

Truth and Falsity in Colour Perception

by

Thomas Baker

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Department of Philosophy

School of Philosophy, Theology, and Religion

College of Arts and Law

University of Birmingham

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Abstract

Two principal questions lie at the heart of the philosophy of colour perception. First: how do colour experiences represent the world? Second: do colour representations veridically represent the world? This collection of papers closely examines the various ways in which colour experience may represent the world, and the possibilities regarding the veridicality of these representations. As it turns out, close attention to the above two questions illuminates novel ways of approaching the metaphysics of colour and colour experience.

Paper one distinguishes different ways in which colour experience can be veridical or erroneous, and uses these distinctions to motivate *realist error theories*: a new class of theory regarding the perception of colour. Realist error theories say that colour experience is erroneous regarding the location and/or metaphysics of colour, but is generally veridical regarding the instantiation of colour. I argue that realist error theories provide a new approach to certain tensions between our motivated metaphysics for colour and how experience represents the colours.

Paper two falls into two parts. In the first part, I argue that extant subject-dependent theories of colour fail to delineate veridical colour experiences from erroneous colour experiences. In part two, I develop novel subject-dependent theories which successfully delineate veridical colour experiences from erroneous colour experiences. I advocate for *mono-minimalism*: a view which says that colours are subject-dependent properties which range over at least one standard perceiver in at least one standard condition.

Paper three focuses on the distinction between steady and unsteady colours. Extant proposals involve positing that steady colours are subject-independent and unsteady colours are subject-dependent. I argue that the subject-dependent theorist can explain the metaphysical difference between steady and unsteady colours in wholly subject-dependent terms. We can say that steady and unsteady colours are both subject-dependent properties, but steady colours range over a broader range of perceptual conditions compared to unsteady colours. I argue that this bifurcation in the scope of the colours is consistent with the mono-minimalist theory of colour proposed in paper two.

Dedicated to my parents, for all they do for me.

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Introduction

Throughout this thesis, I presuppose a representational understanding of perceptual experience. It is therefore an open question whether every claim and argument I make is consistent with other theories of perceptual experience (e.g., theories such as naïve realism). I do not aim to settle that question in this project.

When I was beginning research for this thesis, I became fascinated with the relationship between perceptual experience and the world, and particularly with the different ways in which perceptual experience may be right or wrong about the external world. This fascination led me to the topic of colour experience, since colour experience provides a vivid example of the complexities involved in understanding the truth and falsity involved in perceptual experience. Once I started to pay close attention to how colour experience may represent the world, it became clear to me that matters were much more complicated than had been assumed in the extant literature, and that dissecting this complexity would uncover new conceptual and logical space. This thesis involves closely examining the possible truth and falsity involved in colour experience, and then situating these possibilities in central debates in the philosophy of colour perception. As it turns out, close attention to the possible truth conditions for colour experience provides novel ways of thinking about the nature of colour and colour experience.

This thesis is divided into three papers. In paper one, I explore different dimensions of veridicality and error for colour experience, and then use these distinctions to motivate a novel class of theory regarding the perception of colour. I argue that there are three important dimensions of veridicality and error. First, a colour experience may veridically or erroneously represent an object as *instantiating* a colour. Second, a colour experience may veridically or erroneously represent a colour as being in a certain *location*. Third, a colour experience may veridically or erroneously represent a colour as having a certain *metaphysical aspect* (e.g., being intrinsic). I outline a novel class of theory regarding the perception of colour that emerges from these distinctions: *realist error theories of colour perception*. Realist error theories say that colour experience is universally erroneous regarding aspect and/or location, but not universally erroneous regarding the instantiation of colour. Realist error theories preserve our pre-theoretic conception that colour experience is generally veridical regarding the instantiation of colour, but they maintain that colour experience is nonetheless erroneous regarding metaphysical aspect and/or location.

I focus on the theoretical importance of two formulations of realist error theory. Many thinkers contend that there is a tension between subject-dependent theories of colour – such as

dispositionalism and relationalism – and the way in which colours visually appear. The thought is that colours visually appear to be a way that is inconsistent with subject-dependent theories of colour. For example, some think that colours look to be intrinsic, and that this is inconsistent with colours being subject-dependent dispositions or relations. Subject-dependent realist error theories provide a novel approach to this tension: we contend that colours are subject-dependent properties of objects, but colours are always erroneously represented as subject-independent. Whilst subject-dependent realist error theories commit to error regarding some metaphysical aspect of the colours, they nonetheless maintain the intuitive thought that colour experience is generally veridical regarding the instantiation of colour. An important virtue of subject-dependent realist error theories is that they unify the motivations for a subject-dependent metaphysics of colour with the appealing thought that colours visually appear to be subject-independent.

Now to the second formulation of realist error theory. An age-old tension in the philosophy of colour perception is the tension between the manifest image of colour, and the scientific description of the world. The tension is that the metaphysics that colours visually appear to have is in some sense inconsistent with how science describes the world. Scientific realist error theories provide a new approach this tension: we argue that colours are scientifically respectable properties of objects, but colours are erroneously represented to possess a metaphysical aspect which is inconsistent with the scientific image. For example, perhaps colours are represented as primitive, but perhaps science does not posit the instantiation of any primitive properties which are good candidates for being the colours. Scientific realist error theories say that colour experience is universally erroneous regarding some metaphysical aspect(s) of the colours, but they nonetheless contend that colour experience generally represents objects as instantiating colours that they instantiate. A crucial virtue of scientific realist error theories is that they unite the motivations for a scientifically informed metaphysics of colour with the compelling thought that the manifest image of colours is inconsistent with the scientific image.

In paper two, I closely examine the contexts in which colour experiences are veridical or erroneous regarding the instantiation of colour, and then use these contexts to motivate a novel subject-dependent theory of colour. I focus on what I call ‘the broad veridicality challenge’: classing colour experiences involved in perceptual variation as veridical, and classing erroneous colour experiences as erroneous. In part one of the paper, I argue that extant subject-dependent theories fail to meet the broad veridicality challenge, due to the scope of the

subject-dependent properties that are posited. The problem is that extant subject-dependent theories posit properties which range over the wrong groups of perceivers and/or perceptual conditions. The perceivers and/or perceptual conditions that the properties range over are such that their representation does not class all veridical colour experiences as veridical, and all erroneous colour experiences as erroneous. I also highlight challenges for extant theories which concern the medium of colour representation, and gradations in veridicality in colour experience. The critique of extant theories in part one motivates the need for the novel subject-dependent theories which are outlined in the second part.

In part two, I focus on two novel formulations of subject-dependent theory. First, *scope-change theory* says that the perceivers and conditions over which colours range is dependent upon whether the colour experience in question is veridical or erroneous. This theory classes all colour experiences involved in perceptual variation as veridical, and all erroneous colour experiences as erroneous. It does this because, according to scope-change theory, the veridicality status of the colour experience is more fundamental than the colour property that is represented, since the veridicality status determines the scope of the property that is represented by the experience. On this view, if the colour experience under consideration is veridical, then the experience represents a colour property that ranges over all perceivers for which the object would look that colour in the perceptual condition that the perceiver is in currently. And if the colour experience under consideration is erroneous, then the experience represents a colour property that ranges over all perceivers for which the object would not look that colour in the perceptual condition that the perceiver is in currently. I also argue that scope-change theory dissolves the worries concerning the medium of colour representation and gradations in colour experience which I raise for extant subject-dependent theories.

I then outline a second novel formulation of subject-dependent theory: *mono-minimalism*. The key thought behind mono-minimalism is that we first need to pay very close attention to exactly which colour experiences we think are veridical, and which colour experiences we think are erroneous. The mono-minimalist argues that perceptual variation only involves the colour experiences of standard perceivers and standard conditions. Thus, the criteria by which we determine whether a given colour experience is veridical or erroneous is informed by the colour experiences of standard perceivers and standard conditions. The mono-minimalist argues that a colour experience is veridical *iff* it matches the colour experience of at least one standard perceiver in at least one standard condition, and erroneous *iff* it does not match the colour experience of at least one standard perceiver in at least one standard condition.

The properties posited by the mono-minimalist are inspired by these criteria. They say that the colour blue, for example, is the property of being nomologically possible to cause phenomenal blueness* in at least one standard perceiver in at least one standard condition. The representation of these properties successfully delineates veridical colour experiences from erroneous colour experiences, since the properties are motivated by the exact criteria by which we cleave veridical colour experiences from erroneous colour experiences. I argue that, similarly to scope-change theory, mono-minimalism dissolves the worries concerning the medium of colour representation and gradations in colour experience. I further argue that mono-minimalism is to be preferred to scope-change theory, since mono-minimalism does not have the cost that the veridicality status of colour experience is more fundamental than the colours represented by the colour experience.

In paper three, I explore the difference between steady and unsteady colours, and provide a novel explanation of how the metaphysics of steady colours differ from that of unsteady colours. An example of a steady colour would be the seeming redness of an apple, and an example of unsteady colours would be those we seemingly see on the back of compact discs. One idea in the extant literature is that what explains the difference in steadiness is that steady colours are subject-independent properties, whereas unsteady colours are subject-dependent properties. This poses a challenge to the subject-dependent theorist: explaining the difference between steady and unsteady colours in wholly subject-dependent terms.

I argue that the subject-dependent theorist can meet this challenge. I contend that steady colours and unsteady colours are both subject-dependent, but steady colours have manifestation conditions which involve a broader range of perceptual conditions compared to unsteady colours. I also outline how mono-minimalism is consistent with this view of steady and unsteady colours. The key idea is that steady redness and unsteady redness are both determinates of (mono-minimal) redness. They are determinates of mono-minimal redness in virtue of their manifestation conditions involving at least one standard perceiver in at least one standard condition: this similarity provides the determinate-determinable relation.

After paper three, I outline my concluding remarks. These remarks include how the results of the three papers combine to provide a consistent and pleasing vision of the nature of colour and colour experience.

