Anthropocentric Chauvinism

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Introduction

The question of colour has been a source of great anxiety for philosophers, as most philosophers are split between two seemingly incompatible positions, both having conceptual appeal, yet neither seeming to wholly satisfy our conceptual schema. The objectivist view appeals to our belief that colours are real properties of objects (either microphysical properties (Jackson 1998) or surface spectral reflectances (Hilbert 1987) in the external world, while the subjectivist view appeals to our experience of colours (colour as red-ness, green-ness, blue-ness, etc.), arguing that as these phenomenological aspects cannot be found in the perceiver-independent world, colour must be a product of our mind.

This has led to a third position in the debate. This position known as the secondary quality view (or dispositionalism) which boasts success in finding a middle ground, saving both the externality and the phenomenology by arguing that colours are secondary qualities in that they consist in a power or disposition to produce a sensory experience in a perceiver, this power being grounded in primary qualities. This is a relational stance as the identification of colours is dependent on the experiences of the perceiver (or at least to the experiences of what is often referred to as the normal perceiver), and if there ceased to be perceivers so too would there cease to be colour.

Recent empirical evidence, from various comparative studies of visual systems across species, has given theorists[1] reason to argue that

[1] See Thompson (1992; 1995) who then argues further that this gives us reason to doubt that any objectivist position can be attained. See also Matthen (1999) who proposes a plural realism.

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dispositional accounts are motivated by a species-specific chauvinism, and further that this criticism can be extended to other objectivist positions. If this is right then it appears that we have good reason to reject the objectivist views as possible candidates for explaining the ontological status of colour.

In this paper I will argue that even though we should reject the identification of colour with dispositional properties, we need not reject all objectivist positions on these grounds.

I shall first, in Section 1, set up the general structure of the dispositionalist view showing its dependence on standard perceivers and standard circumstances. In Section 2, I will set out a brief account of how the visual system works. In Section 3 I will reveal the chauvinism that underlies the dispositional account. Finally, in Section 4, I shall propose that the primary quality view (the alternative objectivist position), by acknowledging the chauvinism in dispositionalism and limiting this only to pragmatic use and by identifying colours rather as disjunctive microphysical properties that surpass our experience of them, avoids similar criticisms of chauvinism within their proposed ontology.

Section 1. *Dispositionalism*

Johnston (1992) argues that both the subjectivist and objectivist views 'are each in their own way perfectly true' (Johnston 1992:221), depending on how inclusively[2] one talks about colour. His proposed methodology is that we draw out our beliefs about colour, separating out our 'core' beliefs (those which we use to define the subject which we are investigating) from the more 'periphery' beliefs (those that we hold towards the defined subject, yet can be changed without changing the subject). From this we are able to identify which concepts of colour are central to our colour-beliefs and—practices, thereby identifying those that we are able to give up in pursuit of a coherent theory without changing what we are talking about when we speak of colour.

Following this methodology, a number of philosophers have rejected what they see as the two extremes of objectivism and subjectivism—arguing

[2] '*Ever so inclusively speaking* the external world is not colored. *More or less inclusively speaking* the external world is colored' (Johnston 1992:221).

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that by accepting either one, one must give up too many of our core beliefs[3]—and embraced a (in some way or another) modified Lockean dispositionalism that they argue allows one to salvage both externality as well as phenomenology.

Lockean dispositionalism stems from Locke's distinction (this distinction was earlier made by Boyle, however Locke gave it the mature form from which dispositionalist theories were created) of primary and secondary qualities, whereby colours (much like taste, sounds, odours, etc.) are taken as secondary qualities in that they consist in a power to produce ideas in a perceiver, this power being grounded in primary (perceiver independent, physical) qualities.

> Material things interact with one another in regular causal ways: hence we can say that each thing has various powers. To say that a certain thing has a certain power is just to say that it would affect or be affected by another thing of a certain sort in some specific manner. A power is not the cause of such and such an effect; rather to have the power is to be such as to cause the effect. The cause ... will be some set of properties ... of the thing that has the power: it will generally be, or at least include, some set of properties of the

[3] I believe we have good reason (though I shall not argue this point in this paper) to reject subjectivism in that our use of colour terms is not in reference to the natures of our colour-experiences, but rather to features of objects that we take as causing these experiences (the feature which our colour-experiences represent), where '[t]he evidence for this is that we look at the objects; we do not introspect ... [and further] we take it for granted that it is a good idea to look carefully, and in good light, and that others may be in a better position to rule on the object's color than we are' (Jackson 2000: 153f). By denying this intuition, thereby accepting a subjective stance, one would have to claim that the world is invisible, or at least that we do not *see* the objects, as we see objects by seeing them as coloured (as having a colour-property that causes us to have a visual experience). As our pre-theoretical colour terms are based upon the assumption that the world is coloured, a denial of our objectivist intuition would therefore involve a radical change in our colour language.

