the physical sciences. He offers an *a priori* argument for this general view, plus a (largely undefended) suggestion as to which physical properties colors actually are: configurations of the primary properties of the surfaces of objects. The redness of an apple, then, is just the set of physical properties of its surface which causes us to have the sensation of redness when we look at the apple. Of the three ontological possibilities suggested by Locke for secondary qualities – that they are nothing outside the mind, that they are the powers of objects to affect our minds, or that they are the primary properties in virtue of which objects have such powers – Jackson wants to defend the latter, most realist or objectivist view. Our main interest here will be in extracting Jackson’s account of objectivity from the details of his general argument for this position.

Jackson’s starting point is the “prime intuition about color” – an intuition which he takes to be so central and platitudinous that denying it would be tantamount to giving up on speaking of color at all – namely:

- (1) “Red” denotes the property of an object putatively presented in visual experience when an object looks red.

He takes this to be a summation of our folk view, given above, that colors are objective properties of the world – that we attribute color to things in the world, not our experiences of them, and that we take the same sort of steps to determine this putative property as we do for other objective properties. The second premise of the argument is captured by the schema:

- (2) The property of objects putatively presented to subjects when the objects look red is at least the normal cause of their looking red.

This is another *a priori* principle, expressing what Jackson takes to be a necessary condition on the relation of presentation between an experience and the property of which it is putatively an experience.

Given these two principles, the question of the objectivity of color is reduced to the question of determining the normal causes of color experiences. If there are such normal causes, colors are objective, if not, not. An affirmative answer does not, however, suffice to demonstrate realism of the sort Jackson wishes to defend, for it leaves room for, indeed suggests, the second Lockean possibility that colors are the powers of objects to produce certain sensations in us rather than sets of primary qualities. The final premise of Jackson’s argument must, therefore, rule out such dispositional accounts. To accomplish this, Jackson argues that dispositions are never causes – at least not when they have a categorical basis – and that empirical science shows us that sets of primary qualities are the bases of the powers to cause color experiences.

Jackson’s crucial argument for denying causal efficacy to dispositions is two-pronged. Take fragility, for example. The cause of a vase’s shattering upon impact could not be its fragility for two reasons. One is that the fragility of the vase is, in fact, grounded in or the result of the vase’s molecular structure, and this structure is by itself already a sufficient cause for the vase’s shattering upon impact. Granting the fragile disposition, causal efficacy would amount to a “curious and ontologically extravagant kind of overdetermination” (Jackson 1998, p. 92). The second reason why fragility cannot be the cause is that causes are contingently related to their effects, while the disposition to break upon impact is related *essentially* to breaking upon impact. Hence dispositions are not causes, and colors must be the primary qualities of objects which cause our color sensations.

The above argument for the conclusion that colors are configurations of the primary properties of the surfaces of objects, might well seem too easy. After all, the two crucial *a priori* premises speak of properties putatively presented and the conclusion seems to be that colors are primary qualities of objects *tout court*. What happened to this important

qualification – or rather, given that every sensation is caused, what is the distinction between experiences that present objective properties and ones that do not? Since merely putative presentations are also caused by something, and since, according to Jackson, all causes are complexes of primary qualities of objects, putative presentations are also caused by complexes of primary qualities of objects. The difference between the subjective and the objective must lie in some further facts about these causes and their relation to the experiences they produce.

What we need, according to Jackson, is: “a systematic dependence between the nature of the experience and the nature of what is experienced, a dependence that allows us to think of the experience as tracking the nature of what is experienced . . .” (Jackson 1998, p. 96). To make an actual presentation of a property, not a merely putative one, the causes which produce that type of perception must be systematically interrelated – the causes must form a type of their own, presumably a type specifiable in a way not viciously dependent (by way of, say, a dispositional characterization) on the presentation type.

Unfortunately, as we noted above, color perception is distinctly peculiar. There is a great deal of variability between our color experiences and what they are experiences of, – that is, what causes them – the object that appears red to me now would not appear red if the illumination were different, or if I were closer to it or farther from it, or if the human visual system were different, or if I were color blind, and so forth. Moreover, this kind of variability is generally regarded as the very hallmark of *subjectivity*. For example, perhaps the most popular route to subjectivism in ethics is first to attempt to establish the inconstancy (across cultures or individuals) of ethical judgments or perceptions, given the same situation. If color is to be an objective property, then, variability needs to be tamed.

The objectivist is faced with the task of attempting to say what objective property all red objects have in common. But if, as principle (1) seems to say, redness is the property that objects have whenever they *seem* red, the common property of red objects cannot be redness. Red objects, after all, *seem* orange, or grey, or any number of other colors, given the right observer and circumstances. Jackson’s prime intuition about color thus appears to rule out the objectivity of colors, at least as individuated in the way we commonly individuate the properties of objects we call “red,” “green,” and so forth.

Philosophers who subscribe to some version of principle (1) usually deal with this problem by an appeal to *standard conditions*: red cars are all objectively red because they all appear red to normal viewers (humans with a fully functioning visual system) under standard conditions (say, in daylight, at medium distance). Interestingly, Jackson does not take this “standard conditions” route. Nor, as a matter of fact, is it open

to him to do so. The objective property common to red cars under different viewing conditions and for different viewers is a *counterfactual* property, that is, a *dispositional* one: red cars are just those that *would look red* to a normal human under standard conditions. And as no dispositions are, for Jackson, genuine causes . . .

Instead of taking the standard-conditions route, then, Jackson accepts the consequences of his arguments, and denies that objects are colored *tout court*. He offers the following schema, which relativizes colors to subjects, times and circumstances: “*O* is red at [time] *t* for [subject] *S* in [circumstances] *C* iff there is a property \bar{P} of *O* at *t* that typically interacts with *S* in circumstances *C* to cause \bar{O} to look red in the right way for the experience to count as the presentation of *P* to *S*” (Jackson, 1998, p. 97).

Thus a colored patch in a magazine cannot be said to be red, *tout court*. It has the property of being red, at a certain time, to a certain individual, viewed at a medium distance. It also has the property of being made-up-of-yellow-and-magenta-dots, at some time, to some individuals, when viewed up close. The two properties are, obviously, quite compatible. So, within each of these categories of “red,” variability seems tamed: the relevant property typically interacts with the subject (and others like it) in these circumstances (and others like it) to cause the object (and others like it) to look red to the subject. Thus, to be red-at-*t*-for-*S*-in-*C* is to have a complex set of primary qualities of the surface of those objects which look red to the subject in those circumstances.

It remains a fact, of course, that we speak of red cars, even though they are really blue-at-*t*-for-*S*-in-*C* when *C* includes sodium lights and monochrome-at-*t*-for-*S*-in-*C* when *C* involves sufficiently low lighting conditions, and many other colors-at-*t*-for-*S*-in-*C* for different *t*’s, *S*’s, and *C*’s. To explain this fact, we have to bring in what normal observers see under standard conditions: “As we are humans, we are naturally interested in redness for humans, and for those humans whose perceptual faculties are working normally or properly . . . Also, there is a wide range of circumstances we view as normal for viewing the world . . .” (Jackson, 1998, p. 97). Thus, there is a: “thoroughly anthropocentric sense [of color] tied to normal humans in normal circumstances . . . But the fact remains that the fundamental notion is that of color of *O* at *t* for *S* in *C*” (Jackson, 1998, p. 97). Oddly, then, despite Jackson’s allegiance to Robust Ozzie Realism, he seems to be (and there is no way to put this delicately) a *pragmatist* about what most of us think of as colors: the stable properties of the objects around us, those that make us agonize over paint chips and rush home to compare the newly bought curtains against the living room rug. **There is, for Jackson, no realist sense of “really” in our common attempts to draw an appearance/reality distinction for colors: “I know it looks blue in here, but in better light you would see it is really green.”**

To sum up Jackson's view so far, the objectivity of color requires that there be a type of non-dispositional property systematically correlated with each type of putative presentation of color. One sort of common failure of this correlation is that one and the same object (hence, one and the same kind of surface property) can give rise to many different color experiences. In light of this failure, Jackson is willing to accept the conclusion that such experiences are experiences of different objective colors, although such colors are pragmatically interrelated by our interest in the normal experiences of humans under standard conditions. Unfortunately, the converse variability is also a problem for Jackson's view: experiences of putatively the same color are often caused by what would seem to be multiple, diverse causes (i.e., one and the same color sensation can be caused by many different kinds of surface properties). To use Mark Johnston's example, both an actual yellow canary and a photograph of that canary will cause us to have a yellow experience, but the physical/causal properties of the feathers and the photographic paper are distinct. Although Jackson does not acknowledge it here, this problem – the diversity of physical causes for a single type of color experience – is, empirically, a very serious problem. Most of the colors that we perceive in the "natural" world are the result of organic compounds (dyes) embedded in the surfaces of objects. But while dyes are the most common cause of our color experiences, they certainly are not the only ones. Indeed, Nassau lists 15 different "causes of color," under five general headings: "Vibrations and Simple Excitations" (e.g., gas excitations such as vapour lamps and lightning); "Transitions Involving Lignand Field Effects" (e.g., transition metal impurities such as ruby and emerald); "Transitions between Molecular Orbitals" (e.g., organic compounds including most dyes); "Transitions Involving Energy Bands" (e.g., metals such as copper, gold and silver); and "Physical and Geometric Optics" (e.g., interference effects such as oil slicks on water) Nassau, 1983). So color experiences are caused by a wide variety of surface properties – and by numerous non-surface properties as well.