Paper 1. Realist Error Theories of Colour Perception

1.0. Abstract: This paper develops a novel class of theory regarding the perception of colour: *realist error theories of colour perception*. Realist error theories say that colour experience is generally veridical regarding the instantiation of colour, but is universally erroneous regarding some metaphysical aspect and/or location of colour. The paper is centrally preoccupied with developing and applying realist error theories which commit to universal error regarding some *metaphysical aspect(s)* of the colours. This kind of realist error theory provides a novel response to an important dialectic.

It is not uncommon for a theorist to find themselves in the difficult position of having compelling motivations for colours having a certain metaphysical aspect (e.g., being relational), but for this metaphysical aspect to clash with the metaphysical aspect(s) attributed to colour by experience. The traditional response to this difficulty is to forsake the motivated metaphysical aspect. Theorists then resort to a formulation of colour realism or eliminativism which does not conflict with the metaphysical aspect(s) attributed to colour. Unlike the traditional approach, realist error theories regarding aspect preserve the motivated metaphysical aspect (and colour realism) by holding that experience *erroneously* attributes metaphysical aspect, but is generally veridical regarding the instantiation of colour.

1.1. Introduction

Two questions have been of central preoccupation in the philosophy of colour perception. The first is: do objects – such as lemons, scarves, and bicycles – instantiate colours? And the second is: what is the metaphysics of colours? This preoccupation is well placed: after all, colours *seem* to be instantiated everywhere, and our language and beliefs presuppose that objects are coloured. Colours are important to how we make sense of the world: we use them to identify and categorise objects, both perceptually and cognitively. If it turned out that objects lacked colours, for example, then this would require a drastic revision to our world view. The instantiation of colour would turn out to be a clever but false story told by our perceptual and cognitive systems.

Extant theorising concerning the metaphysics and instantiation of colour has been strongly influenced by a certain kind of conflict. The conflict is this: we have captivating motivations for colours possessing a certain metaphysical aspect (e.g., being dispositional), but this metaphysical aspect conflicts with how colours are represented in experience. For example, we might have persuasive motivations for colours being surface reflectance properties, but this may conflict with colours being visually represented as *primitive*. Or perhaps we have

compelling motivations for colours being subject-dependent, but this may clash with colours being visually represented as *subject-independent*.

Traditionally, theorists respond to this conflict by relinquishing the motivated metaphysical aspect. The pertinent question then becomes whether objects have properties which (1) possess the metaphysical aspect that colours are represented to have, and (2) are plausible candidates for being the colours. Realists retain the instantiation of colour by arguing that objects instantiate properties which meet these criteria. Eliminativists forgo the instantiation of colour by arguing that no instantiated properties meet the criteria. Realists and eliminativists of course differ regarding whether colours are instantiated. But they hold a common assumption: experience only veridically attributes metaphysical aspect(s) to colours.

This common assumption can be denied. It is possible that experience *erroneously* attributes some metaphysical aspect(s) to colours. This paper develops a novel type of theory that emerges from such a denial: *realist error theories of colour perception (aspect)*. The theories are so named because they involve colour realism, but universal error concerning some metaphysical aspect(s) attributed to colour. the realist error theorist argues that it is possible for experience to erroneously attribute a metaphysical aspect to colour, but veridically represent an object as instantiating the colour. For example, redness may *erroneously* be represented as intrinsic, but the object may *veridically* be represented as instantiating redness. Such realist error theorists argue that whilst colour experience is universally erroneous concerning some metaphysical aspect(s) of colour, it is generally veridical regarding the instantiation of colour.

Realist error theories regarding aspect pave a new way of responding to the conflict between our motivated metaphysics for colours and the metaphysical aspect(s) experientially attributed to colours. Traditionally, both realists and eliminativists are united in forgoing the motivated metaphysics. Differently, the realist error theorist maintains the motivated metaphysical aspect through their commitment to experience erroneously attributing metaphysical aspect.

I also outline how one can be a realist error theorist regarding the *location* of colour: these are *realist error theories of colour perception (location)*. According to this kind of realist error theory, colour experience is generally veridical regarding the instantiation of colour, but is always erroneous regarding the location of colour. I sketch some applications of this kind of realist error theory. But the main focus of this paper is developing and applying realist error theories regarding metaphysical aspect.

The plan for the paper is as follows. In §1.2, I distinguish three dimensions upon which colour experience can be erroneous and veridical: instantiation, location, and metaphysical aspect. I outline how these dimensions have been conflated in the literature and explore which combinations of veridicality/error are conceptually possible. In §1.3, I outline and develop the new class of theory that emerges from the distinctions: *realist error theories of colour perception*. I also outline the standard positions concerning veridicality and error in colour experience. In §1.4, I outline *subject-dependent realist error theories*. Subject-dependent realist error theories unify the subject-independent tradition of colour with the subject-dependent tradition of colour in a certain respect. They say that colours are subject-dependent properties which are erroneously represented as subject-independent. Such theories preserve the motivations for a subject-dependent metaphysics of colour with the compelling thought that colours are represented as subject-independent.

In §1.5., I outline *scientific realist error theories*. Scientific realist error theories are a novel approach to the problem of the manifest and the scientific. It is well documented that the manifest image of colours seems to be in tension with the properties ascribed to objects by science. This problem has traditionally led theorists to eliminativism or realist primitivism about colour. The scientific realist error theorist argues that colours are scientifically respectable properties of objects, but that colours do not possess the metaphysics that colours are represented to have. In §1.6, I outline further applications of scientific realist error theories. These applications include how realist error theories bear on discussion concerning colour explanation, realisation, and causation. In §1.7, I explain how realist error theories extend beyond colour perception. One can be a realist error theorist about the perception of *any* type of property which is seemingly instantiated by objects. Thus, realist error theories do not simply provide a novel approach to the perception of colour, but rather to the perception of seemingly instantiated properties *simpliciter*. I then conclude.

1.2. Dimensions of veridicality and error

1.2.1. Instantiation, location, and metaphysical aspect

Philosophers often talk as though there is only one way in which colour experience can be erroneous or veridical regarding colour. Theorists talk loosely of ‘colour illusions’, ‘errors of colour perception’, and ‘veridical colour experience’. But at times there are quite distinct dimensions of veridicality and error in the vicinity. The aim of this section is to clarify three dimensions upon which colour experience can be veridical and erroneous. This taxonomy is

not intended to be exhaustive: there are further ways in which experience can be erroneous or veridical regarding colours. But there are three dimensions which are crucial for understanding and appreciating realist error theories of colour perception.

Let's consider the first dimension upon which colour experience can be veridical or erroneous: colour *instantiation*. Imagine that you are outside in good natural lighting and that there is a melon in front of you. Now imagine that your experience represents the melon as instantiating the colour green. And let's assume that the melon is green. There has here been a:

VERIDICAL ATTRIBUTION OF COLOUR: A visual experience represents an object as instantiating a colour that the object instantiates.

Let's now imagine that the same melon is transferred into a psychophysics lab. In the lab, the lighting conditions are highly non-standard, and the melon is visually represented as blue rather than green as it was visually represented outside. In this case, it is appealing to think that the melon is not blue, since it only visually represented as blue in virtue of the highly non-standard perceptual conditions. Since we are assuming that the melon is not blue, but that the melon is visually represented as blue, there has here been an:

ERRONEOUS ATTRIBUTION OF COLOUR: A visual experience represents an object as instantiating a colour that the object does *not* instantiate.

I think that veridical attributions of colour and erroneous attributions of colour map on to our pre-theoretic understanding of 'veridical colour experience' and 'erroneous colour experience'. When we pre-theoretically think that a certain colour experience is veridical, we think that the object is visually represented as instantiating a colour that it instantiates. And when we pre-theoretically think that a certain colour experience is erroneous, we think that the object is visually represented as instantiating a colour that it does not instantiate. Let's now consider the second dimension upon which colour experience can be veridical or erroneous.

Consider the melon once again. Imagine the melon outside in good lighting whereby the melon is veridically represented as instantiating the colour green. As well as the melon being visually represented as instantiating greenness, the greenness itself is also represented to be a certain way. One property that the greenness is represented to have is a *location* property. In this case, the greenness is represented as being spread out over the surface of the melon.

Given that the melon is green, and that greenness is located over the surface of the melon, there has here been a:

VERIDICAL ATTRIBUTION OF LOCATION: A visual experience represents a colour as being in a location in which it is located.

Now imagine that you are looking at the melon in the psychophysics lab once again. Just as with before, the melon is visually represented to instantiate blueness, even though the melon does not instantiate the colour blue. In this case, the blueness is represented as being spread out all over the surface of the melon. However, in the case we are imagining, there is no blueness spread out all over the surface of the melon. There has therefore been an:

ERRONEOUS ATTRIBUTION OF LOCATION: A visual experience represents a colour as being in a location in which it is *not* located.

I earlier suggested that the veridical attribution of colour/erroneous attribution of colour distinction maps on to our pre-theoretic distinction between veridical colour experience and erroneous colour experience. But we may also hold that when we pre-theoretically think that a certain colour experience is veridical, we think that the colour is *located* where it is represented as being located. And when we pre-theoretically think that a certain colour experience is erroneous, we think that the colour is not located where it is represented as being located. However, there is not a *pre-theoretic equivalence of importance* between the veridical/erroneous attribution of colour distinction and the veridical/erroneous attribution of location distinction.

To demonstrate, consider two scenarios. In the first scenario, it turns out that all objects are colourless, but that colours are located where they are represented to be. This would be a rather strange position, since it would entail that colours were located over the surfaces of objects, but that objects did not instantiate colours. Now consider the second scenario. It turns out that objects instantiate colours, but colours are not located where they are represented to be (i.e., primarily on the surfaces of objects). On my view, the truth of the first scenario would require a bigger revision to our world view than the truth of the second scenario, since it entails that no objects instantiate colours.