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> minute parts of that thing, of the collection of particles of which it is composed... That is, material things have powers to produce sensations and perceptions in us, and these powers, like any others, have grounds or bases in the intrinsic properties of things ... *Secondary qualities* ... of which he gives examples of 'colours, sounds, tastes, etc.', he does identify with powers: they are 'nothing in the object themselves, but powers to produce various sensations in us by their primary qualities (Mackie 1976:9-12).

Locke however acknowledged 'the possibility that "by the different Structure of our Organs" different ideas of colour should be produced in different minds by the same intrinsic attributes' (Ayers 1991:207), thereby if two perceivers, who's sensory organs were sufficiently different, looked at the same object, it is possible that one could have a yellow colour-experience while the other could have a blue colour-experience. However recognising this problem; 'he was careful to make it clear that he did (very reasonably) believe that people's senses in fact function in similar ways to similar effect' (Ayers 1991:209), thereby bringing about a standardisation by dispositionalists of colour perceivers: the standard colour perceiver being any one of us who's perceptual system functions much like the majority of our perceptual systems function. Through reference to standard perceivers, dispositionalists then avoid criticisms from (imagined) possible cases of inverted colour perception as well as from the more common cases of colour-blind individuals (these being non-standard perceivers).

Secondary quality theories of colour therefore (roughly) hold that the colours of objects are the dispositions (Locke referred to these as 'powers') of these objects' surfaces (oddities/finkish dispositions aside[4]) to

[4] Lewis (1997) argues for a way to reform the conditional analysis of how things are disposed to respond to stimuli, in light of oddities/finkish dispositions (a disposition that when put to the test would vanish as the stimulus for it's manifestation may cause the disposition to go away and therefore prevent its manifestation). His proposal is that: 'Something x is disposed at time *t* to give response *r* to stimulus *s* iff, for some intrinsic property *B* that *x* has at *t*, for some time *t'*, *s* and *x*'s having of *B* would jointly be an *x*-complete cause of *x*'s giving response *r*' (Lewis 1997:157).

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produce certain perceptions/experiences (Locke referred to these as 'ideas') of colour in standard viewers under standard viewing conditions (standard conditions are those conditions under which objects are usually observed, thereby avoiding problems of colours viewed under darkness or through coloured glasses, and so on). Thereby dispositionalists attempt to incorporate both the causal properties of objects that underlie the disposition, as well as the 'ineliminable subjective element in the analysis of colour' (Thompson 1995:31). Modifications of this account therefore tend to vary mainly in where they choose to place emphasis: either on the physical surfaces (thereby more in the objectivist camp; for example Johnston 1992[5]), or on the perceived colours (thereby more in the subjectivist camp; for example Harvey 2000). However with this general structure underlying most dispositional theories, dispositionalist hold that they are provided with 'grounds for speaking of objects' being "coloured", meaning that they produce *some perceived colour or other in viewers*' (Harvey 2000:138).

Dispositionalism is therefore a relational theory, in that it relies on physical properties of objects, the (standard) circumstances in which perception is taking place, the physical perception mechanisms of (standard) perceivers, as well as the phenomenological (subjective) aspects of the colours perceived. The disposition is then used to unify these separate aspects (to a lesser or greater degree): the physical properties of objects that are coloured play a causal role (reflecting different wavelengths of light) in such and such circumstances, stimulating the physical perception mechanisms (the photosensitive pigments found in the cones, which then have a causal effect on the post-receptoral channels) of such and such perceivers, causing these perceivers to have such and such experiences (through brain stimulation from the perceptual mechanisms) of colour (red-ness, green-ness, purple-ness, etc.).

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[5] He proposes that colour be taken as a constituted response-disposition, which he defines 'as a higher-order property of having some intrinsic properties which, oddities aside, would cause the manifestation of the disposition in the circumstances of manifestation' (Johnston 1992:234). Therefore an object has intrinsic properties, which are the constituting basis of its disposition to produce a mental response in such and such a subject under such and such circumstances.

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I have left the dispositionalist account above rather general, thereby allowing it to accommodate most dispositional theories. Most alterations to this general structure are responses to various objections, and depend on the dispositionalist's metaphysical leanings, though I will ultimately argue that it is this general structure that is inadequate in offering us the ontological statue of colour.