Now, the folk theory of color tells us, according to Jackson, that there is single property – "redness" – common to all objects that appear red, and Jackson's view is that redness is *the cause* of objects appearing red. But given the diversity of causes of our red-experiences, it seems that any putative single cause would be at best a disjunctive one. For example, redness is either a dye of kind *x* or a certain mineral (namely ruby) or a certain kind of semiconductor (namely cinnabar) or an incandescence of kind *y* or a certain kind of scattering of light, as in a "red" sunset or . . . and so on for all of the other distinct causes of red experiences. The problem is that such disjunctive causes look like ad hoc constructions – like stop-gap constructions designed to fit an *a priori* theory rather than the stuff of serious science and robust realism. If redness is a single prop-

erty of objects, as our ordinary understanding of color suggests, *which* single, causally respectable, non-dispositional property of the world is it (Tolliver, 1994)?

Jackson's response is to argue that some kinds of disjunctive causes are problematic but others are not. For example, when we say that death can be caused by deep wounds, the cause is disjunctive – it was a wound of 100 mm, or a wound of 100.0001 mm, or a wound of 100.00015 mm, etc. – and speaking of death as caused by deep wounds is a perfectly legitimate causal explanation. On the other hand, we cannot say that the cause of a death was either arsenic administered by Harry or cyanide administered by Mary or strychnine administered by Jonathan or . . . Such a cause, according to Jackson, is "excessively disjunctive": presumably, a diverse set of causal properties brought together into a disjunction in an ad hoc manner so that a commonality is claimed where there is in fact none. In other words, Jackson's claim is that disjunctive causes are acceptable, but only insofar as the disjuncts are unified by some "physically interesting" (i.e., we take it, scientifically respectable) property they all share. (If this explanation of what differentiates a "good" disjunctive cause from a "bad" one seems less than crystalline, the reader is correct. We will come back to this problem of multiple causes later.) It is an open empirical question whether or not the causes of color experiences are disjunctive in any problematic way. In the end, then, for Jackson the objectivity of color stands and falls on his conjecture that some distal property does unify all the things that look red, a property that color vision evolved to detect. If no such property exists, we would have to declare color a pervasive illusion.

B. David Hilbert

According to David Hilbert, color is, quite simply, surface spectral reflectance. On earth, sunlight ranges in wavelength from about 320 nm in the ultraviolet range on out past 800 nm in the infrared range; given the material differences in the surfaces of objects, objects will absorb and reflect these wavelengths in different amounts. One can think of each object as having a certain surface "reflectance profile": the percentage of light reflected for each wavelength in the range of visible light by the object's surface (see Figure 1). For Hilbert, each reflectance profile defines a distinct, objective color. Unfortunately, human color vision is not able to discriminate between each such reflectance profile, to see each profile **as a distinct color**. When we perceive a color difference between two surfaces, normally there will be a difference between them in reflectance; **but when we judge that two surfaces are, say, the very same shade of green, the reflectance profiles of those two surfaces may bear very little similarity one to another** (i.e., their "curves" may bear very little resemblance to either). In human vision, that is, there are color metamers – sets

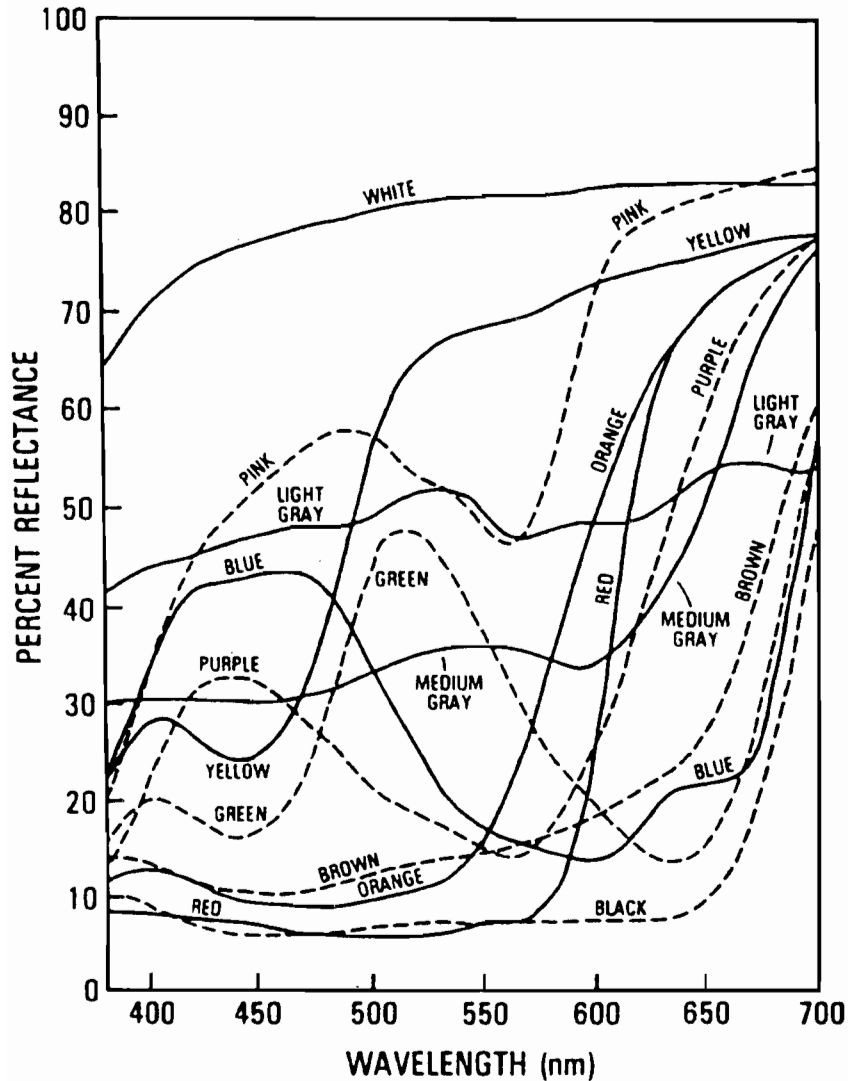


Figure 1. Spectral reflectance curves of ordinary colored construction papers. Percent diffuse reflectance is plotted against wavelength. The names for each color are those given by experimental subjects. (Boynton and Stefurak, 1986)

of distinct spectral reflectance profiles, such that all members of the set have the same appearance to normal human observers under normal lighting conditions. Because there are only three kinds of color receptors, and color is determined (roughly) through a comparison of the excita-

tion of those different kinds of cones, any set of surfaces that excite the receptors in the same ratio of activity will appear to be the same color (under normal lighting). Hilbert's solution to the problem of metamers is to adopt, as he calls it, a form of *anthropocentric realism*. Let each color, such as redness, be identified with a *set* of surface reflectance profiles or a *kind* of surface reflectance. We can define these sets by a mathematical description: a triple of integrated reflectances, scaled to reflect the response curves of each of the three color receptors. For Hilbert, then, color is an objective property of the world (i.e., it is surface spectral reflectance) but we, as human observers, given the limitations of the human color vision, are not able to discriminate (under normal viewing conditions) among all of the actual colors. Like all of our other senses, color vision is rather coarse-grained – what appears to us to be single hue is actually a set of different colors, a set which can be described as a certain triple of integrated reflectances.

What, then, is Hilbert's view of objectivity? For Hilbert, the sole criterion of objectivity – whether for color or for any other property – depends upon their *observer independence*. Hilbert says, “[a]ll that is necessary for the objectivity of a property is that objects have or fail to have that property independently of their interactions with perceiving subjects” (Hilbert, 1987, p. 15), or, more formally, “a property is objective if and only if its possession by an object is independent of the nature or existence of experiences of that property” (Hilbert, 1987, p. 15). But what exactly does this notion of “independence” come to? When assessing color properties for objectivity, Hilbert focuses upon *possible descriptions* of the putatively objective property. A property *p* is objective if and only if it is possible to describe *p* without the use of any terms that refer to our experiences or psychological states (e.g., “hot,” “bright,” “painful”). Thus, if color is an objective property, we must be able to describe that property without referring to the color sensations of human observers. Similarly, in defining individual colors or color categories, we must be able to define, say, the color red without referring to our sensation of redness.

