Box 5.4 *continued*

beliefs and/or desires. Phenomenal states lie at the interface of the nonconceptual and conceptual domains. It follows that systems that altogether lack the capacity for beliefs and desires cannot undergo phenomenally conscious states. For systems that have such a capacity, the sensory or phenomenal states differ from the beliefs in their functional role, their intentional contents, and their internal structure. This approach solves the problem of super blindsight.

5.3 Colors and Other "Secondary Qualities"

On the face of it, colors and other "secondary qualities" (smells, tastes, and sounds, for example) pose a special difficulty for the theory I have been developing. If these qualities are subjective, or defined in part by their phenomenal character, then what it is like to undergo the experiences of such qualities cannot itself be understood in terms of the experiences' representing them. That would create an immediate vicious circle.

Consider, for example, the view of color inspired by John Locke. On the Lockean approach, as it is usually understood, the claim that something, X, is red is analyzed as saying that X is disposed to look red to normal perceivers in standard conditions. This approach has several virtues. Nonetheless, there is an obvious difficulty. 'Red' appears in the analysis as well as in the claim to be analyzed. So there appears to be a simple circle.

One response to this charge is to maintain that, once the Lockean thesis is properly elucidated, the circle is not vicious. There is something it is like to experience red, just as there is something it is like to taste a lemon or to smell a skunk. We all know what these experiences are like from introspective awareness. Each experience has a distinctive, introspectively accessible phenomenal character (or, better, a range of such characters). Let us label the relevant character 'P_k' in the case of the experience of hue, red_k. The Lockean position can now be stated in the following a priori definition:

For any k, X is red_k if and only if X is disposed to produce experiences having P_k in normal perceivers in standard circumstances.

This is an improvement. However, on the PANIC theory, P_k itself involves the representation of red_k. There is certainly still a damaging circle. Something has to go: either the phenomenal character of color experiences is not to be understood in the way I am proposing or partly subjectivist approaches to color must be rejected. Not surprisingly, I favor the latter alternative.

What, then, are colors, smells, sounds, tastes, and the like? Here is not the place to attempt to articulate a full-blown theory of these qualities. Nonetheless, I would like to make some general remarks about the lines I favor, beginning with the case of color.

The obvious view, suggested by our color experiences (and compatible with my position), is that the colors we see objects and surfaces to have are simply intrinsic, observer-independent properties of those objects and surfaces. We think of colors as inhering in the surfaces of the objects and sometimes throughout the objects (as, for example, in the case of a red crayon). We also think of objects as retaining their colors when they are not seen, thereby helping us to re-identify the objects.

Certainly, we do not experience colors as perceiver-relative. When, for example, a ripe tomato looks red to me, I experience redness all over the facing surface of the tomato. Each perceptible part of the surface looks red to me. None of these parts, in looking red, look to me to have a perceiver-relative property. I do not experience any part of the surface as producing a certain sort of response in me or anyone else. On the contrary, I surely experience redness as intrinsic to the surface, just as I experience the shape of the surface as intrinsic to it. This simple fact is one that Lockean approaches to color cannot accomodate without supposing there is a basic illusion involved in normal experiences of color, that colors are really (response-dependent) relational properties even though we experience them as nonrelational. That, it seems to me, is just not credible.

There are other reasons to adopt a perceiver-independent view of object colors. Consider some facts about the human visual system. The cones in the retina respond to the wavelength of the light. Nonetheless, we do not see the color of the light striking our eyes. Our experiences of color are typically indicative of the real colors of object surfaces away from us. Moreover, even when the light reflected from surfaces is exactly the same, we retain the ability to tell that surfaces differ in color, according to some color scientists (see the experiments described in Land and McCann [1971]).[8]

In general, colors are not as variable as many philosophers have supposed. The colors of objects typically do not change when they are moved from outdoors to a setting illuminated by incandescent lamps, for example. And wearing sunglasses has little effect on the colors objects appear to have (Hilbert 1987). Why should this be?

Surely, the most straightforward answer is that the human visual system has, as one of its functions, to detect the real, objective colors of surfaces. Somehow, the visual system manages to ascertain what colors objects really have, even though the only information immediately available to it concerns light wavelengths. It does this initially, according to the theory developed by Land (1977), by identifying brightness gradients on the retina. Where there are sudden changes in brightness, the visual system assumes that there are changes in surface color. Where there are gradual changes, the illumination conditions are taken to have changed. These assumptions are wired into our visual systems, and they provide the link with surface color. Once each tiny surface patch that is visible in the scene is assigned a color gradient, absolute colors are then computed by a further process.

The parallels here between color and shape should be obvious to anyone familiar with Marr's theory of shape recognition (Marr 1982). In each case, the visual system solves a complicated computational problem and delivers a representation of a distal property on the basis of information about proximal stimuli. But if surface color is an objective property like shape, just which property is it?

