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those who think dispositionalism is true at the actual world – don't think, in general, that the dispositional is evident in this sense. (Langsam 2000 is a counterexample to this generalization; but see Byrne 2001 for criticism.) So dispositionalism too is not true for/in the visual world.

The third possibility is that primitivism is true for/in the visual world. This is in fact an extremely plausible thesis. Even physicalists about color often say things which suggest – in our terms – that primitivism is true at the visual world:

[it] is surely right that, for example, the sensible quality of redness looks to be an intrinsic (non-relational) property of certain surfaces. Phenomenally, the primary and secondary cannot be separated. . . . [T]he secondary qualities appear as lacking in “grain” . . . So much for the way it seems. (Armstrong 1987 in Byrne & Hilbert 1997, pp. 36–37)

If we suppose that primitivism is true at the visual world, we now have our second premise, which is intended to be true on the basis of phenomenology:

P2. If intentionalism is true, primitivism is true in/for the visual world.

If we assume in addition that the truth of primitivism in a world excludes the truth of physicalism in that world (and vice versa), it follows from P1 and P2 that the visual world does not coincide with the actual world. But that is simply to say that the error theory is true.

This argument refutes neither physicalism about color nor intentionalism about color experience, or their conjunction. It is open to physicalists and intentionalists to say that color experience is misleading in various ways (e.g., Thau 2002). But B&H are intentionalists and physicalists who say that color experience is not misleading; indeed, for them, color realism is true for that very reason. In sum, their color realism stands in conflict with their physicalism about color and their intentionalism about color experience.

Authors’ Response

Color realism revisited

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Abstract: Our reply is in four parts. The first part, R1, addresses objections to our claim that there might be “unknowable” color facts. The second part, R2, discusses the use we make of opponent process theory. The third part, R3, examines the question of whether colors are causes. The fourth part, R4, takes up some issues concerning the content of visual experience.

Our target article had three aims: (1) to explain clearly the structure of the debate about color realism; (2) to introduce an interdisciplinary audience to the way philosophers have thought about the issue; (3) to argue that colors are certain sorts of physical properties (“productances”).

We are very grateful to the commentators in this continuing commentary for their criticism and constructive suggestions.

R1. Ordinary intuitions and unknowable color facts

As Dennett notes, the target article emphasizes that the problem of color realism is not about color words, or the folk category of color. As we conceive it, the problem concerns certain properties that are represented by the human visual system and those of a variety of other animals. However, Dennett thinks that our methodology does not fit happily with the touted “scientific” nature of the problem: We place too much weight, he claims, on “ordinary intuitions about color.”

But, in fact, we do not place any weight on ordinary intuitions about color. (Dennett himself seems to think that ordinary intuitions should be accorded some weight: An account of color should be “largely consonant with everyday usage.” We disagree.) Dennett’s one example of our alleged reliance on ordinary intuitions is our rejection of the idea that there are different kinds of colors: surface, volume, and illuminant (see sect. 3.1.2 of the target article). Although the ordinary person might well find this idea odd – tomatoes, glasses of Burgundy, and stoplights are all red! – this was not our reason for rejecting it. Rather, our objection was that surfaces, volumes, and illuminants can all look the same in respect of color – a fact which might be revealed by training an animal to press a bar in the presence of a type of light, and then noting that the animal generalizes the rule to certain surfaces and volumes. This fact is best explained, we said, by supposing that there is a common property visually represented. Whether or not we are right about this, the argument certainly does not make any appeal to ordinary intuitions.

Dennett suggests that our claim that it may be unknowable whether a chip is unique green is “counterintuitive.” He might mean by this that ordinary intuition rules out such a possibility (thus implicitly accusing us of arbitrarily picking and choosing between intuitions), but we doubt it, because surely ordinary intuition has no clear opinion on the matter. In any case, whether or not Dennett himself is resting any weight on ordinary intuition here, he offers another consideration entirely. Dennett claims that the conclusion that there are no unknowable color facts follows from the “coevolutionary coordination of color vision and reflectance properties,” and obviously this argument does not appeal to everyday usage or the opinions of the folk.

Dennett does not spell out his argument in any detail; still, it is instructive to set out an argument that is naturally suggested by his remarks. (We emphasize that we are not attributing this argument to Dennett. See also Dennett 1991, pp. 375–83, which we lack space to discuss.) (1) Evolution fine-tuned the colors of certain fruits so they were readily visible to certain fruit eaters, and evolution also fine-tuned the fruit eaters’ color vision (in particular, the spectral sensitivities of their cone pigments) to detect the colors of the fruits (see Regan et al. 2001). Hence: (2) in normal conditions the fruit eaters will correctly perceive the colors of fruits. Hence: (3) in normal conditions the fruit eaters will correctly perceive the colors of things generally. Hence: (4) our claim that most people misperceive unique green chips in normal conditions is incorrect.