Given that this is the sole criterion of objectivity, *contra* Jackson, Hilbert does not believe that the categories of objective perception must be identifiable with any of the categories of science or with causally efficacious properties in general. The colors (red, green blue, etc.) will be vindicated “as long as the properties corresponding to our color language and our color properties can be analyzed in terms of the scientific vocabulary given us by the physical sciences” (Hilbert, 1987, p. 14). It is not **necessary** to effect an intertheoretic reduction between the folk theory of color and a physical theory of color properties in which the categories of color are identified, one to one, with (causally efficacious) properties of the physical sciences. Hilbert writes:

The categories of perceptual knowledge may differ from those that are scientifically useful without impairing the objectivity of those categories . . . Colors are identical with a certain complex and derivative physical property of the surfaces of objects. This property is both causally irrelevant and anthropomorphic in nature. Nevertheless, it is possible to specify the property 'red', for example, in terms that make no reference to human experience or human nature. It is this fact, the specification without reference to features of human experience, that is essential to objectivity. (Hilbert, 1987, p. 15)

Thus, for Hilbert, spectral reflectance profiles count as objective properties of the world even though such a profile is a dispositional property (a disposition to reflect a certain percentage of light from each wavelength) as are triples of integrated reflectances – and hence both the colors we can discriminate (the triples) and those that exist but which we are unable to discriminate (the individual profiles), are objective properties of the world.

Although perceiver independence is the sole criterion of objectivity for Hilbert, there are, nonetheless, other conditions on the explanatory adequacy of any objectivist theory of color. For one, any objectivist claim must square with the biological facts of color vision, the function of color vision. Hilbert wants to claim that, if color just is spectral reflectance (as he claims it is), then it must be the function of color vision to track a certain perceiver-independent property of the world, namely spectral reflectance (Hilbert 1992, pp. 360ff.) – an empirical claim subject to verification or falsification. Starting with our experience of the colors, then, we must check to see whether our color experiences correlate with or track specific spectral reflectances. If so, the theory is confirmed; if not, the theory is refuted. In other words, it would make no sense for the objectivist to claim that color is property *x*, if indeed, the *function* of color vision were to track or detect some other property, property *z*. It is for this reason that our visual capacity for color constancy plays such a crucial role in Hilbert's arguments for his view. The total amount of light reflected from a surface depends upon both the disposition of the surface to reflect a certain percentage of each wavelength – its spectral reflectance profile – and upon the spectral composition of the source of illumination. A mechanism for color constancy serves to disambiguate the contribution of the *light source* from the contribution of the *surface properties* of the object to the spectral composition of the reflected image. Without such a mechanism, then, color vision would tell us nothing about an object's *surface* per se, only about the spectral composition of the reflected *image*. Were we to lack color constancy, then, it would be extremely implausible to hold that the very function of color vision is to extract information about the surface reflectance profiles of objects.

Another condition on the adequacy of an objectivist theory concerns our folk understanding of color. Whatever color turns out to be, this must conform to – at least to some reasonable extent – what, pre-theoretically, we have taken colors to be. For example, color, whatever property it is, must turn out to be *epistemically accessible*. According to Hilbert, "there would be very little point in defending an objectivist view of color that had as a consequence that we are never able to see the color of things" (1987, p. 17). Color, according to folk theory, is a property of the surfaces of objects – a property that we can determine by visual inspection. For example, when an object is red, normally we are able to see that it is red, to determine that it is red through visual inspection. Thus when we give an analysis of color, we are trying to explain a *visible* property of objects. Suppose, then, that it were *possible* to analyze color in terms of some property that, in fact, we humans could not determine by visual inspection. According to Hilbert, it is unclear what such a theory would be a theory of. It would certainly not be an analysis of the colors that we see, for, by definition, colors would not be properties to which we had any perceptual access.

As we said above, however, Hilbert is not committed to the view that we can discriminate among all colors – that is, he does not propose that we have, as it were, perfect epistemic access to the colors. Every perceptual system has a limited range of operation, and within this range, the system has finite powers of discrimination or resolution. As Hilbert points out, for the perception of primary properties, such as shape and length, these sorts of perceptual limitations are not generally considered a threat to their objectivity. When two lines appear to be of exactly the same length, usually the two lines will be imperceptibly different. There are limits to the spatial resolution of the human visual system – we simply cannot see very small differences in length – but this does not threaten our belief in the objectivity of our perceptions of length nor of length *qua* an objective property of objects. So if, according to some particular theory of color, we are not able to discriminate amongst all colors, this failure does not invalidate the proposed analysis. Insofar as the failures of resolution or indeterminacies of color vision are of exactly the same kind as those involved in our perception of primary properties, says Hilbert, the analysis will be acceptable.

Interestingly, given Hilbert's very different motivations from Jackson's, he finds himself with a similar problem concerning the objectivity of color, and comes to a similar conclusion about what kind of an answer **is consistent** with an objectivist theory of color. Given the existence of **metamers**, one and the same color experience can be caused by a diverse **set of spectral reflectance profiles**: at least *prima facie*, color experiences **have disjunctive sets** of causes. Here, similar to Jackson, Hilbert rules out **the use of what one might call ineliminably disjunctive properties**. If we

could describe metamers only by means of a long, disjunctive set (e.g., "either property *F* or property *G* or property *H*"), then "it would make the sort of indeterminacy involved in color perception look very different from the sort of indeterminacy involved with the perception of the other qualities such as length or shape." (Hilbert, 1992, p. 110). In other words, Hilbert agrees with Jackson that colors could not be "excessively disjunctive" properties, but for a different reason – because the standards of objectivity we impose upon color perception must be no stricter than the standards which our perception of primary properties actually meets.

C. Evan Thompson

Unlike Hilbert and Jackson, Evan Thompson is not an objectivist about color. Indeed, for Thompson, the very objective/subjective distinction is rooted in a false view about the nature of perception, the "representationist" view of perception – what Thompson takes to be the received view of contemporary psychology, of sensory physiology, and of most of the philosophical community involved in the color debate. According to this view, perception involves a certain kind of causal chain – a chain leading from a distal, objective stimulus, to a transduced neurophysiological state of the brain, to further processed neurophysiological states, and finally to a (psychological) sensation that "re-presents" the distal cause to the perceiver. For anyone who begins with this view of perception (and, one has to admit, Jackson's view certainly fits the bill) the question "what is color?" or "what kind of property is color?" will appear to have only two possible answers. Either color should be identified with the distal, observer-independent property which is the *cause* of the color sensations, or color should be identified with the subjective, phenomenal object, the color sensation, the end *effect* of the causal chain. To be an objectivist is to make the first kind of identification; to be a subjectivist is to make the second. The representationist view of perception in general, then, according to Thompson, defines the logical space of views about the nature of color: either color is an objective property "out there," or color is a sensation/psychological property "in the head."

For Thompson, then, as he says in this paper, "vindicating" the objectivity of color would require the identification of color (as well as color shades and categories) with "perceiver-independent," distal causal properties of the environment (Thompson, this volume, p. 162). In his criticism of computational objectivism in *Colour Vision*, however, his view of objectivity is more complex. There, Thompson states "the minimum requirement" for establishing the objectivity of color as follows:

[T]he central problem that objectivism faces is how to link physical or objective colors with the colors what we perceive objects to have, i.e., with particular determinate colors or shades belonging to the hue categories red,

green, yellow, and blue as well as the achromatic categories black and white ... *The minimum requirement for establishing such a link is that the candidate physical properties be distal ones that the visual system can at least approximately track or detect*" (Thompson, 1995, p. 111)

Here, Thompson seems to have several distinct requirements in mind. First, like Hilbert, he agrees that whatever property we identify with color, and whatever properties we identify with "the colors," these must be "physical or objective" properties. Second, these must be properties to which we have epistemic access. Again, if our theory is to be a theory of color *qua* a visual property of objects, we must surely be able to see color (and the colors), at least most of the time. Third, Thompson is expressing the shared view of Hilbert and Jackson, above, about the biological function of color, namely, that if color is to be identified with some objective property, it must be the biological function of color vision to track or detect that very property. As we said above, all agree that it would be difficult (if not impossible) to justify the identification of color with property *x*, if, as a matter of fact, the biological function of color vision were to track some other property, property *y*.