Section 2. *The Visual System*

Before we turn to what has been argued should be seen as an unfounded bias, which motivates the desire for a dispositionalist account (I call this 'anthropocentric chauvinism'), we need to first review (briefly and somewhat abstractly) how the visual system functions.

Light of various wavelengths is reflected from the surface of objects as well as their surrounds. This light enters the eye and stimulates the photoreceptors/cones (S, M, and L wave sensitive pigments (having 445nm, 535nm, and 570nm peak sensitivities respectively)). These pigments are however not individually responsible for our seeing spectral stimuli as blue, green, red, or yellow. Collectively these pigments respond throughout the spectrum, but the visual system responds only to the differences in their relative levels of activity (Thompson 1995:53f), whereby the pigments give off response-signals (S, M, and L receptor signals, known as triplets) that are compared (roughly through addition and subtraction) to determine their relative strength, and then recoded in the three post-receptoral channels: An achromatic channel (L+M; as there is no difference measured, it is not spectrally opponent, therefore does not signal difference in wavelength), which determines the luminance of the colour perceived, and two spectrally opponent chromatic channels, a red-green channel (L–M), and a yellow-blue channel (S- (L+M)).

Each channel can be seen as a relative visual response curve. The achromatic response curve determines the whiteness (also known as lightness or brightness[6]) component, in that it specifies the amount of energy

[6] Though, as Thompson (1992:346n) points out, brightness refers to colour appearances (dim-to-dazzling) in the aperture mode, while lightness refers to colour appearance (grey scale of black to white) in the surface mode.

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necessary at each wavelength for a given observer to first detect the stimulus (Thompson 1995:62), this being to the exclusion of chromatic responses. The two chromatic response curves then represent the four basic hues (red, green, blue, yellow), with red and green as opposites on one curve, and blue and yellow as opposites on the other curve, each curve passing through neutral balance points where the chromatic response of that curve is zero, and therefore that channel is nulled. Colour experiences are then determined by the interactions of these channels. If, at a wavelength (around 475nm), the red-green curve crosses its neutral balance point, then the red-green channel is nulled, and the colour experience is determined by the value of the corresponding blue-yellow channel. If the value of the blue-yellow channel is negative, the chromatic response will be blue (as the blue is below the null point while yellow is above the null point, this is however merely convention, and one could indicate the blue as positive and the yellow as negative, as long as one adjusted the red-green curve accordingly). As, in this case, the red-green curve is nulled, we have a unique blue, a blue that has neither red nor green. Further there are points on the curves where the two curves cross each other, either in the positive (whereby red and yellow cross) or in the negative whereby blue and green cross). In such cases one experiences a colour that contains equal quantities of the two hues, this is known as a balanced binary colour (i.e., red and yellow, will result in a balanced orange). Finally, the saturation of the colour experienced at a given spectral location corresponds to the ratio of the responses of both chromatic channels at that location to the sum of the chromatic and achromatic responses at that location (Thompson 1995:63).

We can thus divide the visual system into three parts: the receptoral colour space, determined by the various possible cone triplets; the post-receptoral colour space, determined by the three visual response curves corresponding to the three channels; and a phenomenal colour space, determined by the phenomenal aspects of visual experience (i.e., the experience of colour as the combination of hue, saturation and brightness/lightness/whiteness)[7]. It is not altogether clear that one must

[7] The visual system is far more complicated than what I have given above, and there are other visual spaces (such as cortical colour space), though what I have given is sufficient for the purpose of the following discussion.

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divide the receptoral from the post-receptoral colour spaces as these two can quite easily be viewed as one single colour space, a process of 'stimulation-response-opponent processing'. (Matthen argues: 'Information about spectral distribution is extracted from the outputs of [the L, M, and S] cells by sampling the relative strength of a signal in selected wavebands. This process, called "opponent processing" (in effect) computes the following functions: (L+S)- M, (L+M)- S' (Matthen 1999:49)[8]. The first function gives us the red-green opponent pairs, while the second function gives us the blue-yellow opponent pairs). I have chosen to divide them merely for ease of explanation of the move from stimulation to phenomenology, though it is not important to this argument whether they are treated like this or not, as long as one takes note of some 'stimulation-response-opponent processing' process.