I now want to explore some contexts in which an erroneous attribution of location can occur. I think it is implicitly assumed that there is only one context in which an erroneous

attribution of location can occur. But I shall argue that there are in fact two contexts in which an erroneous attribution of location can occur. Let's consider the first (more orthodox) context. Consider the melon once again. In the case I outlined involving an erroneous attribution of location, the melon did not instantiate the colour blue, and *in virtue of* the melon not instantiating the colour blue, the colour blue was not spread out over the surface of the melon. So, one context in which an erroneous attribution of location can occur is one in which there is location error *in virtue of* the object not instantiating the colour in question:

LOCATION ERROR IN VIRTUE OF INSTANTIATION FAILURE: In virtue of an object not instantiating a colour, the colour is not located over the surface of the object. Therefore, when the colour is visually represented as being located out over the surface of the object, the error occurs in virtue of the object not instantiating the colour in question.

Prima facie, we may think that a location error can only occur in virtue of instantiation failure. But I think there is another context in which a location error can occur. Some theorists argue that colours are dispositions to cause certain kinds of visual experiences, and other theorists argue that colours are relations between objects and perceivers in particular viewing conditions. But it is not at all clear where these properties are located. Indeed, we may not think that the disposition to cause a red experience is located over the surfaces of red objects. And we may not think that relations such as *red for subject one in perceptual condition one* are located over the surfaces of objects. Yet, we may nonetheless think that colours are such dispositions or relations, and that objects instantiate such dispositions or relations.

If we thought the above, then we would think (1) colours are certain dispositions or relations instantiated by objects, (2) such dispositions or relations are not spread out over the surfaces of objects, and (3) colours are represented as spread out over the surfaces of objects. This combination of assumptions entails that visual experiences involve erroneous attribution of location but *not* in virtue of instantiation failure. Consider a case where an object instantiates the colour red, the colour red is a disposition or relation which is not spread out over the surface of the object, and the colour red is represented as being spread out over the surface of the object. Here, there is an erroneous attribution of location, but the error is not in virtue of instantiation failure, since the object instantiates the colour in question (i.e., the colour red). So, it is possible that some colour experiences involve erroneous attribution of location but not in virtue of instantiation failure:

LOCATION ERROR NOT IN VIRTUE OF INSTANTIATION FAILURE: A colour is not located over the surface of an object, but it is not in virtue of the colour not being instantiated by the object that the colour is not located over the surface of the object. For example, perhaps colours are of a type of property which entails that they are not located over the surfaces of objects (regardless of whether they are instantiated). Therefore, when the colour is represented as being spread out over the surface of the object, there is an erroneous attribution of location which is not in virtue of the object not instantiating the colour.

Consider a case whereby (1) colours are dispositions or relations that would not be located over the surfaces of objects even if they were instantiated, (2) the colour red is represented as being spread out over the surface of an object, (3) the object is represented as instantiating the colour red, and (4) the object does not instantiate the colour red. This case is more complicated, since there is an erroneous attribution of colour and an erroneous attribution of location. Even though there is an erroneous attribution of colour, it seems that the erroneous attribution of location is nonetheless *not* in virtue of instantiation failure, even though the colour in question is not instantiated. This is because, even though redness is not instantiated, if the colour red *were* instantiated, redness would not be spread out over the surface of the object. The colour being spread out over the surface of the object is therefore not counterfactually dependent upon the colour being instantiated by the object.

Let's now consider a third important dimension upon which colour experience can be veridical or erroneous. Some theorists think that colours are represented to possess certain *metaphysical aspects* (henceforth 'aspects'). For example, we may think that colours are represented to be intrinsic, subject-independent, primitive, or qualitative. Aspects are higher-order properties of colours which are candidates for fixing the nature of colours.¹ I avoid using 'nature' to denote these properties because it is highly unobvious which aspects fix the nature

¹ One question is whether the category of metaphysical aspects includes *location* properties. For the sake of this paper, the category of metaphysical aspects should merely be taken to include aspects which are not location properties. This isn't to say that location properties aren't aspects: they certainly are candidate properties for fixing the nature of colours. Let me explain why I taxonomise them separately.

The relationship between representation concerning colour location and representation concerning colour instantiation is arguably stronger than the relationship between representation concerning colour aspect and representation concerning colour instantiation. For an object to be represented as instantiating a colour, it seems necessary that a colour is represented as being spread out over the surface of the object. For example, if an apple is represented as instantiating redness, it seems necessary that redness is represented as being spread out over the surface of the apple. There is therefore a tight connection between representations of objects being coloured and representations of colours being in locations. But, *prima facie*, it does not seem that for the apple to be represented as instantiating redness that the redness be represented as having a certain aspect (such as being intrinsic). This might be wrong (and I'll consider this later in the section concerning *psychological mystery and evolutionary advantage*). But I taxonomise them separately due to this *prima facie* difference.

of colours, and also highly unobvious which aspects would fix the nature of colours if they were possessed by colours. I do not wish to take a stand on that contentious issue here. Now, one very influential thought is that the entire nature of colours – which would include *all* of the colours’ aspects – is wholly transparent to us in visual experience. Russell and Strawson held this view:²

‘the particular shade of colour that I am seeing - may have many things to be said about it - But such statements, though they make me know truths about colour, do not make me know the colour itself better than I did before: so far as concerns knowledge of the colour itself, as opposed to knowledge of truths about it, I know the colour perfectly and completely when I see it and no further knowledge of it itself is even theoretically possible’ (Russell 1912: 47)

‘color words are words for properties which are of such a kind that their whole and essential nature as properties can be and is fully revealed in sensory, phenomenal-quality experience given only the qualitative character that that experience has’ (Strawson 1989: 224)

Russell and Strawson seem to maintain the strong claim that colours are represented to possess all the aspects that they do in fact possess. However, we may in principle think that colours are represented to possess some aspects that they possess without thinking that colours are represented to possess *all* the aspects that colours possess. For example, we may think that colours are subject-independent primitive properties but nonetheless think that colours are represented to be subject-independent but not to be primitive.

Even if we think that colours are represented to have only some of the aspects that they do possess, the common underlying thought is that we can glean what aspects colours possess by gleaning what aspects colours are represented to possess. For example, if colours are represented to be primitive, then it is assumed that we can glean from this that colours are primitive. And this underlying thought might be true: it is a live possibility that colours are represented to possess at least some of the metaphysical aspects that they do in fact possess. Let's call a colour being represented to possess an aspect that it does possess a:

² This view is also often attributed to Mark Johnston (1992). But it is not entirely clear that Johnston holds this view. Johnston wrote ‘*Revelation*. The intrinsic nature of canary yellow is fully revealed by a standard visual experience as of a canary yellow thing’ (Johnston 1992: 223). This can be interpreted as the claim that the colour’s aspect of *being intrinsic* is entirely revealed through visual experience. And this is consistent with other aspects of the colours not being revealed (entirely or in part) through visual experience. So, it is not entirely clear that Johnston maintains that *all* of the aspects of colours are entirely revealed through visual experience of colours.

VERIDICAL ATTRIBUTION OF ASPECT: A colour is represented as having an aspect that it possesses.

One under-considered possibility, however, is that colours are represented to possess an aspect that they *do not* possess, and therefore we cannot glean from a colour being represented to possess a certain aspect that the colour has the aspect in question. For example, perhaps colours are not primitive properties, but perhaps colours are represented to be primitive, and so perhaps colours are represented to have an aspect – i.e., being primitive – that they do not possess. It is therefore a live possibility that colour experiences involve:

ERRONEOUS ATTRIBUTION OF ASPECT: A colour is represented to have an aspect that it *does not* possess.

So, we have three ways in which colour experience can be veridical: veridical attribution of colour, veridical attribution of location, and veridical attribution of aspect. And we have three ways in which colour experience can be erroneous: erroneous attribution of colour, erroneous attribution of location, and erroneous attribution of aspect. These distinctions are crucial for what follows.

1.2.2. Dimension conflation

Since these three dimensions upon which colour experience can be veridical and erroneous have not been clearly distinguished before, it is unsurprising that these dimensions are sometimes confused and (arguably) conflated. In the following passage from Colin McGinn, we see erroneous attribution of location not clearly distinguished from erroneous attribution of aspect. Furthermore, whilst his argumentative strategy is not wholly clear, on one reading we see a conflation between erroneous attribution of aspect and erroneous attribution of colour. Consider the following passage:

‘According to [dispositionalism], colors consist in relations between particulars and perceivers; these relations are at the very least dyadic, bringing in the perceiver and the conditions of perception. But surely this misrepresents the phenomenology of color perception: when we see an object as red we see it as having a simple, monadic, local property of the particular’s surface. The color is perceived as intrinsic to the object, in much the way that shape and size are perceived as intrinsic. No relation to perceivers enters into how the color appears; the color is perceived as wholly on the

particular, not as somehow straddling the gap between it and the perceiver. Being seen as red is not like being seen as larger than or to the left of. The “color envelope” that delimits an object stops at the particular’s spatial boundaries. So if color were inherently relational, as [dispositionalism] maintains, then perception of color would misrepresent its structure—we would be under the illusion that a relational property is nonrelational ... given that perception is generally veridical as to color, colors are not relational—which contradicts [dispositionalism]’ (McGinn 1996: 542)

Let’s first consider the beginning of this passage. We may, at first glance, think that McGinn’s phenomenological critique of dispositionalism involves a single broad claim regarding error: that visual experience represents colours as having some aspect(s) which is inconsistent with their being dispositional, and so if colours are dispositions, colour experience always involves erroneous attribution of aspect. However, under closer inspection, McGinn is making two quite distinct broad claims regarding error. The first broad claim certainly is that colour experience represents colours as having aspects: ‘When we see an object as red we see it as having a simple, monadic ... property ... The colour is perceived as intrinsic to the object’ (McGinn 1996: 542). So, if colours being dispositional precludes them from being simple, monadic, intrinsic properties, but colours are represented as having these aspects, then colour experience involves erroneous attribution of aspect(s), as McGinn argues.