Finally, to the above "minimal requirement," Thompson adds another very strong one. Given that (a) the objectivist is supposed to be giving an account of color as *perceived*, that is, of the human experience of color or of human "phenomenal color space," and given that (b) this phenomenal space is well described using the scalar dimensions of hue, saturation and lightness (see illustration), then (c) whatever distal, perceiver-independent color properties the objectivist wishes to identify with the colors should be "able to provide the descriptive resources for making statements about" these features of our phenomenal color space (Thompson, 1995, pp. 122–123). For example, take one dimension of our color space, namely hue. Hues seem to come in two sets of opponent pairs – red-green and yellow-blue – such that the hues of each pair are mutually exclusive. There are, in our experience, no reddish greens or bluish yellows. Other hue pairings, however, can be combined: more specifically, any given hue can be combined with either hue of the other opponent pair. Thus there are greenish blues, and greenish yellows, for example. Additionally, we make a distinction between hues that are "pure" or unitary (the pure hues of red, green, yellow and blue) and hues that are combined or binary (greenish blues, reddish yellows, etc.) It is just these sorts of facts about hue, claims Thompson, that must be accounted for by the distal properties posited by the objectivist's account. **Thus if an objectivist wants to identify color with, say, surface spectral reflectance, and also identify the color categories red, green, blue, and yellow with sets of surface spectral reflectance profiles, such identifications must provide some explanation of these facts about hue – of our**

phenomenal experiences of the color categories red, green, blue, and yellow and any phenomenal relations among them. More generally, Thompson claims that the objectivist must be able to provide a “structure-preserving” mapping between the objective property space and the phenomenal color space. The structure of the distal causes must mimic the structure of the perceived colors.

What exactly lies behind this strong requirement? Looking at Thompson’s replies to Hilbert (and Mohan Matthen) (Thompson, 1995, pp. 131–132), the requirement seems to have at least three different motivations. First, according to Thompson, it is a part of the intuitive conception of colors that the very structure of our color phenomenology is *objective* – that, say, red, green, blue, and yellow are genuine properties of the world itself, and that, as a matter of objective fact, hues are either “pure” (unitary) or “mixed” (binary). Thus, if there is no explanation of these phenomenal properties in terms of the properties of their causes, the objectivist will have failed to explain some of our central pre-theoretic intuitions about color *qua* objective property of the world. Second, the objectivist will have failed to provide an adequate account of the content of our perceptions. Assume, first, that the content of any perceptual state is given by its distal cause. Now assume that, on some objectivist account, there is no structure-preserving mapping between the phenomenal color space and the objective property space such that the structure of the color categories cannot be mapped onto any structure of the distal causes. The problem here, Thompson claims, is that, pre-theoretically, for objects to be colored, just is for them to have “particular determinate qualities that belong to the hue categories red, green, yellow and blue” (1995, p. 131). Such categorization, Thompson claims, is a fundamental part of *how we see colors*, of the *content* of all color perceptions: when see a red fire engine, we see it *as red*, as being of a specific category. Without the relevant structure-preserving mapping, then, the objectivist is denying a seemingly undeniable fact about color experience. Finally, and centrally, Thompson believes that the correct evolutionary explanation of color vision, and hence the correct explanation of its biological function, will ascribe an adaptive role to the color *categories* – that is, we see colored objects as members of hue categories (red, green, blue, yellow) because such a division has had adaptive advantage. Without a mapping that preserves the structure of the phenomenal color categories, Thompson says, such an evolutionary explanation is not possible. Hence, the objectivist will miss a crucial part of the biological/evolutionary explanation of color vision.

How does Thompson wish to jettison the objective/subjective distinction – that is, what is Thompson’s positive view of color which he sees as neither objectivist nor subjectivist? The biological function of color vision, according to Thompson, is to “integrate a physically heterogeneous collection of distal stimuli into a small set of perceptual equiv-

alence classes” (this volume, pp. 176–177). Color perception, in any species, then does not “re-present” to the subject a certain fixed, distal property of the world (e.g., spectral reflectance). Rather, it serves to *divide up* the chromatic world – to partition chromatic phenomena (spectral reflectances, emittances and transmittances) in a way which has proven advantageous to the species as a whole, over the course of its evolutionary history, given its behavioural/motor repertoire and its particular physical/photopic environment. In Gibsonian terminology, colors serve to “indicate what the environment affords for the animal and what the animal can affect in its environment” (Gibson, 1995, p. 244); they track “affordances” and “effectivities.” Finally, these affordances and effectivities are seen, by the subject, *as* the objective color properties of external objects under a certain sensory mode of presentation. In our case, we see objects of the external world as having a certain color, a color “from” the human phenomenal hue space of red, green, yellow, and blue.

The details of Thompson’s positive view are not particularly clear but *vis-à-vis* the debate over the objectivity of color, one can say the following. Thompson regards his view as non-objectivist (as failing to meet the criteria for objectivity) for the following reasons. First, affordances and effectivities are specified essentially by reference to a species’ needs. Hence if colors, *qua* external properties of the world, just *are* affordances and effectivities, colors are not perceiver-independent properties of the world. Second, although the color categories do supervene upon physical, perceiver-independent properties of the world, these properties are “heterogeneous collection(s) of distal stimuli” – just the sort of excessively disjunctive properties which both Jackson and Hilbert reject. Finally, the “heterogeneous collections of distal stimuli” upon which the colors supervene do not serve to explain or reflect the nature of the colors *qua* phenomenal entities nor the relations between them (e.g., that hues are unitary or binary). So the phenomenal features of color experience – what, according to Thompson, we take to be *objective* features of color experience – are not the result of any objective features of their causes. Of course, in rejecting the very objective/subjective distinction, Thompson does not take himself to a “subjectivist” either. For Thompson, a subjectivist holds that colors are “in the head” – strictly mental items, phenomenological objects or sensations – and, on Thompson’s view, there are no such interior objects.

3. Commonalties and Criticisms

Despite their very different views about the nature of color, there are three broad criteria for the objectivity of color upon which Thompson, Jackson and Hilbert agree. First, all agree that if color is objective,

- (a) Whenever an object appears to have a certain color, say, red, there is some distal property of that object which, normally, causes it to appear red.

In other words, under normal circumstances, when I am not sticking a finger into my eye, or staring fixedly at a bright orange rectangle in an effort to produce a rectangular blue after-image or something of a similar nature, my perceptions of color are perceptions of some distal property – namely, of the distal cause of my color experience. Of course, Jackson holds that dispositional properties are not genuine causes, and in this way imposes a further condition on what colors could possibly be. But this further constraint is not shared by Hilbert or Thompson (or, for that matter, by most “non-Australian” objectivists about color).

Second, there is a common agreement about the kind of causal relation that objectivity requires between our normal color experiences and their causes, namely,

- (B) Color vision must function to maintain a *tracking relation* between color experiences and their distal causes – a one-to-one mapping between the distal cause and the color experience which is its normal effect.

Each of the authors explicitly endorses this criterion, and one can also see this view at play in Jackson’s and Hilbert’s attempts to defend objectivism and Thompson’s attempts to deny it. That is, all three philosophers agree that color would not be an objective property of the world, if either:

- (i) there were a one-to-many relation between the distal causes and the color experiences – that is, if one and the same distal property gave rise to a variety of color experiences;

or

- (ii) there were a many-to-one relation between distal causes and color experiences – that is, many different distal properties caused the same type color experience.

It is because human color vision, as a matter of empirical fact, seems to violate both of these conditions, that Jackson and Hilbert expend considerable effort in trying to defuse the *prima facie* counterexamples, while Thompson fans the flames with additional empirical exceptions. In the first case (i), it is the very peculiarity of color perception with which we began this commentary that provides the *prima facie* evidence that there

is a one-to-many relation between distal causes and color experience: one object, a red shirt, will appear many different colors depending upon the nature of illumination, the distance to the subject, who does the viewing and so on. To counteract these patently embarrassing facts about color vision, Jackson is driven to relativize colors to subjects, circumstances and times, while Hilbert relies upon the existence of color constancy mechanisms as well as on the notion of biological function (i.e., on arguments about what the color system is “trying” to do, even if it is not able to effect that function under all conditions, in all viewers, etc.). Thompson attempts to discredit objectivist views by pointing to the limitations of color constancy, to the effects of surround conditions on color perception (put that red shirt with the “right” suit and, depending upon the plaid, you can make the shirt look just about any color at all), to the role of contrast in color perception, and to the ad hoc nature of selecting any single set of standard conditions.