Section 3. *Chauvinism*

The case given above is what is often referred to as colour perception by a standard perceiver by dispositionalist accounts. If an object reflects light which stimulates the three cone-types, which in turn send a triplet response signal that is recoded in the three post-receptoral channels that determine the hue, lightness, and saturation that is experienced by the perceiver, as long as the perceiver has these colour spaces formulated (roughly) in this way, and the experience in the phenomenal colour space corresponds, more or less, to that of the experiences of other perceivers looking at that object, then that perceiver can be said to be seeing the colour of that object, as colour is the disposition of an object to manifest such and such an experience in a standard/trichromatic perceiver (one having three cone-types cross connected to three post-receptor channels) in standard conditions.

We can now turn to the case of colour-blind individuals. These are individuals who due to a failure in the functioning of their photoreceptors (lack of function or non-existence of one of the L, M, or S pigments in their cone) are not able to have certain colour experiences. They are known as dichromats, as they only have the function of two of their cone-types.

[8] Thompson (1995:66) speaks of 'trivariance' to refer to the 'receptor-channel linkage'.

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Colour-blindness comes in two main forms: 1) individuals not able to distinguish colour along the red-green phenomenological axis, these are either protanopes who cannot see red due to lack of L pigment, or deuteranopes who cannot see green due to lack of M pigment; 2) individuals not able to distinguish colour along the blue-yellow phenomenological axis, these are tritanopes. These are therefore individuals who are classified as non-standard perceivers, as their visual systems are somewhat lacking and therefore they are not able to have the colour experiences that trichromats have when faced with a certain object. If a deuteranope looks at a green object, the dispositionalist would say that the deuteranope does not see the green as the perceiver is non-standard, therefore does not see the disposition to manifest such and such an experience in a standard perceiver. However, the dispositionalist will insist that even though the deuteranope does not see the object as green, the object is nonetheless green, in that if the perceiver were standard then the object would be disposed to manifest a green experience in that perceiver.

This amounts to the claim that the trichromat, who has a better visual system (a visual system that has three functioning cone-types, and is therefore able to better discriminate between colours, offering a greater range of colours), is able to see colours that the dichromat is not able to see. But now let us imagine an individual who is an even better colour discriminator[9] than the trichromat, a tetrachromat (who has four visual pigments/cone-types). One could imagine that this individual had an extra visual pigment that was sensitive to wavelengths that fell in the ultraviolet end of the spectrum. This individual would therefore have UV, S, M, and L wave sensitive cones. This individual is sensitive to the wavelengths that the trichromat is sensitive to, and in addition, is sensitive to an extra wavelength, the UV wavelength, that through the limitations of the trichromat's visual system, the trichromat is not sensitive to. Thereby it is argued that the tetrachromat phenomenological colour space, of which the trichromat's phenomenological colour space (consisting of unitary and binary hues) has an extra dimension (one that could have ternary colours) that the human phenomenological colour space thus lacks. One can therefore conclude

[9] Averill has a similar idea, referring to 'unusual human observers' (Averill 1985:290).

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(from knowledge of how the visual system works as a 'stimulation-response-opponent processing' process) that the tetrachromat is able to see colours—UV colours[10]—that the trichromat is not able to see. Imagining such a situation does not require a great stretch of one's imagination, as when one looks to nature one discovers that many species are tetrachromats (e.g. pigeons[11]), and therefore as we have evidence of human beings that are dichromats, the possibility of human beings who are tetrachromats is not a great leap of faith[12].

Now let us assess the situation at hand. We have a dichromat (the deuteranope) who cannot experience green due to a lack of M pigments. We have a trichromat that can experience green, as the trichromat has S, M, and L pigments, though s/he cannot experience UV colours as s/he lacks UV pigments. Finally, we have a tetrachromat who can experience both green and UV colours, as s/he has UV, S, M, and L pigments.

The problem for the dispositionalist should now be clear. The dispositionalist defines colour as a disposition of an object to manifest such and such an experience in a standard perceiver. Therefore the dispositionalist would have to say of the situation I have described, that the trichromat sees green where the dichromat fails to see green, while the tetrachromat sees green, but only has a UV illusion. It seems unclear why the UV colours should be labelled as illusions. After all, the reason that the tetrachromat can see UV colours is not because their visual system is malfunctioning, but rather because it is a better (of greater sensitivity) discriminatory device, in that it can cover a larger part of the visual spectrum than the visual system of the trichromat. This is the same reason why the trichromat's visual system is taken as better than the dichromat's visual

[10] As it is not exactly clear what these would be like phenomenologically, when I refer to them as UV colours all I mean is that they involve light from the near-UV (shorter-wavelength) end of the visual spectrum (wavelengths that do not feature causally in the human visual system).

[11] See Thompson (1995:148-152), and Matthen (1999:51). It has been suggested that pigeons may even be pentachromats, though many other avian species are tetrachromats (therefore could be substituted for pigeons above).

