

Colour

In this essay I will present the view that there exists a real distinction between properties such as colour, sound and temperature – as we perceive them – and properties such as shape, size and motion. I will also present the view that properties of the former class type may be reduced to properties of the second class type. In order to do this I will be focussing upon the properties of colour and shape. In section one I will set out the distinction between the two types of properties or qualities. In section two I will examine the ontological implication of such a distinction. My third section presents a more detailed theory of colour – the physicalist theory – and introduces the notion of reducing secondary qualities – such as colour – to primary qualities – such as shape. In section four I examine some difficulties facing this doctrine before discarding these criticisms and the attempted reformulations of the physicalist theory and returning to accept the original theory in my final section.

1. Locke's Distinction – Primary and Secondary Qualities

Locke presents the theory that the qualities we perceive objects to have can be divided into two distinct categories. The 'primary qualities' are "solidity, figure, motion or rest and number"¹. 'Secondary qualities are colour, temperature, smell, taste and sound. Locke argued that the distinction between these two sets of qualities is clear and well founded. Primary qualities are presented as "utterly inseparable from the body, in what state soever it be... and such as sense constantly finds in every particle of matter which has bulk enough to be perceived." Indeed, Locke maintained that having the aforementioned qualities is a necessary condition for anything to be counted as a 'body' – or a material thing

Material things interact with each other in a causal manner. Therefore, material things have certain powers – that is, the power to "affect or be

¹ Locke, *Essay on Human Understanding*

affected by another thing of a certain sort in some specific manner.”² Powers do not cause effects – effects are caused by the properties of the material things that interact. For a material thing to have a certain power is for it to have the capacity or the potential to cause an effect in certain conditions.

Some of the most philosophically interesting material things that exist are our sense organs. The way material objects interact with these cause us to have certain sensations and perceptions. That is, material objects have the power to cause certain sensations and perception in us. These powers, like any others, are grounded in the properties of the objects we interact with. Our sensations and perceptions have some ‘experiential content’. That is, we may perceive (for example) coloured shapes, sounds, smells or pressure. We may have sensations of pain or heat. We do not normally talk about this complex experiential content. Rather, we talk of the objects that cause our perceptions and sensations. Thus, the experiential effects of the objects of perceptions are commonly taken to reveal certain properties of the objects – and these properties are taken to accurately correlate to the perceptions and sensations they cause in us. Thus, we take the physical world to be composed of objects with both primary and secondary qualities. The non-philosopher unquestioningly assumes that the physical world is made up of objects of certain numbers, shapes, motions, textures, colours, smells, tastes, etc – just as we perceive it to be. Thus, if I have the perception of an orange sphere in my visual plane (whilst I am awake, with my eyes open and in daylight) I am naturally inclined to believe there to be a physical object in front of me and to ascribe this object with the properties of being both spherical and orange.

However, as we have seen, Locke wished to divide these properties into different categories. The primary qualities are those which are properties of the physical world. The secondary qualities are defined as “nothing in the objects themselves, but [except] powers to produce various sensations in us by their primary qualities, i.e. by the bulk figure, texture, and motion of their insensible parts.” Whilst the focus of almost all philosophical inquiry into this

² Mackie, *Problems from Locke*

matter is of the effects the qualities in question have upon our perception of them, the physicalist position I shall be adopting in this essay demands that we treat the effects objects have on our perception as just one particular case of the physical interactions between physical objects. The changes in perception are the result of the interactions between physical objects – in this case a given object and our sense organs. Locke himself allows for this by asserting that secondary qualities are both the powers to produce ideas of colours and suchlike in us, but also the powers to produce changes in other bodies – for example the power of the sun to melt an ice cream. For the physicalist the assertion that secondary qualities are powers to cause changes in physical objects generally is a given – though, as I shall later point out, even the physicalist philosophers are prone to overlooking this fact.