In the second case (ii), it is the existence of metamers (for Hilbert) and the multiple material causes of color experiences (for Jackson) which seem to disprove the objectivity of color, for both are, *prima facie*, examples of many-to-one relations between causes and color experiences. Here, both Hilbert and Jackson must deny the seemingly disjunctive natures of the causes – Hilbert, by providing a unified mathematical description of the sets of spectral reflectances in terms of a triple of integrated reflectances and Jackson through an attempt to distinguish between legitimate and “excessively” disjunctive causes. Thompson, of course, embraces just such cases of multiple causes. For example, he points out that we see, as colored, not merely the surfaces of objects, but also colored lights, water, glass, and so forth, and cites the comparative literature on color vision to illustrate the diverse functions of color vision in other species. It should be noted, however, that Thompson’s own view of color utilizes a certain notion of *tracking* as well. Human color experiences, *qua* phenomenal modes of presentation, track affordances and effectivities: that is their very purpose, their evolutionary *sine qua non*. Even in other species which have, one presumes, different phenomenal color spaces, the distinctions and categories of each color space serve to track affordances and effectivities, albeit the affordances and effectivities of that particular species. As Thompson says, the purpose of color vision, writ large, is to “integrate a physically heterogeneous collection of distal stimuli into a small set of perceptual equivalence classes.” Still, affordances and effectivities are not “distal causes” in any ordinary sense – at least they do not exist independently of the very subjects who track them. But this leads to the final point of agreement between the three theorists, namely that objectivity requires that:

- (c) **The distal causal property must be *mind-independent*.**

As Hilbert explains it, the distal causes of color must be specifiable in some terms which are independent of the human experiences to which they give rise, at least in principle if not in actual practice. (Jackson's most recent view of mind-independence given in his paper in this volume, pp. 150–160, may not be captured here.) All three theorists rule out dispositions of a certain kind, namely the Lockean "mere" powers of objects to cause, in a subject, a certain color experience. Such powers are *defined* by their casual/phenomenal effects, hence are not mind-independent.

Taken together, then, the three criteria for the objectivity of color amount to the following principle of objectivity:

- (OP) Color is an objective property if and only if whenever an object appears to have a certain color, say, red, there is some distal property of that object which (i) normally causes it to appear red; (ii) is tracked by the appearance of redness; and (iii) is mind-independent.

Although OP is held in one version or another by virtually every contemporary philosopher who theorizes about color² strikes us as deeply suspect. As stated, that is, OP defines a relation of covariation between a distal, mind-independent cause and a "color appearance." Before we proceed any further, let us pause here to introduce several distinctions and the accompanying terminology. In our everyday talk and thought about colors, we are generally concerned with attributing colors to objects. Often we talk about the color objects "appear" to have in contradistinction to the colors they really are. Sometimes when we speak of "color appearances," we are emphasizing the fallibility of our color judgments, how the objects in the world might actually be in spite of how we see them, in spite of how vision presents them as being. For example, in a fit of thriftiness, I (Akins) once bought on sale two pairs of the same shoe, one pair black and one pair dark navy blue. For the next several years, I could be heard to comment daily, sometime around noon, "Well, both shoes certainly *appeared* black (or blue) when I put them this morning." As Austin and Sellars have pointed out, this use of the term "appears" serves to emphasize the falsity of the perception not to draw our attention towards any peculiarity of the visual experience itself. For example, had I actually succeeded in putting on a matched pair of shoes in the morning, my visual experience would have been exactly the same. We will call an appearance in this sense a "color judgment," or more precisely "a color judgment known or suspected to be false" since, as we noted, the folk use do not use "appearance" in the unproblematic, veridical cases.

The term *appearance* is also used in the following common way. Looking out at the green mountain landscape before you, you say "Behold the verdant hills of Provence!" If asked how the mountains *appear*,

however, you would concede that they appear *bluish* – indeed, if you are a sophisticated viewer, you might even say that the hills in the distant background are a paler blue than those in the middle distance. This is the color which, on closer inspection, the mountains *seem* to have and this is so even though you see the mountains as being green (for why else call them "the verdant hills"?). Call appearances in this sense *color appearances*. Once again, in common usage the word appearance is used only when there is a divergence – this time not between reality and the perceived color, but between the way the object appears (whatever, exactly, that comes to) and the color judgment we make. Note that in both folk uses of the term, *appearances* are appearances of *objects* – either the color an object is presented as having in visual experience, or the color which an object seems to have.

In the present philosophical context, however, the situation is made more intractable because of a philosophical thesis rooted in the tradition of the British empiricists. On this view, color appearances are a rather different and (to our way of thinking) an odder beast: the "phenomenal aspect" of our intentional visual perceptions of colored objects. If color appearances are thus phenomenal, they turn out to be subjective facts about visual *experience*, an aspect of the metaphorical "visual field" that the eyes present. Again, return to the verdant hills. While the mountains before you might appear to have an overall bluish tinge (e.g., a color appearance of blueness), the truth about your phenomenal color experience is more complex: the painter who wished to render it on canvas might have to use many different colors, from blacks, through browns, deep blues and greens, to yellows and whites as well. It is also part of this tradition to take phenomenal appearance as that which is directly caused in us by our sensory organs, a sensory given, on the basis of which judgments about the world around us are made.³

OP, it seems to us, can only be read as rooted in this tradition. The objectivity of colors requires, according to OP, a covariation between some distal cause and the color appearance that results. The color appearances, however, are taken to be a certain sensory event, a phenomenal color appearance, which the object causes in us.⁴ The problem here, as Berkeley has shown us, is that OP is not satisfied by what we regard as the paradigmatically objective properties of the objects around us. Consider the objective properties of size and shape. It is not true that a three-foot tall object normally causes a particular phenomenal size appearance or that there is one particular size experience which functions to track three-foot objects. Similarly, square objects need not cause squarish appearances, nor is the function of squarish phenomenal appearances to track square objects. **On the contrary, while size and shape are surely objective properties of the world, radio towers look small in this sense when viewed from a distance and tables almost never produce squarish experiences except on**

those unusual occasions when we occupy a viewpoint directly above them (or, more commonly, under them). Moreover, when a one-to-one correspondence between a phenomenal appearance and its distal cause fails to hold (say, when a round penny appears elliptical), we do not treat such cases as threatening the putative objectivity of those properties. In the case of the shape, for example, there is no temptation to adopt a standard conditions account, such that, say, being square is equated with appearing square under standard conditions. Nor, to follow Jackson's example, is there an attempt to restrict objectivity to round-at-*t*-for-*S*-in-*C* – and then claim that it is only our *pragmatic* interest in pennies under standard conditions that leads us to say that pennies are *really* circular. Similarly, no one proposes that we follow something like Hilbert's methodology for "taming" color metamers. We do not search for subject-independent unified descriptions of the causes of familiar size illusions (such as a version of the Muller-Lyer illusion, where lines of different length appear to be the same) and use these descriptions to define "anthropocentric" but objective length-categories. When, for shape and size, phenomenal appearances and distal causes fail to covary, there is nothing that must be explained or explained away. Such counterexamples do not threaten the objectivity of those properties which, we can all agree, *are* objective. So, the covariation of sensory data or phenomenal experiences with a mind-independent distal cause is not a necessary condition of objectivity.

More pointedly, whatever the correct criterion for objectivity might be, it is not a restriction upon a relation between an appearance (whether one takes appearances to be phenomenal or not) and a property of a distal object. The question of objectivity, for all properties, is the question of whether a certain property of objects, as it is perceived (i.e., visually judged to be), is indeed an objective property. Thus, when you look at the table before you and see, correctly, that it is square, the question of objectivity is whether or not squareness is an objective property of the table. Here, shape appearances are neither here nor there. It does not matter whether you are looking at the table from above or from the side, from a distance of six feet or of 18 feet and hence, what shape appearances present themselves (if any do). By the same token, the question of the objectivity of color ought to be the question of whether the colors of objects, as we perceive them to be, involve the perception of an objective property, a particular color. When you see the mountains in the distance as being green, the question of objectivity ought to be whether the mountains are in fact green, regardless of their bluish or purplish appearance. Just as shape appearances do not figure into the objectivity of the shape of objects, the objectivity of color is not a question about color appearances either. To put this another way, insofar as objectivity, as commonly understood, requires covariation at all, it is a "covariation" of a certain uncontroversial sort – between the properties which our veridical inten-

tional perceptions represent an object as having and the properties which, in fact, those objects exemplify. Again, consider the table before you. When you perceive that the table before you is square, and your perception is veridical, then (surprise) that table *is* square. The very same sort of covariation, one presumes, ought to apply to color, if color is indeed an objective property. When you perceive that the apple before you is red, and your perception is veridical, then the apple *is* red, no matter what the apple's variegated color appearance. In other words, what objectivity demands is the uncontroversial covariation between our color judgments and the properties they ascribe. To put it simply: some of our color judgments must be true.

OP, then, does not give us a necessary condition of objectivity. Nor does it serve to exclude clearly subjective properties either. Take, for example, the property of "itchiness." I take to be itchy all those things in the world which, when they come into contact with my skin, feel itchy. For an object to be itchy, then, is just for it to have some property or properties which are itchy feeling. Moreover, if what makes me itchy is somewhat idiosyncratic, that is neither here nor there. If I find polyester itchy, the fact that you are able to wear tight polyester pants without ill effect, is not a counterexample to my claim about itchiness – nor is your contention that Shetland wool sweaters are the *real* offenders. If something *seems* itchy to *me*, it *is* itchy.⁵ Hence our view of itchiness as a prototypically subjective property of an object, as a Lockean dispositional property. The problem for OP is that, according this definition, itchiness could turn out to be an objective property. Imagine, for example, that exactly one property in the world makes me itchy under normal conditions and that this property is being made of polyester. Polyester, one assumes, can be identified independently of its effects upon my experiences, namely by its molecular structure. So, whenever an object appears itchy, polyester is the property that (a) normally causes it to seem itchy, (b) my feelings of itchiness track the property of being made of polyester, and (c) polyester is mind-independent. But, surely, itchiness is not thereby an objective property (i.e., the property of being made of polyester).