[12] See Thompson (1995:166-168) for a discussion on the real possibility of tetrachromacy in a portion of the human female population.

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system. Saying that the tetrachromat experiences a UV illusion is as odd as claiming that the trichromat experiences a green illusion. The dispositionalist is forced into holding some mysterious double standard. I am arguing that maintaining this double standard is motivated by what I am calling anthropocentric chauvinism. Once again it is the bias of seeing humanity (or the major part of humanity-as-it-is-now) as the centre of the universe.

The double standard becomes even more mysterious when one looks at colour language. The dichromat is not able to know what the experience of green is like, yet is still able to speak about green things, such as the 'go' (green) traffic light, and actually believes that that light is green, even though s/he cannot experience it's green-ness. Why then is the trichromat not in the same position when speaking about UV colour? Surely commonsense dictates that as in the case of the deuteranope and green, the trichromat should say that certain things are a UV colour, though not being able to have a UV colour-experience. Just as the deuteranope would have to ask someone if a certain object was green, and then only after being told that the object is green (by someone with a better visual system, i.e., a trichromat or a tetrachromat) refer to that object as green, so too the trichromat would have to ask someone if a certain object is a UV colour (someone with a better visual system, i.e., a tetrachromat) and only then refer to that object as a UV colour. Through advances in science, one can no longer appeal to the argument that 'where that dichromat can, through language, appeal to the trichromat's experiences about the existence of extra colours, the trichromat has no one to appeal to' as through an understanding of the workings of the visual system, one can conclude that tetrachromats do see other colours, even though we are not able to conclude what the colour experiences caused by these colours would 'look like'. When conceptualising trichromats and tetrachromats, one would not have to conclude, as some dispositionalists would have us believe, 'that the best way to describe the two groups of viewers is to speak of their having two different colour-languages' (Harvey 2000:54), in fact one would be mistaken to do this. They *would* share a colour language, speaking about which objects are which colours (like the dichromat and the trichromat both speaking of the 'go' traffic light, as green), though they would not share certain colour experiences. This however is merely a difference in the phenomenological colour space, which

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is either more or less sensitive to colours depending on the receptoral and post-receptoral colour spaces of the particular organism.

If one looks at colour concepts in the real world (our tetrachromatic human being aside), then when told of how the visual system works, and then told that pigeons do have an extra UV-sensitive pigment, and therefore have an UV experience[13], one is *not* cast into some conceptual confusion. As Smart (1961:135) points out:

> Since Wittgenstein we surely know better than to think of a word's having meaning as consisting in its evoking a certain sort of mental image. Meanings are not mental images [rather] the meaning of a word consists in its *use*, not in its associated imagery.

One is therefore able to accept that the pigeon does see extra UV colours, even though we are not able to know what its colour experience is like. This merely places us in a position similar to that of the deuteranope who is faced with the 'go' traffic light, which is a perfectly acceptable position, a position that in no way conflicts with (but rather, is a part of) our commonsense view.

Just as we once held that the sun revolves around the earth, now the dispositionalist wants us to hold that colours revolve around our (trichromatic) visual system. Both the former and the latter claims can be attributed to mere anthropocentric bias, an appeal to some kind of 'human-special-ness'. The dispositionalist has no justification as to why we (trichromatic) human beings should have some special colour-incorrigibility. As we have seen from science, other species have visual systems that are more sensitive than our visual system. As we have seen from colour language, we *do* separate out colours from colour experience (as in the case of the dichromat). Therefore as we are able to speak of objects having colours other than those that we experience those object as having, and as we do speak of visual systems that are more sensitive as giving us a greater ability to discriminate between colours than those less sensitive, we have no reason (as the dispositionalist would have us say) to conclude that tetrachro-

[13] As the tetrachromat probably has three post-receptoral chromatic channels, this could be a situation where both the red-green and the blue-yellow channels are nulled, while the UV channel has a response value.

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mats, when responding to UV light, are having a colour illusion.

> A general conception of color and color experience should allow us to treat the human and the pigeon systems as instances of a general kind. Or else it should give us a principled reason for excluding the pigeon (Matthen 1999: 51).

As no principled reason is given it seems that the dispositionalist is not justified in appealing strictly to standard human observers in arguing for an ontology of colour. The dispositionalist needs to acknowledge this and therefore, when doing metaphysics, cease being an anthropocentric chauvinist.