But McGinn also makes another broad claim regarding error: ‘the color is perceived as wholly on the object, not as somehow straddling the gap between it and the perceiver’ (McGinn 1996: 542). This is the claim that colour experience represents the colour’s *location* and represents the colour as being located wholly on the object. The claim here, therefore, is that if the colour were a disposition, then the colour would not be located wholly on the object, it would instead straddle the gap between the object and the perceiver. Now, one interpretation of McGinn’s view here is that such dispositions would be located solely in-between the particular and the perceiver (although I find this obscure), and so experience would be wrongly locating colours on the surfaces of objects if colours were such dispositions. So, this phenomenological objection of McGinn may *prima facie* appear to be the claim that dispositionalism combined with the phenomenology of colour experience entails that all colour experience involves erroneous attribution of aspect. But McGinn’s claim in fact is that dispositionalism combined with the phenomenology of colour experience entails that all colour experience involves erroneous attribution of aspect and erroneous attribution of location.

I also want to draw your attention to the end of the passage: it is here that there is arguably a more problematic conflation. McGinn writes ‘So if color were inherently relational,

as [dispositionalism] maintains, then perception of color would misrepresent its structure - we would be under the illusion that a relational property is nonrelational. Contraposing, given that perception is generally veridical as to color, colors are not relational - which contradicts [dispositionalism]' (McGinn 1996: 542). Here, McGinn argues that if colours were relational, then we would erroneously represent the aspect(s) of colours, and so colour experience would always be erroneous. He then argues that this conflicts with the fact that perception is generally veridical regarding colour. And he argues from this that a relational view of colour is inconsistent with the veridicality of most of our colour experiences, and so therefore that colours are not relational. Yet, importantly, this reasoning from McGinn arguably involves conflating one dimension of veridicality/error with another dimension of veridicality/error.

Firstly, as I have suggested, we have a pre-theoretic understanding of 'veridical colour experience' and 'erroneous colour experience'. Our pre-theoretic understanding of 'veridical colour experience' is that we represent an object as having a colour that it has. And our pre-theoretic understanding of 'erroneous colour experience' is that we represent an object as having a colour that it does not have.

Thus, when we pre-theoretically think that colour experience is generally veridical, we think that colour experience generally involves representing an object as instantiating a colour that it does instantiate. And when we pre-theoretically think that some colour experiences are erroneous, we think that some experiences involve representing an object as instantiating a colour that it does not instantiate. McGinn argues that if colours are dispositional, but we represent colours as monadic (and simple, intrinsic, etc.), then this would entail that colour experience would not generally be veridical. Indeed, with the assumptions that McGinn has in place, presumably such experiences would never be veridical. He then argues that such erroneous attribution(s) of aspect conflict with our pre-theoretic thought that colour experience is generally veridical. McGinn writes 'So if color were inherently relational, as [dispositionalism] maintains, then perception of color would misrepresent its structure ... given that perception is generally veridical as to color, colors are not relational - which contradicts [dispositionalism]' (McGinn 1996: 542).

Here, McGinn argues that erroneous attribution of aspect (entailed by dispositionalism) conflicts with the fact that perception is generally veridical regarding colour. But, crucially, McGinn *seems* to illegitimately use our pre-theoretic assumption regarding (1) colour experience being generally veridical as to which colour an object instantiates, to motivate the claim that (2) colour experience is generally (or always) veridical regarding aspect. But these

are distinct representations. Indeed, it is possible that a colour experience involves a veridical attribution of colour but an erroneous attribution of aspect. If this is true, then colour experience always involving erroneous attribution of aspect would still be consistent with dispositionalism, since the dispositionalist could argue that colour experience generally involves veridical attribution of colour, but always involves erroneous attribution of aspect. In other words, the dispositionalist could agree with McGinn's phenomenological intuition concerning the aspect(s) attributed to colours, but nonetheless argue that colours are dispositions which are generally veridically attributed to objects.

1.2.3. *Dimension compatibility*

We have three dimensions of veridicality and error on the table: instantiation, location, and aspect. Let's now explore the conceptual possibilities concerning the error and veridicality involved in colour experience along these three dimensions. In this paper, we shall make the following assumption:

ASSUMPTION ONE: The colour attributed to the object is the colour represented in location representations and aspect representations. For example, if an experience represents an object as blue, then the location/aspect representations concern the blueness attributed to the object.³

³ In principle, we could deny this assumption. Perhaps we think that the location/aspect representations concern whichever colour is *instantiated* by the object. For example, consider an experience which represents a shirt as yellow, but let's assume that the shirt is only red. Perhaps we think that whilst the *shirt* is represented as yellow, it is in fact redness that is represented as intrinsic and as being spread out over the surface of the shirt. For this to be a coherent conceptual thesis, we introduce another representation. Perhaps the instantiated redness is erroneously represented as being *identical* to yellowness, and this is why the shirt is represented as yellow. But whilst the shirt is represented as yellow in virtue of this erroneous representation regarding colour *identity*, the location representation still concerns redness, and so it is redness that is represented as being over the surface of the shirt. The underlying thought here is that since redness is erroneously represented as being identical to yellowness, reference to redness has already been established, and so it is not an incoherent hypothesis that redness is represented as spread out over the surface of the shirt. Furthermore, since redness is represented as identical to yellowness, the phenomenal character of the experience is the same as an experience which represents in the following way: represents the shirt as yellow and represents yellowness as spread out all over the surface of the shirt. I am not suggesting that we think that colour experience always represents the instantiated colour as being spread out over the surface of the object, merely that it is a conceptual possibility.

If we deny assumption one (and contend that some location/aspect representations do not concern the colour attributed to the object), then the question about which dimensions of veridicality/error are compatible is a rabbit hole (trust me I've been down there). For example, it becomes far less obvious that an erroneous attribution of colour comes with an erroneous attribution of location. Since this paper will work under assumption one, I shall not outline dimension compatibility for assumptions which deny the claim made in assumption one. However, in paper two of this thesis, I explore further representations concerning colour (such as identity representations), and how such representations bear on the debate concerning perceptual variation.

We shall also assume, for ease, that it is not the case that multiple colours are attributed to the object in question. For example, if I stipulate that redness is attributed to an apple, we shall assume that it is not the case that some other colour (such as greenness) is also attributed to the apple. Now, let's firstly consider a case whereby a pear is represented as instantiating the colour green. Let's assume that this attribution of greenness is veridical, and that the greenness is represented as being spread out all over the surface of the pear and is represented as being intrinsic. On my view, it is conceptually possible that these attributions of location and aspect are veridical and/or erroneous. I shall explain.

Let's first consider the attribution of location. I think it is conceptually possible that the pear is veridically represented as instantiating greenness, and that the greenness is veridically represented as being spread out over the surface of the pear. I take this to be an uncontroversial view. I also think that it is conceptually possible that the pear is veridically represented as instantiating greenness, but greenness is erroneously represented as being spread out over the surface of the pear. On this view, the pear is green, but greenness is not located over the surface of the pear: perhaps the colour green is a disposition or relation which is not so located. I am not denying that there is a close relationship between the *representation* of the pear as green and the *representation* of greenness being spread out over the surface of the pear. Arguably it is necessary that for an object to be represented as instantiating a colour that the colour is represented as being over the surface of the object in question. Indeed, I cannot conceptualise a case whereby an object is represented as instantiating a colour, but the colour is not represented as being over the surface of the object. But we should not conflate this close connection between attribution of colour and attribution of location, with the thought that for a colour to be instantiated, it is necessary that the colour possesses the attributed location.

So, an attribution of colour arguably requires an attribution of location, but a veridical attribution of colour does not require a *veridical* attribution of location. It is important to note that my claim is not that an attribution of location requires an attribution of colour. Indeed, Langsam argues that an attribution of location is insufficient for an attribution of colour:

‘One cannot say that visual experiences represent colour appearances as properties of physical objects solely in virtue of representing them as being on the surfaces of physical objects. For something can be visually represented as being on the surface of something without being represented as being a part or property of that thing ... I can see a red after-image as located on a white wall without seeing it as a part or property of that wall: that part of the wall at which the after-image is located is not itself presented to me as being red. Thus that colour appearances are

presented as being located at or on the surfaces of physical objects is not a sufficient condition for their being presented as properties of those physical objects' (Langsam 2000: 71-72)

Whether coloured afterimages are even represented as being located over the surfaces of objects is unobvious. A competing hypothesis is perhaps that they are represented as being in the visual field. I shall not discuss this further here. What I shall say is that *if* it is the case that coloured after-images are represented as being over the surfaces of objects, then these are cases where there is an attribution of location but no attribution of colour, since it does not seem that objects are represented as *instantiating* the colours found in coloured after-images.

Let's now consider attribution of aspect. I think it is conceptually possible that the pear is veridically represented as instantiating greenness, and that greenness is veridically represented as being intrinsic. I take this to be uncontroversial. I also think that it is conceptually possible that the pear is veridically represented as instantiating greenness, but greenness is erroneously represented as intrinsic. This involves a veridical attribution of colour but an erroneous attribution of aspect. If this were the case, then the pear is green, but the greenness of the pear is not intrinsic. *Prima facie*, there does not seem to be the close relationship between an attribution of colour and an attribution of aspect that there is between an attribution of colour and an attribution of location. It does not seem that an attribution of colour requires an attribution of aspect. For example, it seems conceptually possible that a pen is represented as instantiating blueness, but blueness is not represented to possess any aspect. However, there *might* be a close relationship between certain attributions of aspect and attributions of location. For example, perhaps an attribution of intrinsicity requires a representation of the colour being spread out over the surface of the object. But even if this is so, it does not seem that a veridical attribution of aspect requires a veridical attribution of location. Perhaps a colour is veridically represented as intrinsic, but the (intrinsic) colour is erroneously represented as being over the surface of the object.

The following table highlights the conceptual possibilities concerning veridicality and error when we assume that there is veridical attribution of colour. 'VA' abbreviates 'veridical attribution', and 'EA' abbreviates 'erroneous attribution'. Consider:

Table 1

VA colour	EA colour	VA location	EA location	VA aspect	EA aspect
✓	✗	✓	✗	✓	✗

✓	✗	✓	✗	✗	✓
✓	✗	✗	✓	✓	✗
✓	✗	✗	✓	✗	✓

Let's now assume that the representation of the pear as instantiating greenness is erroneous. The question then becomes whether the representation of the location of greenness is veridical/erroneous, and whether the representation of greenness as intrinsic is veridical/erroneous. I do not think that it is conceptually possible for the attribution of colour to be erroneous but the attribution of location to be veridical. For example, if the pear is erroneously represented as instantiating greenness, then it is not possible for the representation of greenness as spread out over the surface of the pear to be veridical. I have argued that it is possible that an object can instantiate a colour without the colour being located over the surface of the object. But it does seem that if the colour is located over the surface of the object, then the object instantiates the colour. Thus, if a colour is veridically represented as being over the surface of an object, then the attribution of the colour to the object is veridical.