Stated more generally, the point is just this: on the assumption that sensations supervene on physical events, one can always describe in "mind-independent" terms a property which causes a particular sensation, given the knowledge of the requisite underlying physical events – and this is so for all sensations, even the ones which serve as the basis for our attribution of prototypically subjective properties, and for all causes, even those which we are naturally inclined to classify as "disjunctive."⁶ Return again to the example of itchiness. Suppose that you are sensitive to a wide variety of materials, to polyester, woolens, starched fabrics, and so on. It is probably the case that there are some particular receptors in the skin which, under normal conditions, must be activated, in order for

you to feel those properties as itchy. (Here, "normal conditions" excludes the sort of case in which, say, you imagine there is a mosquito settling on your leg and you feel itchy at just that point.) By looking at the receptors themselves, one could describe, in physical terms, what is sufficient to bring about a reaction to the stimuli – for example, the sort of shape an "itchy" molecule must have in order to bind with the requisite "itch-producing" receptor sites, or the sort of mechanical deformation that is required in order to create an electrical potential in an "itchy" receptor. Here, itchiness *qua* sensation need never be mentioned. So what we gain is a mind-independent description of some unified distal property, the objective property of itchiness. As long as we can say what triggers the causal chain which begins at the receptor site and eventuates in the relevant sensation, we can define, in "mind-independent" terms, some "unified" causal property – and thereby satisfy OP. The conditions of OP do not serve to select objective properties at all.

If the above method of meeting OP seems somewhat dodgy (and it *is* dodgy, since it is always available), note that, inadvertently, Hilbert uses just this means to describe metamers/anthropocentric colors. Recall that each anthropocentric color is defined as a triple of integrated reflectances, scaled to mimic the response curves of each of the three color receptors. More plainly, a single anthropocentric color such as red is just that set of spectral reflectance profiles which will cause a particular ratio of activity in each of the three cone types – for example, 1:3:2 for the blue, red, and green cones – the very ratio which will normally produce a red sensation in us (given a colored patch against a white background). Hilbert's descriptions of anthropocentric colors, then, do not advert to any human color experiences, strictly and literally speaking. Rather, they are mathematical descriptions of the neurophysiological events which result in our color sensations, and, according to OP, count as descriptions of mind-independent properties which are tracked by those sensations. Note also that, although Thompson takes himself to have escaped an objectivist view, his commitment to OP ensures that an analogous dodge can be used to make his affordances and effectivities into mind-independent (and thus objective) properties.

OP, then, provides neither necessary nor sufficient conditions for those properties commonly held to be objective. This is one reason, as we said above, that we find OP suspect. A more central reason, however, is that OP conflicts with the one standard of objectivity upon which most folks can agree: the appearance/reality distinction. Objective properties, we standardly think, are those properties which exist independently of our perceptions of them, for which reality transcends mere apprehension. On the one hand, there is some fact about how our intentional perceptual judgments represent the world and on the other, there is some fact of the matter about how the world actually is. Again, take the ex-

ample of squareness. Right now you sit looking at a table, in broad daylight, with your glasses on, at a distance of six feet – a vantage point from which you see the table as being square. But whether or not the table *is* square and whether or not it is visually presented as square are two different matters – neither entails the other. This is so no matter how ideal the conditions of viewing, no matter how reliable the actual perceptual mechanisms, and irrespective of how good the perceptual data upon which such a judgment or perception rests. Thus, if, in an unusual turn of events, you hover above a table, with your glasses on, in broad daylight, such that its top appears "squarishly" to you, or if, from a more normal perspective, you simply "see" that the table is square, it is nonetheless conceivable that the table is not actually square. For a property to be objective, it must always be possible, at least in principle, for our judgments to fail to be true.

Return again to color and OP. If color is objective, then, color properties must also admit of a seems/is distinction. For color, just as for primary properties such as shape and size, the following must hold: there must be a distinction between what color an object appears to have and what color an object actually has; it must be possible for our color judgments to fail, and all our perceptual evidence must be defeasible, at least in principle – and this means that color sensations, *qua* perceptual "evidence," must not give us infallible access to distal color properties. Thus, even if, *per impossible*, we enjoyed an infallible tracking relation between a color sensory experience (whether or not this turns out to be the phenomenal color appearance favoured by OP) and some objective property of the world, objectivity would demand that fallibility still be *possible*. OP, however, seems to preclude this. Assume that OP is satisfied and that color is objective according to this criterion. Because color appearances must track particular distal causes under normal circumstances, OP *guarantees* that color judgments, based upon color sensations, are veridical *some of the time*, namely under normal circumstances. Necessarily, objects that appear red under normal circumstances *are* red. It is difficult to see, then, how OP might be satisfied and yet a seems/is distinction hold for color. If red objects are *of necessity* tracked by red sensations, in what sense is the "evidence" of our color sensations defeasible in principle?

What we hope to have shown is that OP is a very strange criterion for objectivity. In tying color to phenomenal color appearances, OP is neither necessary nor sufficient for objectivity; moreover, it conflicts with the one standard of objectivity which is commonly held, namely the appearance/reality distinction. Why then, is it embraced by objectivists about color?

In fairness, most objectivists themselves see the oddity of OP but **nonetheless** feel that OP, or something like it, is unavoidable. As Jackson puts it, there is "something peculiarly visually conspicuous about the

colors" (Jackson, 1998, p. 89): unlike shape and size, being a certain color seems ineliminably linked to a particular phenomenal appearance, red to red appearances, blue to blue appearances, and so on. After all, if red objects did not appear red, at least most of the time, what exactly would be meant by calling them "red"? Thus, the very notion of color involves, in some way or another, the phenomenal experience of color – and this view, at least on first glance, is a subjectivist intuition. Recall that Jackson names this view the *prime intuition* about color, which he states as follows:

"Red" denotes the property of an object putatively presented in visual experience when an object looks red. (Jackson, 1998, p. 89)

What, then, ought one to do in the face of the prime intuition? One could, for example, accept the prime intuition at face value, decide that it is incompatible with our common conception of objectivity, and therein reluctantly accept the subjectivity of color. Then again, one could stick with the worn path and try to reconcile the prime intuition with some criterion of objectivity similar to OP – objectivity-for-colors, as it were – the route taken by Jackson and Hilbert. Note just how difficult this latter path is, however. Anyone who wishes to vindicate the prime intuition and who also wishes to be an objectivist about color must be able to show first, why there is good reason to believe that the intuition is true – for it is not obvious that the prime intuition *is* true or even that our folk notion of color embodies it, as we will argue below.⁷ More importantly, however, he or she must show us why the prime intuition necessarily leads to something like OP – why, even if it is true that the very notion of a color involves the phenomenal appearance of that color, the criterion for the *objectivity* of color must be formulated in terms of a relation between an external property and a phenomenal color appearance. And finally, the objectivist must explain how we are to understand the new criterion so that it is compatible with our common understanding of objectivity, with the appearance/reality distinction. Even if one could provide good reasons to believe that the prime intuition is true, in other words, and that, therefore, any criterion for the objectivity of color must posit a relation of covariation between distal objective properties and phenomenal appearances, why believe that OP is actually a criterion for objectivity? That is the challenge faced by this sort of objectivist.⁸

New Directions

The route we suggest, however, is a simple one: jettison the prime intuition and with it any special criteria for the objectivity of color, such as OP. Instead, we should treat color as we would any other putatively ob-

jective property by asking whether it conforms to an appearance/reality distinction. As we said above, if color is objective, then we must be able to draw a distinction between our representations of color properties and color properties themselves, a distinction which we must be able to make under all circumstances, even under normal conditions or under those conditions which generally produce veridical perceptions. Second, the appearance/reality distinction must hold between, on the one hand, the properties which objects are represented as having in our fully intentional perceptions of objects – in our *visual judgments* of object color, as Descartes would have it – and whatever color properties are actually exemplified. The distinction, if there is one, must be between color *attributions or judgments* and colors, not between color *appearances* and colors, whether one takes color appearances to be phenomenal or not. This is what it would be to treat colors as objective in the ordinary sense.

Pragmatics aside, there are, we think, good reasons for dispensing with the prime intuition, three of which we will give briefly below. First, despite Jackson's view to the contrary (Jackson, 1998, p. 89), we doubt that the prime intuition is a part of folk color theory. No doubt, if asked, the average person would accept the prime intuition, as stated, as true. But this, we expect, relies upon an ambiguity in Jackson's phrasing, in the term *looks*. What the average person believes is that when you correctly perceive that the object before you is red (i.e., your color judgment that it is red is true), then, normally, the object is red. Moreover, the folk believe that most of our color perceptions are veridical. Folk color theory does not, however, accept the prime intuition in the sense relevant to OP, for it acknowledges that the color of an object may, and often does, part company with its color appearance.⁹ This fact does not, however, conflict with the objectivity of color.