2. Ontological Implications of Locke's Distinction

With this view of the distinction between primary and secondary qualities in mind we may turn to the ontological implications of Locke's distinction. If secondary qualities are nothing but powers to cause certain effects then we may discard the notion that our perception of the power in any way resembles the way the world is. For example, whilst physical objects have shapes, just as we perceive them to have, they do not literally have colours as we perceive they do. Thus, to attribute a secondary quality to a thing is "equivalent to a counterfactual conditional of the form: If x stood in relation R to a normal human, the human would have a sensory idea of such and such a kind."³ This is entirely consistent with the view that primary qualities are simply powers rather than actual physical features of the object, leading Locke to declare of the sensory ideas or perceptions produced "the ideas of primary qualities... are resemblances of them, and their patterns do really exist in the bodies themselves; but the ideas produced in us by these secondary qualities have

³ Bennett, *Locke, Berkeley, Hume: Central Themes*

no resemblance in them at all.”⁴ For example, we may attribute a ripe banana the quality of being yellow. However, this quality does not arise from the fact that the banana is *actually* yellow in the manner we perceive it to be. Rather, modern physics tells us that this quality is perceived by us because the banana’s surface is composed of certain particles with certain arrangements of electrons that cause certain wavelengths of light to be reflected. Thus, the property of the banana being ‘yellow’ is literally something like it having a certain surface composition – rather than its surface being yellow as we perceive it.

We must note that my earlier point regarding physical objects having shapes just as we perceive them to have does not entail that we are never wrong about what shapes objects are. On the contrary it is clear that illusions frequently occur and mistakes are frequently made about the shape of physical things. Therefore I would argue that Locke’s thesis simply entails that “material things have, for example, shapes which are determinations of the same determinable or category, shape in general, as are the shapes seen, felt, or thought of.”⁵ Thus whilst I may be wrong in thinking a piece of paper to be square when it is in fact a non-rectangular parallelogram it is clear that a piece of paper could have a shape of either of these sorts and that both shapes belong to the same ‘family’ - i.e. the shapes are very similar (in the sense of *relative* similarity) in that they share many properties that are generally attributed to shapes: number of sides, angles, number of equal sides and angles etc. This description of how we err in our perception of primary qualities differs from a description of how we appear to err in terms of secondary qualities – for example, when we make mistakes about colours. Whilst we may make mistakes of the kind described above when judging colours – for example by incorrectly matching different shades of red in dim lighting – we also make a different kind of error. Even in ideal conditions for perceiving colours, the colours we perceive are totally different from the powers to produce such perceptions. There is nothing in the category of the colour yellow as we perceive it in a ripe banana. This kind of mistake is

⁴ Locke, *Ibid*

⁵ Mackie, *Ibid*

obviously of a very different type to the mistakes we make about primary qualities.

One may object that by solely focussing on our talk of 'powers' when referring to secondary qualities we are obscuring the fact that the primary qualities of an object also result in it having a power to cause sensations in us – thus reducing the difference between the primary and the secondary. However, I would freely concede that primary qualities result in powers. The difference is that the power of an object to cause the perception of a square in ideal conditions is the result of the object being a square. This extreme similarity between the sensations the powers cause in us and the cause of the power is, as has been discussed, lacking in the case of secondary qualities. Therefore, whilst the perceptions caused by both types of quality represent real differences in the objects possessing the quality (for example the difference between a ripe banana's yellowness and a ripe tomato's redness represents a real difference in their surface compositions) – it is only our perceptions of primary qualities that faithfully depict actual qualities in the object.

3. A Physicalist Theory of Colour

Having discriminated between primary and secondary qualities, and having used the phenomenon of colour as the paradigmatic case of a secondary quality throughout our discussion, I shall turn to a more detailed theory of colour. Having denounced the claim that colour as we perceive it is a property of any physical object we must now explain the phenomenon ourselves. In so doing, I aim to further discuss the philosophy of colour in general and, by providing a strong and unsuccessfully criticised theory, further strengthen the claims I have already made about the nature of colour and secondary properties in general.

It is clear that the division between primary and secondary qualities is a division endorsed by modern physics. Scientists since Galileo, writing here in

1842 have believed that colours “hold their residence solely in the sensitive body; so that if the animal were removed, every such quality would be abolished and annihilated.”⁶ Thus, it seems apt of us to turn to a scientific explanation of the phenomenon in focus.

The physicalist account of colour begins with the premise that when objects appear to look red, they have a physical property that is normally detected by that experience.⁷ By this I mean that when a normal person (i.e. someone who can “make at least as many [colour] discriminations as any other.”⁸) correctly perceives an object to be red (by correctly I mean correctly insofar as all normal-sighted humans would agree that it was red in this situation and the perceiver is not the victim of some illusion) their perception is caused by the object having some property that is common to all other red objects.