There are three main problems with this argument, apart from the fact that the coevolution hypothesis is not an established fact. First, and perhaps most seriously, on any remotely defensible elaboration of (1), it does not imply (2). The most (1) could imply is that the fruit eaters are by and large correct: any evolutionary fine-tuning of fruits and cone pigments would leave plenty of room for minor misperceptions of determinate shades, and minor variations between individuals (see sect. R2.6 of our Response to the
first round of commentaries, Byrne & Hilbert 2003). Sec-
ond, (2) does not imply (3). A system specialized for infallible
detection of the colors of ripe fruits might well make
mistakes with other colors. (In this connection, it is worth
pointing out that the coevolution hypothesis just concerns
the red-green opponent system, not the yellow-blue sys-
tem.) Third, (3) does not imply (4). The main empirical evi-
dence for coevolution concerns certain species of Old
World monkeys, not humans. Granting for the sake of the
argument that some remote trichromatic ancestor of hu-
mans never misperceived colors in normal conditions, it by
no means follows that humans have retained this capacity.

Rosser offers a “pragmatic account of veridical color”
which, he claims, has the “advantage” of avoiding “un-
knowable color facts.” As explained in our first Response,
we think this is no advantage at all. But, in any case, we do
not think Rosser’s account is of the right sort. Rosser holds that
“an object’s veridical color is relative to favored conditions
of perceptual access” – these favored conditions being a
matter of our interests and purposes (Ross 2000). This form
of relativism is inconsistent, however, with our commitment
to intentionalism (see sect. R4 below). To apply his theory
to visual experience, Rosser needs to assume that the pheno-
menal character of color experiences is independent of
their content. Without such an assumption his theory, if it
can be applied at all, results either in the conclusion that the
apparent colors of things vary with the choice of pragmatic
standards, or that we never see the true color of anything.
Rosser’s pragmatic physicalism may be adequate as an
account of some parts of color language, but it is inadequate
as an account of what we see.

R2. Opposition-process theory

In his interesting commentary, Broackes raises a number of
issues concerning opponent-process theory and its rela-
tion to our thesis that colors are represented in visual expe-
rience as proportions of hue magnitudes (sect. 3.2 of
the target article). He points out – as did the previous com-
mentators Kuehni, Jakab & McLauglin, and Pautz in BBS
26(1), 2003 – that the very simple physiological model we
use for illustration is empirically inadequate. As Broackes
recognizes, however, we do not endorse this model; our dis-
cussion of it was merely intended to show how the hue
magnitudes might be given a rough-and-ready characteri-
zation in physical terms.

Broackes thinks that our theory presupposes some ver-
sion of opponent-process theory. In particular, he thinks that we “claim a precise parallelism between the structure
of phenomenal color space and that of the physiological
processes underlying it.” There are two questions here. (1)
Does our theory require the kind of straightforward map-
ning that Broackes describes? (2) Is there reason to doubt
the existence of such mappings? Broackes rightly holds that
the answer to the second question is “yes.” There seems to
be no evidence at present for the existence of distinct pop-
ulations of cortical neurons with the characteristics re-
quired to support the various psychophysically identified
color processes. In particular, there are no identified pop-
ulations of cortical neurons that have the tuning required by
a simple implementation of the psychophysically deter-
mimed chromatic response curves (Lennie 1999).

So everything hangs on the first question, and fortunately
for us this has a negative answer. Broackes may have been
misled by the details of the last paragraph of sect. 3.2 of
the target article. We chose to give an approximate specifica-
tion of the magnitudes in terms of physiology, partly to
make vivid the compatibility between our theory and the
physiology, not because we require the connection to be
made at this level. Our claim that colors are represented as
proportions of hue magnitudes is simply a claim about the
content of color experience, not about physiology.

R3. Color and causation

It has seemed obvious to many philosophers that color per-
ception involves some sort of causal transaction between
the colors and our visual systems. We agree – otherwise it
is difficult to explain how visual systems could recover color
information. (This widely held causal claim, according to us,
is simply a plausible empirical assumption, not a conceptual
truth about perception.) Botterell argues that this as-
sumption is inconsistent with our view that the perceivable
colors are to be identified with reflectance-types rather
than determinate reflectances. According to Botterell, it is
the determinate reflectances that are causally efficacious,
not the perceivable colors themselves.