Our folk theory tells us, in other words, that we live in a world of observer-independent objects with various observer-independent properties, and these include not just size, shape, location, weight (or the primary properties in general) but also color (and temperature, sound, even smell and taste). Thus, when you judge an object to be a certain color, you believe that there is some color that it has independently of how the object appears to you now, and quite possibly, independently of how it normally appears to anyone. For example, whether the new Saab you covet is Brushed Silver or Scarab Green is a question about the stable, independent color of a car, a property it either has or lacks regardless of how its color now appears. We no more expect a Saab to look the same color under all viewing conditions than we expect it to appear the same size and shape no matter what the circumstances. Thus, it will look a different color under bright sunlight than it did in the showroom, and, sitting in the shade, it will appear yet another color (indeed, it had better, given the industrial effort behind the technology of multi-layered car

paint). We expect the Saab to be of indeterminate coloring in the dusk and to be invisible in the dark – yet we no more attribute to it an actual loss of color at dusk or in the dark than we attribute a loss of shape or size. And much as we are only slightly surprised when a Saab looks really big parked next to a Morris Mini or small when dwarfed by a semi-trailer, we are only mildly surprised when it looks exceedingly green when sitting beside a red Miata.

The folk also believe that certain conditions may be particularly favourable for discerning the Saab's real color, while other conditions may be particularly adverse – and that which conditions count as which may well be independent of what count as the normal conditions of viewing. For example, if you are just a little bit neurotic about the color of your (possible) car, we suggest you look at the Saab color samples under halogen lighting instead of under incandescent light or sunlight. Because the differences you want to discern are in the blue-green range and both incandescent light and sunlight are slanted towards the yellow-red range, halogen lighting will allow you to perceive the large difference between the spectral reflectance profiles of these two (particular) color samples. Once you see the difference for yourself, you will acknowledge that the samples are of significantly different colors – and by this you mean that the samples are of different colors *tout court*, not different relative to the viewing conditions as Jackson would have it (e.g., Brushed-Silver-under-halogen-lighting-and-green-under-sunlight).

Finally, our folk notion of color acknowledges that there could be colors that, you, a normal color viewer, cannot yourself see or that no one is able to see under normal conditions. It suffices that someone could reliably sort between Brushed Silver and Scarab Green in some special circumstances, for you to readily admit that there is a color difference. Similarly, children are usually fascinated by Buck Roger's Decoder Gum (yes, gum), but they are seldom conceptually confused by it. For those readers without children, Buck Roger's gum comes in a package with a red plastic filter; view the individual gum wrappers through the filter and various profound phrases become visible (e.g., "Hi, stupid!" and "You stink"). Just as children readily understand that the phrases were there all along but for the means to see them, folk psychology holds that color distinctions could exist independently of our abilities to perceive them. Another familiar example of "unseen" colors can be found in various articles for the layman about color vision in bees – that is, in those photographs that purport to show us "How the Bee Sees the World." These are photographs of flowers that use ultraviolet sensitive film, film which reveals the markings on flower petals that guide bees towards the flower's pollen-laden pistil. What the photos are meant to convey is that bees see colors in the ultraviolet range, colored patterns on the flower petals that we cannot see without the help of ultraviolet films. Of course,

it is exceedingly unlikely that *that* is how the bee sees the world (that being a bee is just like being you, looking at a photograph taken with ultraviolet sensitive film), but we can certainly grasp the concept at issue – the idea that bees see colored markings on the petals that we do not.

Folk theory's view of the link between color and its visual appearance, then, is not the simple one of covariation, and, more importantly, we want to claim, this is one point that folk psychology gets exactly right: there is no direct covariation between any sensory "given" and the objective color properties of objects.

It is true, we can readily agree, that color as perceived varies along three dimensions – brightness, hue, and saturation – dimensions that correlate roughly (but not exactly) with the physical properties of a projected light, its intensity, wavelength, and percentage of the dominant wavelength of light. Shine a colored light against a white background, vary it along these three physical dimensions, and one will effect changes in, respectively, its perceived brightness, hue, and saturation. The question at hand, however, is about discerning the color of ordinary objects – and determining the color of objects is an exceedingly complicated representational task: it requires no less interpretation (or computation or "judgment") than does the determination of object shape, size or any other primary property. Consider, first, the chromatic properties of the retinal image that result from viewing a single colored object, an actual Scarab Green Saab. When viewing a three-dimensional object, the chromatic properties of the image are the result of a number of complex interactions: between the three-dimensional shape of the object (e.g., there will be marked intensity differences caused by the shadowing or the irregular shape); the angle and distance to the viewer (e.g., walk around the Saab in an admiring sort of way and its retinal image will be in constant flux, each unique to the eye's viewing angle); the direction, intensity, and spectral make-up of the source of illumination (e.g., there will be a profound chromatic difference in the image of an object depending upon whether the object is in the direct sun or in the shade, whether the object is facing towards or away from source of illumination; how bright the illumination is; whether it is mid-morning or dusk, which affects the spectral make-up of sunlight), plus; the interreflection of light from various nearby objects (e.g., even a dull blue bowl sitting on a plain white tablecloth will have profound effects on the spectral composition of the light reflected from the table cloth, and vice versa). In the actual world, a crowded, three-dimensional world with multiple sources of illumination and an indefinite number of viewing angles, a uniformly painted Scarab Green Saab does not cause a uniformly "painted" Scarab Green retinal image. On the contrary, it produces an indefinite number of spectrally **distinct** retinal images, none of which can be considered canonical or primary or "basic," all of which require complex interpretation in order to

disambiguate the surface color of the viewed object from the various other properties of the visual scene. There is no direct route from the spectral properties of a retinal image to an object's surface color.

The same lesson, one presumes, ought to hold for color appearances if these are taken to be phenomenal. Assume, for the moment, that there are phenomenal color appearances of objects, non-intentional phenomenal states from which, in the ordinary course of vision, the color properties of objects are inferred. Traditionally, at least, such phenomenal states are perceptual givens, states that are produced by the senses without inference or judgment. In the case of color vision, then, phenomenal color appearances must arise (in some sense or other) as a direct result of, without inference from or addition to, the retinal stimuli (i.e., the spectral visual image). But if discerning the color of an object from the retinal image is a sophisticated task of interpretation, then so too must be the task of discerning the color of an object based upon an object's phenomenal appearance. *Chromatic* phenomenal images are no more closely linked to object color than are spectral retinal images.

What we tend to forget from our first-person point of view, then, is that when the visual system finds its way back from the retinal image of the Saab to a fully intentional perception of a uniformly colored dark green Saab, it performs a highly sophisticated computational/ inferential task. We also tend to forget that this is the task of discerning objective color, not the naming of colored lights against a neutral background. Moreover, we do not make color ascriptions by looking inward and discerning the chromatic properties of a phenomenal appearance, nor do we do so by selecting from amongst the myriad "colors" of a Saab appearance the true or real color of the Saab. Ascribing colors to objects could not be such a task given the way the world is. This is our point. Nothing about the optics of the world guarantees that, given a single static view of the green Saab, *any* of part of the retinal image, the corresponding phenomenal appearance, or anything else produced by a simple causal process, will covary with the spectral reflectance profile of Scarab Green paint.

Finally, one last reason to give up the prime intuition is that phenomenal color appearances, as we said above, are rather unnatural beasts. Just as we can learn to discern, with suitable training in perspective, the phenomenal shape appearances of the objects in front of us, we must learn to discern, with suitable training in color, their phenomenal color appearances as well. Look out the window at that green Saab and on first glance, the car will look, well, green. Perhaps if you concentrate hard, with a little "refocusing" of your "inner eye" you will be able to see the surface of the car (non-intentionally construed!) as composed of a multitude of colors, each with a different hue, saturation and brightness. More likely not – for a shiny car is one of the more difficult cases

to "eyeball," given the specular reflectance of the paint. Indeed, one will do better to start by looking at a color photo of a Saab and then, looking at an actual Saab, trying to see "that." We agree, then, with the prime intuition, that there is something like phenomenal color appearance but only in this rather special, "eye squinting" sense – but it is a long way from this admission to the thesis that, in the normal course of visual processing, one can identify (perfectly detailed) phenomenal color appearances which must invariably play an intermediary role between retinal stimulation and our color judgment, the phenomenal basis from which we infer the colors of external objects. Yes, there is a phenomenology of color but, with all due respect to Hume, purely phenomenal states are very difficult – if not impossible – to get a hold of and are unlikely to play a central role in ordinary vision. It might be best, then, as many other philosophers have noted before us, that we not to take up with, or posit, such (unnecessary) unnatural beasts.