The most sensibly candidate for this property of ‘redness’ is the property of having one of a set of surface atomic structures.. All members of this set have surface atomic structures such that when white light shines upon the object a high percentage of light of a wavelength of around 660 nanometres is reflected – as briefly described in section 1. A similar property is true of all objects that are blue (but with a surface structure suitably adjusted so as to reflect a high percentage of light of around 440 nanometres) and so on for all objects. Thus the atomic surface structure of an object can be discerned – in a manner adequate for a philosophical discussion of colour – by the wavelengths of light the object reflects. Thus rather than talk of an object’s surface structure we may talk of its reflecting light. This general property of reflecting certain wavelengths of light is the ‘surface spectral reflectance’ (SSR) of an object.⁹ Given this, we may now assert that if two objects share the same SSR they are identical in colour. If two objects have a similar SSR they may be very similar in colour – or perceptually indistinguishable if, for example, the differences in the percentages of light they reflect occur outside of the visible spectrum. In terms of SSRs, we may now say that two objects

⁶ Galileo, *Opere Complete di G. G.*

⁷ Boghossian and Velleman, *Colour as a Secondary Property*

⁸ Smart, *Reply to Armstrong*

⁹ Byrne and Hilbert, *Colors and Reflectances*

that are (e.g.) red have the same type of SSR – call it ‘SSR-red’. This property is a propensity to reflect light of around 660nm – as described above. It may be noted that the property ‘SSR-red’ is not a very interesting property from the scientific point of view. Whilst properties such as the charge of the electron would be extremely important to scientists of any species across the entire universe, any species lacking visual organs like ours would not find SSR-red a noteworthy property of an object.

4. Problems for the Physicalist Thesis.

Having briefly outlined the physicalist thesis of colour we will discuss some of the problems that arise from it. This is important both to find any weakness in the theory and to discuss the theory in more depth than we have done so far.

It is pertinent to note an important problem that arises from including a theory admitting the existence of secondary properties whilst upholding a purely scientific world view. In Locke’s extended theory of secondary qualities, the primary qualities of an object simply produce ideas or sense data (or mental objects of some sort) in the mind of the person perceiving them.

Once one accepts the physicalist doctrine that the mind is part of the physical world, one can no longer treat it as an “ontological dustbin”¹⁰. To speak of the mind somehow containing secondary properties caused by physical objects outside it makes no more sense than to talk of the objects themselves having these properties – for the physicalist proposes that the mind simply *is* a physical object. Therefore any physicalist account of colour faces the task of surmounting this problem. Armstrong suggests that this is possible by embracing a Representative theory of perception. Whilst he concedes that such a theory has its own disadvantages he also proposes that the physicalist theory of colour faces more problematic – but related – criticisms than this.

¹⁰ Armstrong, *Smart and the Secondary Qualities*

It may be suggested that the physicalist doctrine is mistaken in asserting that colour is reducible to a physical property. One may illustrate this by appealing to aspects of the distinction between primary and secondary qualities. For example, a primary, physical quality, such as the shape square, has characteristic interaction patterns. For instance a square will not roll smoothly down a hill.¹¹ Conversely, red and white billiard balls behave in exactly the same way on a billiard table. This difference between shape and colour may be presented as an argument against the physicalist thesis' reduction of colour to a physical property.

Jackson and Pargetter suggest that this may be disputed by pointing out that, for example, red and white billiard balls behave differently on a billiard table in that red balls end up in the pockets more often than white balls. This is because certain physical properties of the red balls cause them to appear red to the players. This fact, combined with the players' beliefs about the rules of billiards and desires to win the game, result in the balls behaving differently on the table.

However I believe that this counterargument goes a step further than is necessary to successfully refute the suggested criticism. The simple fact that the red balls appear red to us is enough to dismiss the criticism. In order for the balls to appear red they have some physical feature (i.e. their SSR) which, in certain conditions (i.e. when white light is shining on them), result in them causing light to interact with our eyes in such a way as to cause us to perceive them as red – rather than white. Therefore our simple perception of them as red rather than any other colour is a symptom of red balls having a characteristic interaction pattern with certain physical features of the world that, for example, white balls do not have. This interaction is no different in type from a square displaying a different interaction pattern with a hill than a circle does.