It does seem, however, that an experience can involve an erroneous attribution of colour but a veridical attribution of aspect or an erroneous attribution of aspect. For example, an object may erroneously be represented as pink, and the pinkness may veridically or erroneously be represented as primitive. The following table highlights the conceptual possibilities concerning veridicality and error when we assume that there is erroneous attribution of colour:

Table 2

VA colour	EA colour	VA location	EA location	VA aspect	EA aspect
✗	✓	✗	✓	✓	✗
✗	✓	✗	✓	✗	✓

1.2.4. Worry from reference

When presenting this material, many have raised a worry concerning reference that I want to address. Consider an experience which I would hypothesise involves a veridical attribution of colour but an erroneous attribution of aspect (with assumption one in place). We may worry that the experience is not in fact about the colour of the object, and therefore there is no veridical attribution of colour. For example, consider an experience that seemingly represents

an object as red and seemingly represents the seeming redness of the object as primitive. Let's assume that the object does not instantiate any primitive properties. We may think that *given that* the object does not instantiate any primitive properties, the experience is not about a colour of the object. It is instead about some property which is primitive which is not instantiated by the object. This reasoning entails that assumption one is false when the object does not instantiate any properties with the aspect attributed by the experience.

In the example I have given, the representation concerning aspect is hallucinatory rather than illusory. A property which is not before the perceiver (some primitive property) is represented as being primitive. This is similar to cases whereby objects are not before the perceiver but are arguably veridically represented in some way. For example, imagine that you hallucinate that Roger Federer is in front of you. Imagine that you represent Federer as having brown hair. Arguably this representation of Federer as having brown hair is veridical, since Federer does have brown hair, even though Federer is not before you.⁴ Thus, perhaps the cases which are hypothesised to involve erroneous attributions of aspect actually involve *veridical* attribution of aspect, since the representations are hallucinatory and are about a property not before the perceiver. Someone inclined to this view may think that there are never erroneous attributions of aspect, since all attributions of aspect involve a property which has the aspect(s) attributed to it.

Thus, given that we are assuming that the aspect representation is about an uninstantiated property which has the attributed aspect, perhaps we think that the same uninstantiated property is attributed to the object. Thus, an experience which seemingly involves a veridical attribution of colour but an erroneous attribution of aspect actually involves an erroneous attribution of a property (perhaps a colour) but a veridical attribution of aspect. This is the:

REFERENCE WORRY: If an experience represents a property as having aspect F , and the object before the perceiver does not instantiate a property which possesses aspect F , then the experience veridically represents an *uninstantiated* property as having F . Thus, an experience does not simultaneously involve a veridical attribution of colour and an erroneous attribution

⁴ Whether this is true will depend upon how we understand the nature of representation. If representation of an entity e as having property F requires e to be before the perceiver for the representation of e as F to be veridical, then it is not possible to have an hallucination which involves veridical property ascription. However, if it is possible for an entity e to be veridically represented as having F even if e is not before the perceiver, then it is possible for a hallucinatory experience to involve veridical property ascription.

of aspect, since if aspect F is attributed to a property, then the representation concerns a property which possesses F (regardless of whether that property is instantiated).

Let me respond to the reference worry. The key thought behind the worry is that given the property is represented as having aspect F , the representation is about a property with aspect F . But consider objects. We can (and sometimes do) represent objects as having properties that they do not have. And we do not think that purely because the object does not have the attributed property, that the experience is not about the object and is instead about some other object which *does* have the property. Consider a cardboard box which is seemingly erroneously represented as circular. We do not think that the experience is in fact about some other object (which *is* circular) purely because there is an attribution of circularity to the square object.

Similarly, in the case of colour, purely because the object does not instantiate a primitive property does not mean that the attribution of primitivity is to some primitive property not instantiated by the object. It is perfectly coherent that the aspect is attributed to an instantiated colour of the object. This is not to say that *all* attributions of aspect are to colours instantiated by objects. Consider a case whereby the colour red is erroneously attributed to an object, and redness is represented as intrinsic. Regardless of whether redness is intrinsic, the representation of redness as intrinsic is hallucinatory, since redness is not instantiated by the object and so is not before the perceiver. Thus, in this case, the attribution of intrinsicity is to a colour which is not instantiated by the object (I.e., redness).

I also think that we have a further reason for thinking that an experience can involve a veridical attribution of colour but an erroneous attribution of aspect. The objector who adopts the reference worry argues that an attribution of aspect F entails that the representation is about a property with aspect F . Thus, if no property instantiated by the object possesses F , then the representation is about an uninstantiated property. But let's imagine that as well as the property being represented to possess aspect F , the property is also represented as being in a location: spread out over the surface of the object.

The objector argues that there is a veridical attribution of aspect to a property not instantiated by the object. But presumably the objector does not want to say that the *location* representation is veridical. If they said that the location representation is veridical, then presumably the property would be instantiated (since it would be located over the surface of the object), and thus the object would instantiate a primitive property (which we assumed it did not). Thus, it is sensible for the objector to say that the location representation is erroneous,

given that they think the property is not instantiated. But once the objector is prepared to admit that the attribution of location is erroneous, it is strange for them to contend that an attribution of aspect *F* entails that the aspect representation concerns a property with *F*. Once they admit *erroneous* attribution of location into their metaphysics, they are admitting that properties (including colours) can erroneously be represented in some way. And this undermines their contention that an attribution of aspect *F* entails that the property has *F*, and thus undermines their contention that all attributions of aspect are veridical.

1.3. Realist Error Theories of Colour Perception

In this section, I first outline the standard positions regarding veridicality and error involved in colour experiences. I then outline realist error theories of colour perception and situate them in the conceptual space. I then outline a worry from psychological mystery and explain how realist error may confer an evolutionary advantage. I finally outline how one can also be a realist error theorist concerning belief and language rather than simply about visual experience.

1.3.1. Standard positions

Now that we are clear on three dimensions upon which colour experience can be veridical or erroneous, we can consider the two orthodox ways of thinking about the error and veridicality involved in colour experiences. It turns out that the division between them cuts across the orthodox ways of thinking about the instantiation of colour. Firstly, there are those who subscribe to *colour realism*: the position that objects instantiate colours. And secondly, there are those who subscribe to *colour eliminativism*: the position that objects do not instantiate colours. Associated with realism and eliminativism are two standard ways of thinking about the truthfulness of colour experiences. First, consider:

STANDARD REALISM: Objects instantiate colours. Some colour experiences involve veridical attributions of colour, and some colour experiences involve erroneous attributions of colour. Colour experiences do not universally involve erroneous attributions of aspect. Not all colour experiences involve erroneous attribution of location. All erroneous attributions of location occur in virtue of instantiation failure.

Those who subscribe to standard realism are those who have adopted the various realist theories of colour. Physicalists argue that colours are in some sense reflectance (or productance)

properties: see Armstrong (1969), Byrne & Hilbert (2003), Lewis (1997), and Jackson (1996). Dispositionalists identify colours with dispositions to cause certain kinds of experiences: see Levin (2000), Harman (1996), Johnston (1992), McDowell (1985), Peacocke (1984), and McGinn (1983). Relationalists contend that colours are relations between objects and perceivers in particular viewing conditions: see Averill (1992) and Cohen (2009). And finally, realist primitivists identify colours with non-physical *sui generis* properties of objects: see Allen (2016), Campbell (1994), McGinn (1996), and Gert (2008).

Standard realists vindicate our common-sense intuition that objects instantiate colours. They also draw the important pre-theoretic distinction between experiences which involve veridical attribution of colour and experiences which involve erroneous attribution of colour. We shall return to these virtues later on when we consider realist error theories. But let's now consider the second orthodox way of thinking about the truthfulness of colour experience. Consider:

STANDARD ELIMINATIVISM: Objects do not instantiate colours. All colour experiences involve erroneous attribution of colour. Colour experiences do not universally involve erroneous attributions of aspect. All colour experiences involve erroneous attributions of location which occur in virtue of instantiation failure.

Those who subscribe to standard eliminativism are those who have adopted eliminativist theories of colour. Eliminativist primitivists identify colours with non-physical *sui generis* properties which they contend are uninstantiated: see Holman (2002), Maund (1995), and Wright (2003). Mental property theorists identify colours with mental properties of subjects: see Boghossian and Velleman (1989). Furthermore, eliminativism is the mainstream view among scientists working on colour vision: see Palmer (1999), Land (1983), Kuehni (1997), and Cosmides and Tooby (1995).

Standard eliminativists disagree with standard realists in two important ways. First, they disagree about whether objects instantiate colours. And second, the standard eliminativist fails to draw the distinction between experiences which involve veridical attributions of colour and experiences which involve erroneous attribution of colour, since they argue that all colour experiences only involve erroneous attribution of colour. However, there is an important similarity between the standard realist and standard eliminativist: both contend that colour experiences do not universally involve errors of aspect.

1.3.2. *Realist error theories of colour perception*

It is important to first note that realist error theories maintain that objects instantiate colours, and so realist error theories subscribe to a genuine realism about the instantiation of colour. However, the signature claim of the realist error theorist is that colour experiences universally involve erroneous attribution of aspect and/or universally involve erroneous attribution of location. Given this universal error to which realist error theories subscribe, we may initially entertain a thought expressed by Keith Allen:

‘All else being equal, it seems that we should prefer a theory of colour that is consistent with the way that they appear; otherwise, our theory of the nature of colour will entail a potentially unattractive error theory about colour experience, belief, and language’ (Allen 2012: 331)

I want to first address the latter of Allen’s concerns: that such a theory would entail an unattractive error theory. The important point to make here is that similarly to standard realism, but unlike standard eliminativism, realist error theories draw the distinction between experiences which involve veridical attribution of colour and experiences which involve erroneous attribution of colour. Indeed, I hope the following insight of the realist error theorist can be appreciated even by those who reject realist error theories. The insight is this: it is possible for an *object* to be veridically represented as instantiating a certain colour, but for the *colour* of that object to be erroneously represented as possessing a certain aspect/being in a certain location.⁵ For example, it is possible for the redness of a tomato to be erroneously represented as dispositional, but the tomato to be veridically represented as red.