There are three sorts of cone cells on the retina. They respond to light of three bands of wavelengths: short, medium, and long. The color of the light incident on the eye is a function of the color of the object surface and the color of the light striking it. It is natural, then, to suppose that the color of a surface is an ordered triple of the *reflectances* of the surface with respect to light in these three wavelength bands (Matthen 1988; Hilbert 1987), where the reflectance of a surface at a given wavelength is its disposition to reflect a certain percentage of the light at that wavelength.[9] On this view, our visual systems are designed to detect certain ranges of spectral reflectances, just as they are designed to identify certain ranges of shapes.

There are two main objections to an objectivist theory of color. First, it is claimed that there are no properties of the surfaces of colored objects with which colors may reasonably be identified. Spectral reflectances, it has been suggested, can vary without any variation in the perceived color of objects. Second, it is argued that there are many facts about the relations between colors, whose explanation seems to require reference to facts about perceivers.

Neither of these objections seem to me very damaging to the objectivist approach. The well-known fact that spectral reflectances can change without any change in perceived color, in and of itself, does not directly show anything very significant. For one thing, the relevant triples of reflectances involve wavebands. There is plenty of room for differences of wavelengths within these bands from object to object without any change in real color. For another, the shape of an object can vary without any variation in perceived shape. All that entitles us to infer is that perceived shape is not always the same as real shape. Similarly, sometimes object surfaces do not actually have the reflectance triples our experiences represent them as having. So what?

There is a further point worth making here. The expression 'the color of an object' is vague. A single object can be red, vermilion, a highly saturated vermilion, $vermilion_{23}$, and so on. This fact is captured nicely by the view of colors as triples of spectral reflectances. The more determinate the color is, the narrower the pertinent wavebands.

Still, it might be argued, there are serious difficulties lurking in the background. Metamers are stimuli that have different spectral reflectance distributions but are exactly the same in their experienced color. In some cases, metamers can have very different spectral reflectance distributions and yet look exactly alike, even when viewed in normal circumstances by normal perceivers. This fact refutes the claim that the color of a surface is one and the same as its reflectance at all wavelengths of all light to which humans are sensitive. But it can be accommodated by the view that colors are triples of reflectances, because this allows wide variations of reflectances at many wavelengths. And metamers have the same, or very similar, surface reflectances within the three pertinent wavebands.

There are also cases of color that seem to have nothing to do with reflectance. Intuitively, the summer sky is blue. But supposedly it is not blue in virtue of reflectance (Campbell 1969). One way to deal with this case is to say that we are deluded when we look at the sky, that we *mis*perceive it as blue. A better response is to say that the sky has numerous particles of dust and moisture in it and that the reflectance properties of these particles is responsible for the blueness of the sky.

Consider next the claim that there are facts about the relations between colors that undercut objectivist theories. Let me mention the two most commonly cited of these "facts." First, there is the fact that the hues form a circle, even though the light frequencies do not (Teller 1991). Second, there is the distinction between the four primary or unitary colors, red, green, blue, and yellow, and the secondary or binary ones (Hardin 1993). Orange, for example, *is* reddish-yellow. Red, however, is *not* orangish-purple. What explains these facts? Nothing in the account of colors as ordered triples of spectral reflectances explains the binary-unitary distinction and why red is a unitary color whereas orange is a binary one. Here, it is sometimes suggested, is another reason for rejecting objectivism about color.

The fact that the hues form a circle is easy to explain on the proposed view. Think of color space as a three-dimensional space, with each dimension corresponding to the surface reflectances at one of the three wavelength bands. Then think of the relevant triples of reflectances as coordinates in this space. The hues may now be seen to mark out a closed circular loop in color space.

As for the binary-unitary distinction, it can be preserved as a basic truth about color mixing. Orange, for example, is the color you get when you mix red and yellow pigments; but red is not the color that results when you mix purple and yellow pigments. These facts are arguably facts we have learned from training, not facts given to us in our color experiences and extractable from them without any basic lessons or art classes on the various colors and their relationships. So in one sense, orange is reddish-yellow, a sense that is comparable to that in which a mule is an equine ass. In each case, you get the one by mixing the others (though the sorts of mixing are obviously different).

This approach to colors extends naturally to the other "secondary qualities." Consider smells, for example. Smells seem patently objective. They have locatable origins; they move through space. Indeed, they spread out and fill volumes of space. The receptors for the olfactory system are now thought to be of a sizeable number of different types, perhaps as many as twenty or thirty.[10] Molecules of odorants come into contact with these receptors and stimulate them. The mechanism by which odorous molecules stimulate receptor cells is a matter of dispute. According to some theories, molecular shape is the primary factor.[11] According to others, the vibratory motion of molecules is also important. With little agreement about the exact nature of olfactory transduction, any definite proposal about the nature of smells would be highly speculative. But the form of such a suggestion would not: the smells humans can discriminate should be identified with ordered *n*-tuples (where *n* is between twenty and thirty) of the relevant external property of the odorous molecules (the counterpart for smell to spectral reflectance).