¹¹ Jackson and Pargetter, *An objectivists Guide to Subjectivism About Colour*

Smart, one of the most successful proponents of the physicalist doctrine, emphasises that if one treats the secondary qualities as additional to primary qualities, and as having the qualities we have described them as having, one faces the problem of how to connect the two qualities by laws. Armstrong elucidates that “when exceedingly complex assemblages of physical conditions occur... then in association with these conditions, relatively simple qualities emerge.”¹² Smart claims that belief in such laws is not compatible with a scientific world view, believing their “disjunctive and idiosyncratic”¹³ nature to be contrary to the proper form of physical laws. Hence, such laws are viewed as unwanted accretions on the elegant and organised complex of physical law that is emerging.

I do not see why Smart finds fault with his thesis because the laws it entails lack elegance. Indeed, after unsuccessfully reformulating his thesis in an attempt to deal with its perceived problems, he returns to his original thesis and simply accepts the inelegance he originally found so distressing. However, before doing so he entertains another version of physicalism that is of philosophical interest to us.

5. A Reformulation of Smart's Physicalist Theory

Smart's reformulates his theory by asserting that the powers of the secondary quality of colour cause further powers in the perceiver. Specifically, these are discriminatory powers. Thus, to say that something is blue is to say that it could not easily be identified if it were set upon a background of bluebells. However it would easily be picked out from a background of red roses.

This thesis was soon attacked for being unable to deal with simple criticisms. The most interesting and damaging of these is presented by Martin. Martin suggests a thought experiment whereby all colours are inverted in an ordered manner. That is, the colours opposite each other on the 'colour wheel' familiar from school art lessons are systematically swapped over. If this were the case

¹² Ibid

¹³ Smart, *On Some Criticisms of a Physicalist Theory of Colours*

the blue object of the previous paragraph's example would become red. However, as bluebells would also turn red and the roses would turn blue the discriminatory power of the normal perceiver would not change. Therefore there has to be something wrong with an account of colours in terms of powers to cause certain discriminations to be possible and others impossible.

6. Rejecting the Original Criticisms of Physicalism

Therefore, Smart abandons his reformulated theory of colour and is forced to return to his original theory and face up to the problems he initially rejected it for. We will recall that Smart found the inelegance of the laws connecting perception with physical states in the objects of perception contrary to his beliefs about science. He expressed this inelegance by referring to the thesis as "very disjunctive and idiosyncratic."¹⁴ In order to reject the criticism that Smart initially believed to be so damaging we must therefore show that the disjunctive and idiosyncratic implications of the physicalist thesis are not damaging.

We have, in a limited sense, already accepted the idiosyncrasies of our theory in accepting that an object's SSR is not property that is especially important to physical theory. The SSRs are only of contingent importance to us – contingent, that is, upon the way our eyes and brains interact with certain wavelengths of light. I do not believe this to be a problem at all.

A more serious problem is presented by the fact that "colour-qualities might have to be adjudged ineluctably disjunctive."¹⁵ The biggest worry relating to this claim is that we may encounter two instances of objects that appear to exactly the same shade of colour but that have very different micro-structural characteristics. This may indeed present a problem for any scientifically minded person who wishes to tie the effect of perceiving a specific colour to a specific cause in a given situation.

¹⁴ Ibid

¹⁵ Armstrong, Ibid

Armstrong suggests that we may accept this circumstance by focussing on a particular thought experiment. We can imagine that there exists in the brain an 'or' neuron. This neuron may have multiple input channels, each activated by a different sort of visual stimulus. When any one of these channels is activated the neuron responds by turning 'on', or sending a signal to the brain. The same signal is sent no matter which input channel is activated. Therefore, whilst our two apparently identically coloured objects may activate different input channels, the output from the 'or' neuron will be the same and will result in the same response further on in the causal sequence in the brain – that is, either object can cause the same colour to be perceived.

Armstrong highlights the possibility of something like this being the case by referring to the 'Headless Woman' effect. This is the effect produced when a woman's head has been obscured by a dark cloth against a black background. Because we fail to perceive the head we seem to perceive the head's absence however this is not the case – absence of evidence is not evidence of absence. With this in mind we can see how our inability to perceive the presence of disjunctivity with respect to colour may lead us to imagine we perceive a lack of disjunctivity – this is not necessarily the case.

Having rejected the central criticisms of the physicalist theory of colour I believe we are in a position to accept it as a plausible and useful theory. It serves to explain the phenomenon of colour vision in terms compatible – indeed, reliant upon – modern scientific theory and preserves the important distinction between primary and secondary qualities as we presented it early in our discussion.