Section 4. *The Primary Quality View*

Objects *are* disposed to look coloured, this is clear in that some objects do look such and such a colour to such and such a perceiver under such and such circumstances. The argument that I have presented has not denied *this* claim. Dispositions are however relational and highly relative concepts. A colour-disposition is a relation between properties of an object and a certain kind of observer in certain circumstances, therefore an object could be disposed to look such and such a colour to such and such a perceiver under such and such circumstance, while disposed to look such and such a different colour to a different perceiver or under different circumstances. Dispositions therefore cannot, without appeal to chauvinism, be awarded the ontological status of colour.

The process I propose in identifying colour, is that one separate out colour from colour-experience, with the former (following Jackson: 1998; 2000) identified with microphysical causal properties (primary qualities that underlie dispositions), and the latter identified with representations[14] in phenomenological colour space (having hue, saturation and brightness/lightness). I thereby argue that it is these microphysical colour

[14] Though the question of what it means to have such representations, and exactly how the primary qualities are represented is another debate altogether, and would require a separate paper to be adequately discussed.

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properties that are represented in colour-experience by typically causing colour-experience. This separation may at first seem slightly counterintuitive, though I believe that even though colour and colour-experience are often conflated by us into a single concept, this is a mistake on our part made largely by the fact that these two concepts do not often have occasion in our day to day life to come apart. I shall however argue that when we analyse our concepts of colour we find that these two concepts do come apart, and evidence for this is given through language use, in that they often are taken apart in language when need arises in certain circumstances. It is precisely in circumstances where we speak of extra colours (above) that we can see our concepts coming apart, in that here we address colour as separate from colour-experience. It is this separation of our concepts that made these circumstances problematic for secondary quality theories.

Despite the problems that the secondary quality view has in deviant circumstances, it did have initial conceptual appeal, and therefore if one is to uphold our concepts of colour, one should maintain that dispositions are in some way relevant. Prior, Pargetter, and Jackson (1982) argue successfully that when it comes to causation of manifestation it is *not* the disposition that is doing the causing, as dispositions cannot (strictly) cause their manifestations, but rather it is the first-order properties that constitute that disposition that cause the experience. Jackson and Pettit (1990) then argue further that even though the dispositions are not causally efficacious (in that it is the constituting bases that do the causal work) they may still be causally relevant, in that their 'realization programs for the realization of a lower-order efficacious property' (Jackson & Pettit 1990:115). This works, in that by this higher-order property being realized it ensures that there is some lower-order causally efficacious property that is doing the work.

Dispositions thereby can be seen as causally relevant in that an object's disposition to manifest a colour-experience in a certain kind of perceiver under certain circumstances informs that perceiver that the object has a (causally efficacious) colour property that is causing them to have such and such a colour-experience. Colour-dispositions are therefore useful (pragmatic) in that they provide a group-specific account of the perceived colours of certain objects under certain circumstances. The problem however was that the dispositionalist theory is too reliant upon these perceived colours, the particular group of perceivers and the circumstances in which

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they are perceived. The dispositionalist account was left trying to do too much in that it tried to incorporate our colour and colour-experience concepts under the single label colour from a single group perspective, and because of this it was not flexible enough to accommodate our extended (non-experiential) colour concepts adequately, instead it imposed certain counterintuitive positions upon us when circumstances deviated from the norm.

It is for this reason that one should rather conceptualise colour-dispositions merely as heuristics for identifying colour, as each colour-disposition of each object would provide a certain group of perceivers (these being united by similarity in their visual system) with information about which colour they are observing, this information is in most cases somewhat crude as it is limited according to limitations of that groups visual system. Dispositions thus are causally relevant in informing a group of the colours *for that group*, though this does not mean that that group has full information of the colours proper.

I propose that groups of colour perceivers should therefore be placed on a continuum, with dichromats at the one end (as this is the minimum visual state to experience colour) and *n*-chromats at the other, with trichromats, tetrachromats, and so on, in between. The positing of *n*-chromats does not however mean that this continuum is endless, with each organism with ever increasing number of kinds of photoreceptive pigments (and corresponding post-receptoral and cortical visual systems) placed further and further along the continuum (ad infinitum), as after a certain *n*-chromatic system has been reached, an *n+1*-chromatic system would no longer offer the organism any visual advantage over the n-chromatic system, as the difference in sensitivities of the visual systems would be finer than the difference in colours, therefore both visual systems would be equally efficient in discriminating between colours by representing all colours in colour experience (where the continuum ends is however a question for science to solve). This *is* just part of our (extended) commonsense intuition, as shown in the case of extra colours, whereby the trichromat (standard human perceiver) discriminates more precisely and represents more accurately the colour properties of objects than the dichromat (a colour blind human perceiver), while a tetrachromat (i.e., a pigeon, or our imaginary tetrachromat human perceiver) would discriminate more precisely and

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represent more accurately the colour properties of objects than a trichromat.