Thus, whilst realist error theories maintain that colour experience is universally erroneous regarding some aspect(s) and/or location of the colours, this does not entail that colour experience is universally erroneous regarding the *instantiation* of colours. For example, imagine that a yellow lemon is represented as instantiating yellowness and that the yellowness is not intrinsic but is represented as intrinsic. The realist error theorist argues that the *lemon* is veridically represented as instantiating the colour yellow, but the *yellowness* of the lemon is erroneously represented as intrinsic. These are distinct and compatible representations. Consider the schematic conception of this type of view:

⁵ After drafting this work, Will Sharp highlighted to me that this framework can be used to make sense of Chalmers’ (2006) interesting distinction between an edenic world and a non-edenic world.

REALIST ERROR THEORIES OF COLOUR PERCEPTION: Objects instantiate colours. Some colour experiences involve veridical attribution of colour, and some colour experiences involve erroneous attribution of colour. All colour experiences involve erroneous attribution of aspect and/or all colour experiences erroneous attribution of location.

Realist error theories bifurcate into three types of realist error theory. The first concerns only aspect:

REALIST ERROR THEORIES (ASPECT): Objects instantiate colours. Some colour experiences involve veridical attribution of colour, and some colour experiences involve erroneous attribution of colour. All colour experiences involve erroneous attribution of aspect.

The second concerns only location:

REALIST ERROR THEORIES (LOCATION): Objects instantiate colours. Some colour experiences involve veridical attribution of colour, and some colour experiences involve erroneous attribution of colour. All colour experiences involve erroneous attribution of location (which occur *not* in virtue of instantiation failure).

The third concerns aspect and location:

REALIST ERROR THEORIES (ASPECT & LOCATION): Objects instantiate colours. Some colour experiences involve veridical attribution of colour, and some colour experiences involve erroneous attribution of colour. All colour experiences involve erroneous attribution of aspect. All colour experiences involve erroneous attribution of location (which occur *not* in virtue of instantiation failure).

We can immediately appreciate two important theoretical virtues that realist error theories have over standard eliminativism. Realist error theories maintain that seemingly coloured objects are in fact coloured. They therefore vindicate our common-sense intuition that objects are coloured, and so possess the following virtue over standard eliminativism:

INSTANTIATION VIRTUE: Objects in the actual world instantiate colours.

Realist error theories also have another theoretical virtue over standard eliminativism. Indeed, this virtue highlights why the error theory entailed by realist error theories is more appealing than the error theory entailed by standard eliminativism. Realist error theorists argue that some colour experiences – perhaps *most* colour experiences – involve veridical attribution of colour, but that some colour experiences involve erroneous attribution of colour. Realist error theories therefore vindicate our pre-theoretic distinction between ‘veridical colour experiences’ and ‘erroneous colour experiences’, since our pre-theoretic distinction maps on to the distinction between experiences which involve veridical attributions of colour and experiences which involve erroneous attribution of colour. This virtue is distinct from the instantiation virtue: one could in principle maintain that objects instantiate colours (and therefore maintain the instantiation virtue), but also maintain that all colour experiences involve veridical attribution of colour (perhaps on the basis that every object instantiates every colour).

Standard eliminativists cannot draw the distinction between experiences which involve veridical attribution of colour and experiences which involve erroneous attribution of colour, since they argue that no objects instantiate colours and therefore that all colour experiences involve erroneous attribution of colour. Thus, universal error regarding the instantiation of colour is a greater cost than universal error regarding the aspect(s) of colour, since universal error regarding instantiation entails that we cannot draw the pre-theoretic distinction. Unlike standard eliminativism, therefore, realist error theories possess the:

INSTANTIATION DISTINCTION VIRTUE: Some colour experiences involve veridical attribution of colour, and some colour experiences involve erroneous attribution of colour.

Realist error theories are not new theories about the metaphysics of colour, and nor do they entail a particular realist metaphysics of colour. However, being a realist error theorist places certain constraints on which metaphysics of colour can simultaneously be adopted. Since realist error theories subscribe to a realism about the instantiation of colour, any metaphysics of colour adopted by the realist error theorist must be consistent with realism. Realist error theories are therefore consistent with all extant realist theories: these include physicalism, dispositionalism, relationalism, and primitivism. Realist error theories are not, however, consistent with every theory of colour adopted by standard eliminativists. For example, realist error theories are not consistent with colours being mental properties of subjects, since mental properties of subjects are not instantiated by objects, and realist error theories commit to objects instantiating colours.

1.3.3. Bedrock assumptions

There are some bedrock assumptions which have influenced extant theorising regarding colour and colour perception. *Prima facie*, realist error theories may seem inconsistent with such assumptions. But I want to outline how realist error theories are consistent with them. First consider Boghossian and Velleman:

‘When philosophers ask whether colors are real, they are asking whether any of the properties acknowledged to be real are the ones attributed to an object by the experience of its looking colored; and so they are asking, in part, which properties are represented in that experience-which is a question of its content’ (Boghossian & Velleman 1991: 68)

There are two connected thoughts in the above. The first is that colours are properties attributed to objects by colour experiences. The second is that whether colours are real depends upon whether objects instantiate the properties attributed to them by colour experiences. The standard realist agrees with the standard eliminativist on both assumptions. They simply disagree about whether objects instantiate the properties attributed to them by colour experiences.

The realist error theorist also agrees that colours are properties attributed to objects by colour experiences, and that whether colours are real depends upon whether objects instantiate such attributed properties. But the realist error theorist first notes that there are subtly different ways in which objects and colours are visually represented. It is of course true that *objects* are represented to instantiate colours. But it is also true that *colours* are represented to possess certain aspects and certain locations. For example, colours may be represented as intrinsic and represented as spread out over the surfaces of objects. Furthermore – as the realist error theorist emphasises – the question of whether colours are real is not the question of whether *colours* have the aspect(s) and location(s) that they are represented to possess. It is perfectly possible that objects have the colours that they are represented to instantiate, but that colours do not have the aspect(s) and location(s) that they are represented to possess.

An analogy with objects may help here. Imagine that there is a pear in front of you. Now imagine that the pear is represented to instantiate the colour green. But let's assume that the pear does not instantiate the colour green. The question of whether the *pear* is real does not hinge upon whether the pear instantiates the colour green. The entity – in this case the pear – can be real, despite it not having a property that it is visually represented to have. Similarly,

colours can be real – that is, they can be properties instantiated by objects – even if they do not have at least some of the aspect(s) or location(s) that they are represented to possess. The question of whether colours are real is not, therefore, the question of whether colours have the aspect(s) and location(s) that they are represented to have. The question of whether colours are real is instead the question of whether *objects* have the colours that they are represented to instantiate.

1.3.4. Error & Disconnect

So far, we have focused on the possible error and veridicality involved in colour experience and the positions we can hold regarding such error and veridicality. But it is important to note that there is a phenomenon closely connected to error: *disconnect*. A disconnect occurs when an entity being represented to be a certain way is not *caused* by the entity being the way it is represented to be. A disconnect is therefore distinct from an error: error involves an entity being represented to be a way that it is not, but disconnect involves an entity being represented to be a certain way not being *caused* by the entity being such a way. Let's first consider the disconnects associated with standard eliminativism:

STANDARD ELIMINATIVIST DISCONNECTS: An object being represented to instantiate a certain colour is never caused by the object instantiating the colour in question. A colour being represented as being in a certain location is never caused by the colour being in the location in question.

There are also disconnects associated with realist error theories:

REALIST ERROR DISCONNECTS: Colours being represented to possess some aspect(s) is never caused by the colours having the aspect(s) in question (realist error concerning aspect). Colours being represented to be in some location(s) is never caused by the colours having the location in question (realist error concerning location). Realist error theories concerning both aspect and location maintain both the above two disconnects. Furthermore, all realist error theories maintain that sometimes when an object is represented as instantiating a colour it is not caused by the object instantiating the colour in question.

Similarly to standard eliminativism: (1) realist error theories say that there is universal error in colour experiences, and (2) a certain entity being represented to be a certain way is never caused by the entity being the way it is represented to be.

There are also disconnects associated with standard realism. Standard realists subscribe to there being occasional disconnect associated with the instantiation of colour, since some experiences involve erroneous attribution of colour. But standard realism does not subscribe to there being any universal errors or disconnect regarding the aspect(s) and/or the location(s) of the colours. The following table displays the error and disconnects associated with the different theories of colour experience. ‘A’ abbreviates ‘always’, ‘S’ abbreviates ‘sometimes’, and ‘N’ abbreviates ‘never’:

Table 3

Relationship	-	Standard realism	Standard eliminativism	Realist error theories (aspect)	Realist error theories (location)	Realist error theories (aspect and location)
Error	Instantiation	S	A	S	S	S
	Location	S	A	S	A	A
	Aspect	N	N	A	N	A
Disconnect	Instantiation	S	A	S	S	S
	Location	S	A	S	A	A
	Aspect	N	N	A	N	A

1.3.5. Psychological mystery & evolutionary advantage

We might justifiably think that there is a degree of psychological mystery associated with realist error theories. To the realist error theorist concerning aspect the question is: why are colours universally represented to have some aspect(s) that they do not possess? To the realist error theorist concerning location the question is: why are colours universally represented to have some location that they do not possess? And to the realist error theorist concerning aspect *and* location the question is: why are colours universally represented to have some aspect(s) and location(s) that they do not possess?