The route that we suggest, of jettisoning the prime intuition, relegates color appearances (phenomenal or otherwise) to a small and relatively inconsequential role in the explanation of both color and objectivity. For example, according to this view, objective properties are not differentiated from subjective ones by virtue of a "systematic dependence between the nature of color experience and the nature of what is experienced" (Jackson, this volume, p. 159). Nor is it claimed that, as a matter of empirical fact, there is any correlation between color appearances and color properties, nor that the biological function of color sensations is to track distinct color properties of the external world. Moreover, in the ordinary run of visual events, color appearances are unlikely to play any role at all in whatever visual processes eventuate in our visual judgments of object color. Insofar as such phenomenal states exist at all, they are unlikely to be the sort of uninferred color sense data from which such color judgments are inferred. Finally, it follows from these views that color appearances (again, whether or not one thinks they are phenomenal) are not essential to the notion of color. Take a particular shade of red, say crimson, and it is not essential that crimson objects normally cause in us crimson appearances. These are conclusions, we acknowledge, that many people will find both strange and unpalatable.

On the other hand, this suggestion has considerable theoretical advantages. Adopting the appearance/reality distinction for color brings color into line with the way we think of other objective properties and their "appearances." Two examples might make this point clearer. Take a commonplace case of looking at a table. You see a square table, and make the correct perceptual judgment that it is square. Although the table's phenomenal appearance changes with the angle of viewing, if we care to note it (say, for the purposes of sketching the table), in most familiar circumstances the table will simply look square to you – and you

will not note, in addition to your judgment that it is square, any further appearance it might have. Now let us move to somewhat less familiar circumstances. You see a table on the stage of a theatre. The stage floor is tilted and the objects on it thus look somewhat different – besides, they are stage props and you know about the use of *trompe l'oeil* in such circumstances. The table you see appears as though its front edge is wider than its far edge, but you are no fool and comment to your neighbour: “See how that square table appears a different shape from here!?” But you are wrong. The table before you really has the shape it appears to have – it is a cleverly constructed stage prop designed to give the illusion of a square table but which is really made wider at the edge facing the audience. We note here that the visual appearance more or less agrees with the way the table really is. The nature of the relevant mistake is a mismatch between the perceptual judgment and the real shape of the table.

Colors work the same way. For example, Akins once had the experience of driving through some hilly country in springtime California. Pointing to the green hills in the distance, she commented, philosophically, to the passenger beside her, just how very purple the distant green hills *appeared*. Ten miles further down the road, however, the very same hills, now closer, continued to appear purple – indeed, the closer one got, the more purple the hills seemed. The fact of matter: the hills were covered in bushes laden with purple flowers. Once again, the color appearance of the hills agreed with reality: the hills appeared purple and were purple. But Akins saw the hills as green nonetheless. Just as in the case of shape, the question of whether the hills have a real, objective color is independent of how they appear – the color appearance of the mountains agreed with their real color, after all. If colors are objective, it is the color judgment (consciously or unconsciously made) which needs to be true, at least in some cases – and it is a color judgment which either agrees or disagrees with how the world lies.

Finally, the very peculiarity of color, with which we started this article, is no longer at odds with the objectivity of color. On the view of objectivity that we have been criticizing, OP, the variability of colored objects seemed to gainsay the objectivity of color. To put this another way, the intuition that lies behind OP is that exceptionless covariation constitutes the ideal for objectivity. If color were purely objective, particular color appearances would track, without exception, particular colors. Of course, as color theorists often note, the world in which we live is a rather messy one, and thus not a world that can sustain this ideal. This is why a disclaimer clause, one that makes reference to “normal conditions,” is prudently inserted into OP. Nonetheless, anyone who subscribes to OP believes that the objectivist is charged with a particular task: to show that covariation holds and that all putative exceptions can be discredited; that is, the objectivist must discount metamers, the effects

of colored surrounds, the apparent multiplicity of surface properties that cause a single color sensation, and so on. When a soft celadon sofa looks a bilious lime green against the surround of a red living-room rug, well, that is a problem for the objectivist to solve.

Against the background of an appearance/reality distinction, however, color turns out not to be such a peculiar property after all. Those unruly relations between color appearances and the world around us are no different from the unruly appearances of any other objective property – indeed they constitute one of the conditions of objectivity. Color, to repeat a line from above, is not the sort of property whose appearances provide an infallible guide to its actual distribution in the world. Moreover, if an appearance/reality distinction is to hold for color, this is just what one would expect: it must be possible for, say, a celadon green sofa, viewed by a competent observer in the plain light of day at a distance of 10 feet, to appear a bilious lime green. Variability in color appearance – or rather, the failure of our color judgments – is what objectivity demands and, fortunately, what celadon green sofas and red carpets provide. Thus, with hindsight, we can see the irony of OP. The very cases that OP brands as *prima facie* counterexamples to the objectivity of color – as facts that must be explained away – may well be the instances which serve to ground our folk conception of color as an objective property of the world. We are able to treat colors as objective properties just because, as every child knows, colors like shapes and sizes are not always as they appear to be.

Notes

- 1 This paper was originally intended as a commentary on papers presented by Evan Thompson and Frank Jackson at the 1996 Vancouver Studies in Cognitive Science conference. This version has been expanded to include the work of David Hilbert, who was a late addition to the conference program. The summaries of the three authors' views draw heavily upon their previously published and forthcoming works, in particular upon Jackson (forthcoming), Thompson (1995) and Hilbert (1987, 1992).
- 2 Joseph Tolliver is a notable exception (Tolliver, 1995).
- 3 As is probably already clear, we do not subscribe to the phenomenal view of color appearances. What color appearances turn out to be, how to account for the folk talk about them as well as what ontological status (if any) that color appearances should have are all interesting and unresolved issues. Fortunately, the present paper can proceed without a resolution to these problems – so we shall keep our suspicions concerning them to ourselves.
- 4 Locke's “simple ideas,” Berkeley's “ideas” or “sensible qualities,” and Hume's “impressions” are, among other things, phenomenal appearances in the relevant sense, as are the color sense-data of more recent empiricist philosophers. Still, we do not mean to suggest that our three authors imbue

phenomenal color appearances with all the properties traditional empiricist representationalists give them. Even those contemporary theorists who deny the existence of such metaphysically controversial entities as color qualia nonetheless advert to phenomenal appearances, in one guise or another, in defining color objectivism. The same is true of our three authors. For Thompson, who flatly denies the existence of color qualia, color experiences are our experiences of *hue* from the human phenomenal color space (that is, hues *qua* reds, greens, blues and yellows and their empirically possible combinations). For Hilbert, color experiences are what one might call "the discriminable colors" or those points in human color phenomenal space that are distinguishable, one from another. For Jackson, the phrase "color experience" seems to refer to broad categories of visual experience, such as "redness" (although his stable view here is not entirely clear to us.)

- 5 When we question whether a sweater is *really* itchy, what we are questioning is whether the current circumstances are "normal" (perhaps I am very hot) or whether this sweater would reliably cause me to feel itchy.
- 6 A very similar point is made by Robert Kraut (1992).
- 7 As we understand it, there are at least three reasons why the prime intuition, or something like it, is adopted by most philosophers working on color, reasons that may be held individually or conjointly. First, there are those who hold what we call the Phenomenal Conception of Color. This is an *a priori* metaphysical view about the nature of color. In effect, it takes the prime intuition to express an essential fact about color: how colors phenomenally appear to us plays a constitutive role in their individuation. This view is explicitly espoused by Jackson and presents a constant temptation to almost every philosopher who writes on the topic of color. Second, there are those people who adopt the prime intuition based upon an empirical hypothesis about the biological function of sensations – the empirical thesis that the very function of sensations is to track distal properties of a particular kind. Constant correlation holds because the very purpose of sensations is to provide us with information about specific properties. This is a view which all three authors hold. Finally, in Jackson's contribution to this volume, he presents a third reason to accept the prime intuition: we can see colors only under a phenomenal guise, and hence when we refer to color properties using color terms, we can do so only as, say, that property *p*, whatever it might be, that all red-appearing objects have in common. Call this the Opacity Thesis. Thus, red objects are tied to red appearances in virtue of certain (accidental) facts about the human senses (i.e., we have only one means of detecting and representing the spectral properties of light) and about our practices of linguistic reference. We take all three reasons to be false but will not argue for this conclusion (although for an argument against the view that sensations function to indicate distal properties, see Akins 1996).
- 8 As a testimony to just how difficult this route is, note that in his article in this volume, Frank Jackson has conceded that his theory is an objectivist account "with a subjective aspect."
- 9 To ask whether folk color theory accepts the further thesis that color appearances are phenomenal would be, it seems to us, to attempt to push folk-philosophical anthropology beyond its oft-strained limits. We suspect the folk have little to say on this score.

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