One can therefore see the way that colour properties of objects and the colour-experiences come apart. The primary quality view therefore maintains that colours are primary qualities of objects that cause (in being causally efficacious) colour-experience. The question that one then needs to ask is whether the primary quality view can then account for our commonsense colour beliefs in standard cases as well. Johnston (1992:234-236) points out, through his example of Zinka the canary and a colour photograph of Zinka, that the primary quality account would have to maintain that as the physical property (P_1) which causes the canary yellow experience when looking at Zinka is very different from the physical property (P_2) which causes the canary yellow experience when looking at a photograph of Zinka, canary yellow must be a disjunctive property consisting of disjuncts P_1, P_2, as well as other disjuncts that cause canary yellow experiences. The problem for the primary quality view then, is that our belief commonsense belief is that yellow is the property that causes yellow-experience, however it is dubious to say that such a disjunctive property is the cause, as it seems to put forward to many different possible causal candidates. This is mostly, though not entirely, right. Jackson (1998) argues that disjunctive properties can be causes, citing the example of the depth of a wound that is responsible for the death of a victim, arguing that it is not the precise depth that is important, but rather that the depth fall in the range of depths that would count as deep enough to be fatal, claiming further that 'it is arguable that most things we cite as causes are more or less disjunctive' (Jackson 1998:106), though adding that such disjunctive properties are causes as long as 'the disjunction is not excessively disjunctive' (Jackson 1998:108). When faced with disjuncts that are excessively disjunctive, one rather makes sense of these as separate causes, whereby the claim is about either one or the other disparate disjunct, where an excessively disjunctive claim such as 'either a 10cm knife wound by Frank or a 15cm bullet wound by Mark caused the death of the victim' should rather be understood as 'either a 10cm knife wound by Frank caused the death of the victim or a 15cm bullet wound by Mark caused the death of the victim'.

Returning to Johnston's example, the reason why I refrain from saying that his analysis of the primary view commitment is right, is that he

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cites the property P_1 as 'very different' (Johnston 1992:235) from P_2[15]. If these properties were very different (though one need not say that they are), then one would have to conclude that the disjuncts are excessively disjunctive, and thereby have to rephrase the situation as done with the knife wound and the bullet wound above: either P_1 caused the canary yellow experience or P_2 caused the canary yellow experience. P_1 and P_2 should then be identified as two different colours as, through being excessively disjunctive, they are separate causes. However the two properties do cause a single colour-experience in human beings, which is identified by us, phenomenologically, as a single canary yellow-experience. We therefore need to accept that even though they do cause a single colour-experience (canary yellow-experience) in human beings, P_1 and P_2 should however remain separate colours (canary $yellow_1$ and canary $yellow_2$) as they have separate causal properties that cause the same effect in human beings *only because of the limitation of the human visual system.* These would however cause two different effects in beings that have visual systems that are finer discriminators (are more sensitive) of colour. These beings would then have a separate colour-experience/representation of canary $yellow_1$ from the colour-experience/representation of canary $yellow_2$[16] (thereby they would have the ability to separate out canary $yellow_1$ from canary $yellow_2$ through perceived/phenomenological differences between the representations caused by the two properties). We should therefore accept that two objects that we see as having the same single colour could actually differ in colours. Further

[15] This would however be the view held by primary quality theorists such as Smart (1975), whereby Smart identifies colours as disjunctive physical properties underlying our (normal observer) colour experience under normal lighting conditions. Therefore Smart would have to accept that even if the microphysical properties causing Zinka's canary yellowness and the microphysical properties causing the yellowness of the photograph of Zinka were found to be very different (excessively disjunctive), they would still be the same colour.

[16] By using 'represent' I do not here tie myself to the view that the representation is the object of perception (i.e., a sense datum view), but rather that the external object of perception is perceived by me by being represented in a certain way through the use of my visual system.