I agree there is a degree of psychological mystery associated with the realist error theories. But it is important to note that this kind of mystery is not unique to realist error theories. The standard eliminativist thinks that our colour experiences are subject to universal

error, since they argue that our colour experiences always involve erroneous attribution of colour. Thus, to the standard eliminativist, the question is: why are objects universally represented to have colours that they do not possess? The worry is that there is a psychological mystery regarding *why* there is such universal error regarding instantiation, aspect, or location.

Let's firstly consider how standard eliminativism may explain the seeming psychological mystery associated with their position. The standard eliminativist may argue that there is no mystery associated with universal error regarding instantiation, precisely because there is an *evolutionary advantage* to objects being represented as instantiating colours that they do not instantiate. Objects being represented as coloured allows us to categorise and identify objects in helpful ways. This advantage explains why objects are represented as instantiating colours that they do not instantiate. Cosmides and Tooby nicely make this point on behalf of eliminativism:

'Far from being a physical property of objects, color is a mental property – a useful invention that specialized circuitry computes in our minds and then “projects onto” our percepts of physically colorless objects. This invention allows us to identify and interact with objects and the world far more richly than we otherwise could. That objects seem to be colored is an invention of natural selection, which built into some species, including our own, the specialized neural circuitry involved' (Cosmides and Tooby 1995: xi)

The realist error theorist can take a similar strategy in explaining why colour experiences universally involve errors of location and/or aspect. Let's first consider the realist error theorist concerning only location. As I argued in section 1.3., there is a close connection between the *representation* of an object instantiating a colour and the *representation* of a colour being in a certain location. In order for an object to be represented as instantiating a colour, the colour in question needs to be represented as being over the surface of the object. Thus, the realist error theorist concerning location can argue that colours are represented as being spread out over the surfaces of objects because this is necessary for the visual system to represent objects as being coloured, and representing objects as being coloured confers an evolutionary advantage (since it allows us to distinguish and categorise objects). The realist error theorist concerning location therefore argues that there is no psychological mystery associated with such a realist error theory, since erroneous attribution of location allows us interact with objects in helpful ways.

Let's now consider the realist error theorist concerning only aspect. It is *possible* that colours being represented as having certain aspects (that they do not have) confers an

evolutionary advantage. It is possible, for example, that colours being represented as possessing aspect(s) that they do not possess helps us to identify and categorise objects based on their colours. I want to stress our ignorance here. In the case of location, it is clear that an attribution of colour requires an attribution of location. But it is far less obvious that an attribution of colour and attribution of location require an attribution of aspect. Nonetheless, it is possible that objects being represented to instantiate colours requires that colours are required to be represented as possessing an aspect that they happen not to possess. For example, perhaps for objects to be represented as coloured, and for colours to be represented as being over the surfaces of objects, colours need to be represented as intrinsic. Or perhaps the phenomenon of colour constancy requires that colours are represented to possess an aspect that they lack. The argument from evolutionary advantage may therefore be available to the realist error theorist concerning aspect as well as the realist error theorist concerning location.

1.3.6. Belief and Language.

Whilst I have focused on visual experience and three dimensions upon which colour experience can be veridical or erroneous, the distinctions are also relevant to belief and language. Consider when someone believes that an apple is red and believes that the redness of the apple is intrinsic. Let's assume that the apple is red, but that the redness is not intrinsic. This person would erroneously believe that the redness of the apple is intrinsic but veridically believe that the apple is red. Their belief about the property that the *object* instantiates is correct even though their belief about the aspect the *colour* possesses is false. Their beliefs therefore involve a veridical attribution of colour but an erroneous attribution of aspect. The same applies to language. Consider the following utterance directed at the same apple: "the apple in front of me is red and the redness of the apple is intrinsic". This sentence involves a veridical attribution of colour but an erroneous attribution of aspect. To be clear: the claim of the realist error theorist involves solely visual experience. But, just as a visual experience may involve a veridical attribution of colour but an erroneous attribution of aspect and/or an erroneous attribution of location, so too can belief and language.

1.3.7. A common dialectic: motivated metaphysics conflicts with representation

Qua theorists, we tell two important stories. We tell a story about how the world is represented. Perhaps we think that the world is represented as coloured. And perhaps we think that colours are represented as possessing certain aspects and locations, such as being subject-independent

and being spread out over the surfaces of objects. We also tell a story about the possession of properties. Perhaps we think that objects possess colours. And perhaps we think that colours possess certain aspects and location properties. This story of possession can be informed in different ways. For example, this story can be informed by the philosophy classroom, or by our best current science, or by both.

In the philosophy of colour perception, the representation story and the possession-story have been intimately linked. This intimacy is centre-stage in two important debates. Firstly, we may have compelling motivations for colours being certain subject-dependent dispositions or relations. But some philosophers have argued that colours are not certain dispositions or relations, on the basis that colours are represented to possess an aspect which is inconsistent with such theories. Secondly, we may have compelling motivations for colours being scientifically respectable properties of objects. But some philosophers have argued that colours are not scientifically-respectable properties, on the basis that science does not posit candidate properties to be the colours with the aspects that colours are represented to possess. There is an orthodoxy in these debates. The orthodoxy is assuming that the representation story of aspect(s) is true, and then drawing possession-story consequences regarding both instantiation and aspect from this assumption. Realist error theories regarding aspect (henceforth ‘realist error theories’ unless otherwise specified) reject this orthodoxy. The realist error theorist denies that the representation story of aspect(s) is entirely true, and so denies that the metaphysics of colour is constrained by the aspect(s) attributed to colour by visual experience.

1.4. Subject-dependence & realist error

In this section, I first outline motivations for a subject-dependent metaphysics of colour. I then outline an important objection to such theories which is that colours are represented to possess some aspect(s) that colours would not possess if they were subject-dependent. I then outline standard reactions to the problem. I finally outline a formulation of realist error theory which allows us to preserve the motivated subject-dependence of colour.

1.4.1. Motivating subject-dependence

Subject-dependent theories maintain that the nature of the colours is constitutively dependent on the experiences or other psychological responses of perceiving subjects. There are two prominent extant formulations of subject-dependent theory. The first is *dispositionalism*: the view that colours are dispositions to cause certain kinds of experiences in certain kinds of

perceivers in certain kinds of conditions. The second is *relationalism*: the view that colours are relations between objects and perceivers in particular viewing conditions. Consider the following important motivations for subject-dependence:

Multiple realisation: Different objects with different reflectance properties are often represented to instantiate the same colour by standard perceivers in standard conditions (this is known as ‘metamerism’). If we think that such objects instantiate the same colour, then we may think that colours are multiply realised: properties realised by different reflectance properties. A natural question, therefore, is the following: what multiply realised properties are colours? Good candidates are certain *subject-dependent* properties. For example, the disposition to look red to standard perceivers in standard conditions, or the relation red for perceiver *S* in condition *C*. Subject-dependent theories of colour such as dispositionalism and relationalism therefore vindicate our pre-theoretic thoughts about which colours objects have, since they entail that objects with different reflectance properties can nonetheless instantiate the same colour.

Counterfactual tracking: Consider an object that in the actual world is represented to instantiate the colour green by many standard perceivers in many standard conditions. Now imagine a different possible world in which we have an object with all the same non-dispositional and non-relational properties. And in this different possible world the object is represented as instantiating the colour red by many standard perceivers in many standard conditions. In this different possible world, perhaps the visual systems and/or perceptual conditions are very different to those in the actual world. One natural thought is that, in the actual world, the object is green, but in the other possible world, the object is red. Which properties vindicate this natural thought?

Given that the objects have all the same non-dispositional and non-relational properties, but the objects instantiate different colours, the colours must be dispositional or relational properties. Which dispositional or relational properties are apt? The answer is *subject-dependent* dispositions or relations. For example, the disposition to look green to standard perceivers in standard conditions and the disposition to look red to standard perceivers in standard conditions. If colours were these dispositions, then in the actual world the object would be green, but in the other possible world the object would be red.⁶ Certain subject-

⁶ See Levin (2000: 152) on the virtue of counterfactual tracking.

dependent theories of colour therefore correctly track what colours objects would instantiate in different contexts. What multiple realisation and counterfactual tracking have in common is that they both involve subject-dependent theories correctly vindicating the kinds of judgments we wish to make about which colours objects instantiate. But the virtues are distinct: we could think that colours were subject-dependent dispositions, for example, without thinking they were *multiply realised*.

Perceptual variation: There is a vast amount of perceptual variation regarding the instantiation of colour amongst standard perceivers in standard conditions.⁷ For example, let's imagine a lime being viewed by two standard perceivers in natural daylight. To one standard perceiver the lime is represented as instantiating unique green, but to other standard perceivers the lime is represented as instantiating yellow-ish green. The question is: which experiences involve veridical attribution of colour? There are three options. *One-ism*⁸: one experience involves veridical attribution of colour but the other involves an erroneous attribution of colour. *Neither-ism*: neither experience involves veridical attribution of colour. And *both-ism*: both experiences involve veridical attribution of colour. There is an appeal to both-ism, since both perceivers are standard, and both are viewing the lime in the same standard viewing condition. Both-ism has motivated certain subject-dependent theories. For example, relationalism – most notably defended by Jonathan Cohen (2009) – maintains both-ism by arguing that the lime is simultaneously unique green for *S1* in *C1* but yellow-ish green for *S2* in *C1*.

1.4.2. Visual Objections.

One of the most important arguments against dispositionalism and relationalism is that colours visually seem to possess aspects that are seemingly inconsistent with such theories. The basic thought is that there is a conflict between the visual data and the view that colours are dispositions to affect perceivers and/or the view that colours are relations between objects and perceivers. Let's consider some articulations of this objection to dispositionalism and relationalism:

‘According to [dispositionalism], colors consist in relations between objects and perceivers; these relations are at the very least dyadic, bringing in the perceiver and the conditions of perception. But

⁷ See Kuehni (2004) for an overview of the empirical data on inter-personal variation. And see Jacobs (1981) for an overview of the empirical data on inter-species variation.