In the case of taste, there are four basic kinds of receptor cells, corresponding to the four primary taste qualities (sweet, salty, bitter, and sour). The taste receptors are not restricted to the tongue, as is often supposed. They are also to be found elsewhere in the mouth, for example, on its roof. This is why patients who have been fitted with a full denture plate that covers the whole roof of the mouth frequently complain of diminished taste.

Each of the four types of taste receptor in humans is sensitive to the action of a certain sort (or range of sorts) of molecules. For example, the sour receptor seems to respond primarily to hydrogen ion concentration. The overall taste of an item has an effect, to varying degrees, on each of the receptors and may plausibly be identified with an ordered quadruple of molecular characteristics. Exactly which characteristics are pertinent to tastes is still a matter of dispute.

Sounds, like smells, have objective locations, and they travel through space. The receptor cells, in this case, are hair cells located within a coiled bony structure, known as the cochlea, inside the ear. There are two sorts of hair cells, inner and outer. Sensations of pitch and loudness seem tied to the frequency and intensity of sound, but the connection is complex.

For example, at a given sound pressure, the loudness of a sound can be altered markedly by altering only frequency, even though loudness also varies most notably with variations in pressure. The hair cells respond to these physical features of sound waves, and (in first approximation) the sounds humans discriminate depend on the number and type of cell responding. So it seems plausible to suppose that an objectivist treatment can be developed for sounds, broadly similar to those for colors, smells, and tastes (even though the details may well be very complicated).

I hope that I have now said enough to indicate how, in my view, the so-called secondary qualities are best handled. I want next to consider the dependence of phenomenal character on brain processes.

Box 5.5

Summary

Colors are objective, physical features of objects and surfaces. Our visual systems have evolved to detect a range of these features, but those to which we are sensitive are indirecty dependent on facts about us. In particular, there are three types of receptor in the retina, each of which responds to a particular waveband of light, and the spectral reflectances of surfaces at these wavebands (that is, their disposition to reflect a certain percentage of the incident light within each of the three bands) together determine the colors we see. So the colors themselves may be identified with ordered triples of spectral reflectances. An account of the same general sort may be given for smells, tastes, sounds, and so on.

5.4 Can Duplicate Brains Differ Phenomenally?

Over 95 percent of amputees who have an arm or leg removed report phantom limbs. The limbs feel to the amputees very like their real limbs. They say that they can move them in a normal way and that they have the same size and shape as before. For example, a patient with a phantom hand may try to reach for objects with it just as he would with a real hand. Through time, the phantom limbs become smaller and often fade away altogether (Melzak 1990).

Interestingly, children who are born without a limb or part of one often feel vivid phantoms. One child reported feeling the palm and middle finger of a phantom hand; another the upper calf and two toes of a phantom leg (Weinstein 1964; Poeck 1964). So it is not necessary to have had a real limb in order to feel a phantom one.

In general, phantom limbs seem intensely real to their subjects, at least initially. Why should this be? One obvious answer is that the experience of a phantom limb is the same as the experience of a real limb because the underlying brain process in the two cases is the same. This leads to the philosophical thought that *necessarily* same brain processes, same phenomenal experiences.

The thought is not obviously correct, however. Consider again the case of the children who are born without certain limbs but who nonetheless feel phantoms. Granted they undergo similar brain processes to those other, fully endowed humans undergo with respect to the corresponding real limbs; still, it does not follow from this that any creature whatsoever, regardless of its setting or evolutionary history, would *have* to feel what the children feel if it were subject to the same brain processes. For there is no guarantee that those brain processes, wherever they occur, must represent the same limbs, any more than there is a guarantee that the sign design 'tumbler' must always mean acrobat (or anything at all, for that matter). And representational content, I claim, is at the heart of phenomenal feel.

The lesson of the problem of transparency is that *phenomenology ain't in the head*. Just as you cannot read semantics out of syntax, so you cannot read phenomenology out of physiology. This is why you cannot find any technicolor qualia, any raw feels, by peering around inside the brain (with or without a flashlight). They simply are not in there. To discover what it's like, you need to look outside the head to what the brain states represent. Phenomenology is, in this way, externally based. So systems that are internally physically identical do not *have* to be phenomenally identical.

Still, it cannot be denied that many philosophers accept the thesis that the internal microphysical facts *metaphysically* fix the phenomenal facts, that brains identical in all microphysical respects *must* support phenome-