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if this difference were pointed out, it could then be that in some cases we should refer to them as separate colours (which however cause the same experience in us). One could imagine that the male canary (which we can imagine has the ability to discriminate between canary yellow $_1$ and canary yellow$_2$) is attracted to female canaries because of their canary yellow$_1$-ness, while is simply unmoved (or even repelled) by canaries that have been painted with a canary yellow$_2$ paint (because of a dislike of the canary yellow$_2$ colour, and not because of it being paint etc.). In such cases, when speaking about the mating activities of canaries, an ornithologist would say that the colour that canaries are attracted to is canary yellow$_1$, while they are repelled by canary yellow$_2$. An example (given by Jackson 1998: 112) that lends plausibility to this explanation (as a way that we do actually react to similar cases) is that of the ornamental stone jade, whereby when it was discovered that there were two different forms of jade—nephrite and jadeite—this did not lead people to denounce the existence of jade, rather one says that there are two kinds of jade. The lay person, may refer to these as both being Jade, and in a way s/he would be right, though a mineralogist would then be able to correct them and exclaim that there are in fact two different kinds of jade where the lay person saw only one. So too then could an ornithologist correct a painter who by using canary yellow$_2$ paint believed s/he was painting a wall the same colour as that of a canary. This however, does not mean that the painter need say that the room is not canary yellow, s/he needs merely accept that technically it is a different canary yellow to that of a canary.

One does not then however have to extend this division to every disjunct of the disjunctive property. In that one would not be compelled to claim that each strawberry red disjunct is then a different colour, i.e., strawberry red$_1$, strawberry red$_2$, strawberry red$_n$. The primary quality theorist is *only* compelled to say that the excessively disjunctive properties are separate colours, as argued above, though disjuncts that are not excessively disjunctive would be labelled as a single colour. I have equated colours with microphysical causal properties, therefore those properties that are not excessively disjunctive are properties that are unified under their causal role (though as noted above, this causal role is not a role identified by the effects on a human being (trichromat), but rather on the effects of a *n*-chromat). What therefore prevents a colour from being an excessively

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disjunctive property is that it is highly implausible that excessively different disjuncts would be able to play the causal role required for a disjunctive property to count as a single colour. It is therefore the role that restricts which causally efficacious microphysical properties fall into which disjunctive colour property. A point that needs to be noted is that even though I speak of microphysical properties that cause experience in the *n*-chromat, this does not mean that there has to be such an *n*-chromat, or any perceiver at all for that matter. Colour properties can be causal even if they do not have the colour-experience effect (i.e., they cause light to be reflected in such and such a way; one could here possibly appeal to something like Hilbert's (1987) Surface Spectral Reflectance[17] as the common cause that holds the disjuncts together). The use of the *n*-chromat is merely there to indicate that the physical colour properties are disjuncts that are grouped together by some commonality between them that surpass our experience of them and that can be adequately discriminated by a perceiver if such a perceiver has an appropriately sensitive visual system. Colour properties are however external real properties that are not relational (in the sense that they would exist in a world where there were no colour perceivers) even though they do (in a world where there are such and such colour-perceivers) play a relational role in causing colour-experience in perceivers.

Conclusion

> Perception of difference points strongly to the real existence of such differences, failure to perceive differences points much less strongly to the absence of differences (Armstrong 1968:286).

From comparative studies we have found that species with visual systems that are more sensitive than the human visual system are able to make finer discriminations between colours and are therefore, in some cases, able to see two separate colours where we see only one. This revealed that

[17] Surface Spectral Reflectance is the percentage of light that a surface reflects at each wavelength across the entire visual spectrum (from 300nm-700nm).

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dispositionalist theories of colour are motivated by an unfounded anthropocentric chauvinism that is unable to account for this empirical evidence, as well as unable to deal with our extended colour concepts.

However, by acknowledging both that dispositions are species-specific causally relevant properties that program for the underlying causally efficacious microphysical properties, and that our visual systems are limited discriminatory systems, the primary quality account is able to save objectivism. The primary quality account holds that colour properties are disjunctive (microphysical) properties (the disjuncts are grouped together as a disjunctive property by their common, perceiver independent, causal role) that typically cause colour-experience. The experience is however limited by how fine a discriminatory visual system is representing the causal properties. As the human trichromatic visual system is limited, we shall often represent two different disjunctive properties as a single colour-experience. However to claim that this means that these are metaphysically a single colour would be indulging in anthropocentric chauvinism.

Through limitations in the human visual system, the primary quality theorist must accept that their colour-perception is corrigible (this is however no different from perception in general) and thereby must accept that when in day to day activities s/he uses colour terms these are (for pragmatic reasons) based in an anthropocentric chauvinism (as colour terms were made by human beings and used to identify colours through anthropocentric colour experiences). However as our colour concepts *do* outrun our colour-experience, the primary quality theorist is able to maintain that colours, metaphysically, surpass our experience of them, and that if we were finer discriminators of colour we would then be able to identify a greater array of colours in the world[18].

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