We have two points to make about Botterell’s argument.
First, we often do in practice give causal explanations that
appeal to determinables rather than determinates, even
though the determinates are individually sufficient for the
effect. Why did the bridge collapse? Because a truck weigh-
ning more than 10 tons was driven across it. This explanation
appeals to a determinable, weighing more than 10 tons,
rather than to its determinates, like weighing 10.13 tons.
According to Botterell, this “explanation” must be understood
as gesturing towards the genuine explanation that appeals
to the precise weight of the truck. But – and this is our sec-
ond point – Botterell’s insistence that only the determinate
property is causally efficacious is not well motivated. What
matters is that the weight of the truck was too large, not
which determinate weight the truck possessed (Yablo 1992).
Any weight greater than 10 tons would have pro-
duced the same effect. Similarly, in the case of color, it is
the type which is causally relevant to the visual effect rather
than the determinate reflectance (Jackson 1996; Jackson &
Pargetter 1987; Smart 1975).

R4. The content of visual experience

In the target article we used the philosophical apparatus of
propositions to elaborate on the fact that color experiences
are either accurate or inaccurate, depending on whether ob-
jects have the colors they visually appear to have. For ex-
ample, it might visually appear to someone that there is an
orange sphere on top of a blue cube. The subject’s experi-
ence represents that there is an orange sphere on top of a
blue cube, and this representation can be assessed for truth
or falsity. In other words, the experience has propositional
content – namely, the proposition that there is an orange
sphere on top of a blue cube.

Skokowski challenges our claim that color experiences
have propositional content, on the ground that nonlinguis-
tic animals have color experiences but not experiences with
propositional content. But we see no reason to accept
Skokowski’s unargued assumption that possession of a lan-
guage is a necessary condition for undergoing experiences with propositional content, or for being in mental states with propositional content. (As we read Tye & Dretske – whom Skokowski cites as fellow-travellers – they do not accept this assumption either [Dretske 1995, pp. 25–27; Tye 2000].)

Skokowski’s positive view is that the color properties, not propositions, will serve as the contents of color experiences: “when I experience the yellow of the lemon, I experience the physical property yellow (reflectance).” But what is the content of the experience described two paragraphs back? According to us, it is the proposition that there is an orange sphere on top of a blue cube; according to Skokowski (apparently) the content is a set of properties and relations: {the property orange, the property blue, the property of being a sphere, …}. If that is right, then Skokowski cannot distinguish the experience of an orange sphere on top of blue cube from the experience of a blue sphere on top of an orange cube: both experiences have the same Skokowski-content. And since the experiences evidently do differ representationally, Skokowski’s alternative account of content is inadequate.

Stoljar agrees with us that experiences have propositional content, and uses this fact as part of his ingenious argument that we have an unstable position. We endorse physicalism, intentionalism (or representationalism: see sect. 3.5 of the target article), and deny, as Stoljar puts it, “that color experience is systematically illusory.” Stoljar argues that these first two claims imply that color experience is systematically illusory.

Intentionalism is the thesis that the phenomenology of color experience cannot vary independently of its content: If two experiences are alike in their representational content, they are alike in their phenomenology. Thus, according to the intentionalist, if you and I are “spectrally inverted” with respect to each other, the representational contents of our experiences must differ; according to the anti-intentionalist (notably Block 1990) this is not so. Although intentionalism was to a large extent left on the sidelines in the target article, it is in our view an important component of our overall theory, not least because many erroneous accounts of color are motivated by anti-intentionalism (see our discussion of Ross in section R1 above).

The crucial step of Stoljar’s argument is from intentionalism to the claim that color experience purports to inform us that colors are sui generis properties (a fortiori not reflectances or productances). Granted this step, the rest of the argument goes through: If intentionalism is true, then color experience represents that physicalism is false; hence, if intentionalism and physicalism are true, then “color experience is systematically illusory.”

How troubling is this conclusion? Perhaps not very, a fact that is slightly obscured by Stoljar’s use of the expression “error theory” to characterize the conclusion. The error theory is usually taken to be the view that objects do not have the colors that they appear to have (see sect. 2.1 of the target article). But on this way of speaking, the error theory is not the conclusion of the argument: the “error” is that physicalism is false, not that lemons are yellow. We could live with the view that experience misleads us as to the true nature of color.

In any event, we question the crucial step: We don’t see how intentionalism supports the view that color experience represents that the colors are sui generis, and so, that physicalism is false. In order for experience to represent this, it would have to represent the color properties themselves as having properties (in particular the property of being un-analysable or sui generis), and we don’t think experience has this sort of content: lemons look yellow, but yellowness does not look any way at all (Byrne 2003).

There is a distinction between not representing F and representing not-F, which Armstrong illustrates by the “headless woman illusion” (Armstrong 1968; 1987). (The “headless woman” merely does not look to have a head, as opposed to looking to have no head.) The important question Stoljar raises is whether experience tells us that physicalism is false, as opposed to not telling us that it is true (Hilbert 1987, p. 37). Color experience, we think, is in this respect like the headless woman illusion.

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[Note: The letter ‘r’ before author’s initials stand for CC Response Article references.]

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