⁸ I here use Morrison's (2020: 293-6) helpful labels of 'one-ism' and 'both-ism'.

surely this misrepresents the phenomenology of color perception: when we see an object as red we see it as having a simple, monadic, local property of the object's surface. The color is perceived as intrinsic to the object, in much the way that shape and size are perceived as intrinsic' (McGinn 1996: 541-42)

'A basic phenomenological fact is that we see most of the colors of external things as "steady" features of those things... A course of experience as of the steady colors is a course of experience as of light-independent and observer-independent properties' (Johnston 1992: 226)

'But what is the argument that redness does not look to be what the naïve [dispositional] view says it is: an intrinsic nondispositional sui generis color property? This would seem to be exactly how it looks' (Yablo 1995: 489)

'If colours looked like dispositions...then they would seem to come on when illuminated, just as a lamp comes on when its switch is flipped...But colours do not look like that; or not, at least, to us' (Boghossian and Velleman 1989: 86)

The common thought amongst these philosophers – and others⁹ – is that colours are represented to have an aspect that such colours would not possess if colours were certain dispositions or relations, and therefore colours are not certain dispositions or relations. There is no explicit agreement among the objectors concerning which specific aspect(s) colours are represented to possess.¹⁰ However, there does seem to be agreement that it is subject-dependent theories of colour that are seemingly inconsistent with the aspect(s) attributed to colours. Since it is subject-dependent theories of colour that are primarily subjected to the visual problem, my tentative suggestion is that it is *dependence on the subject* that lies at the heart of the objection. If this is true, then we can understand the visual problem as the following: colours are represented as subject-independent, in the sense that the nature of colours is constitutively independent of the experiences or other psychological responses of perceiving subjects, and this conflicts with colours being subject-dependent. It is important to note that this is simply *a* way of understanding the visual problem. Some will think that colours are represented as intrinsic or primitive (for example), and it is these represented aspects that seemingly conflict with colours being subject-dependent dispositions or relations. In the following sections, such theorists should simply understand 'subject-independent' as a placeholder for whichever aspect

⁹ See also Armstrong (1987), Averill (1992), Tye (2000), Gibbard (2006), and Averill and Hazlett (2010).

¹⁰ It is possible that these objectors are all referring to the same aspect but are using different *terms* to refer to the same aspect. This cannot be ruled out. But neither can it be assumed, since such objectors do use different terms which are often used to refer to different aspects.

they think colours are represented to possess which seemingly conflicts with colours being subject-dependent dispositions/relations.

The argumentative structure of this objection against dispositionalism and relationalism is unclear. One aim of this section, therefore, is to clarify the structure of the objection. As it turns out, there are two ways of formulating the *visual objection*.¹¹ Let's consider the first formulation:

Visual objection: evidential formulation

P1: Colours are represented to be subject-independent.

P2: Colours have the aspect(s) that they are represented to possess.

C1: Colours are subject-independent.

P3: Subject-dependent dispositional and relational theories of colour entail that colours are not subject-independent.

C2: Subject-dependent dispositional and relational theories of colour are false.

The key premise for our purposes is P2: colours have the aspect(s) that they are represented to possess. It seems to have been assumed that *if* colours are represented to have a certain aspect, then colours have the aspect that they are represented to have. Furthermore, many theorists maintain that colours are represented to have some aspect(s), and so many assume that colours possess the aspect(s) that they are represented to possess. The thought behind P2 is that colours being represented to have a certain aspect is *decisive evidence* for colours having such an aspect (hence '*evidential formulation*').

Realist error theories concerning aspect of course deny that colours always possess the aspect(s) that they are represented to possess, and so they deny that colours being represented as possessing aspect *F* is decisive evidence for colours possessing aspect *F*. This denial of the realist error theorist may seem radical, but it is structurally similar to a denial made by the standard eliminativist. To demonstrate this similarity, consider a structurally similar argument which instead concerns objects and colours:

¹¹ This objection is sometimes called the 'phenomenological objection' (e.g., Boghossian and Velleman (1989)). However, firstly, the link between how the world is represented, and the phenomenology of experience, is not completely clear, and I don't want to make any assumptions on that contentious issue here. And secondly, such objectors to dispositionalism and relationalism are primarily concerned with how colours seem *visually*, rather than visual phenomenology *per se*. 'Visual objection' is therefore more apt.

Visual objection to eliminativism

P1: Objects are represented as instantiating colours.

P2: Objects instantiate the colours that they are represented to instantiate.

C1: Objects are coloured.

P3: Standard eliminativism entails that it is not the case that objects are coloured.

C2: Standard eliminativism is false.

Many theorists – especially eliminativists – would remain unpersuaded by the visual objection to eliminativism. The eliminativist argues that whilst objects are represented to instantiate colours, it does not follow that objects instantiate colours. From the eliminativist's perspective, objects being represented as coloured is not *decisive evidence* that objects are coloured. The realist error theorist argues in a similar fashion. We argue that from the fact that colours are represented to possess a certain aspect, it does not follow that colours have such an aspect. The former is not *decisive evidence* for the latter. Let's now consider the second formulation of the visual objection. This formulation expresses the objection in terms of a *reductio ad absurdum*:

Visual objection: reductio formulation

P1: A subject-dependent theory of colour is true.

P2: Colours are represented to be subject-independent.

C: Colour experiences involve universal erroneous attribution of subject-independence to (subject-dependent) colours.

Once we pay attention to the three dimensions upon which colour experience can be veridical and erroneous, the conclusion of the reductio formulation is not absurd as it may *prima facie* appear to be. Whilst the realist error theorist argues that colour experiences involve universal error regarding the aspect(s) and/or location(s) of the colours, they maintain that objects instantiate colours, and that experiences of colour generally veridically attribute colours to objects. Indeed, the realist error theorist argues that the universal error entailed by standard eliminativism is more absurd than the universal error entailed by realist error theories, since

standard eliminativism entails that all colour experiences involve errors of *instantiation*, and so the standard eliminativist fails to maintain the *instantiation distinction virtue*.

1.4.3. Orthodox reactions to the visual problem.

We have certain compelling motivations for colours being subject-dependent properties of objects: these include multiple realisation, counterfactual tracking, and perceptual variation. But colours being subject-dependent seemingly conflicts with colours being visually represented as subject-independent. Among theorists who accept that there is this kind of conflict, the orthodox response is neglecting the subject-dependence of colour. Realists contend that colours are (either physical or non-physical) subject-independent properties of objects. Eliminativists argue that colours are uninstantiated subject-independent properties. The commonality here is neglecting the motivated metaphysical aspect and assuming that the attribution of subject-independence is veridical.

1.4.4. Subject-dependent realist error theories

Consider subject-dependent theories of colour. We have compelling motivations for a subject-dependent metaphysics: these include multiple realisation, counterfactual tracking, and perceptual variation. But we face the visual problem which says that colours are represented as subject-independent. A certain formulation of realist error theory unifies the visual intuition found in the visual problem with the compelling motivations for a subject-dependent metaphysics of colour. The thought is that colours are subject-dependent properties of objects, but colours are erroneously represented to be subject-independent. These realist error theories are:

SUBJECT-DEPENDENT REALIST ERROR THEORIES: Colours are subject-dependent properties of objects and colours are always erroneously represented as having the aspect of subject-independence. Some colour experiences involve veridical attribution of colour, and some colour experiences involve erroneous attribution of colour.

If we adopt a subject-dependent realist error theory, then we can maintain colour realism and our motivated subject-dependent metaphysics for colours. We argue that multiple realisation, counterfactual tracking, and perceptual variation are compelling motivations for a subject-dependent metaphysics of colour. We further argue that visual experience is at odds with subject-dependence in a sense, considering that colours are represented to be subject-

independent. But the subject-dependent realist error theorist argues that rather than forsaking the compelling motivations for subject-dependence, the preferable position is to maintain that colours are instantiated properties which are *erroneously* represented as subject-independent.

1.5. Scientific realist error theories

In this section, I first outline routes of motivation for a scientifically respectable metaphysics of colour. I then outline the problem that the manifest image seemingly conflicts with colours having a scientifically respectable metaphysics.

1.5.1. *Motivating scientific respectability*

Wilfrid Sellars (1963) neatly expressed two ways in which we conceptualise the world. The first is the manifest image: the image of the world conceptualised by our ordinary experience. The second is the scientific image: the image of the world conceptualised by science.

We may begin with persuasive motivations for colours having a metaphysics which is consistent with the scientific image. Perhaps we desire a scientifically based ontology regarding *all* properties, and thus maintain that colours (*qua* properties) have a scientifically respectable metaphysics. Or perhaps we desire a scientifically respectable metaphysics regarding colours in particular, and thus hold that colours possess a metaphysics which is scientifically respectable. Or, maybe we have persuasive motivations for colours having a certain metaphysics which is (perhaps coincidentally) consistent with the scientific image. For example, we might have captivating motivations for colours being surface reflectance properties, and such motivations need not necessarily involve surface reflectance properties being scientifically respectable.¹² But whichever path of motivation we take towards a scientifically respectable metaphysics of colour, a central problem is that a scientifically respectable metaphysics is seemingly inconsistent with the manifest image. Let's examine this issue.

1.5.2. *The manifest-scientific problem*

¹² There is of course debate over exactly which properties are scientifically respectable. I here assume surface reflectance properties are scientifically respectable, but it is possible that they are not.

I think there are two elements which inform how we understand the manifest-scientific problem.¹³ The first element is the richness of visual experience regarding the aspects of the colours. The second element is the permissiveness of the scientific image. There are certain minimum assumptions required from these elements to generate the problem. I first outline those minimum assumptions and then outline how they could be strengthened.

Let's first assume that visual experience only veridically attributes *some* aspects to colours. Thus, it is not the case that colours are veridically represented as possessing all of their aspects, and nor is it the case that experience involves any erroneous attributions of aspect. For example, perhaps colours are intrinsic, primitive, and subject-independent, but perhaps colours are represented as intrinsic, but are not represented as primitive or subject-independent.

Let's now consider our second assumption which concerns the permissiveness of the scientific image. For the sake of argument, we can imagine that science posits that objects have certain properties which are intrinsic. Thus, science posits that objects have certain properties with the aspect(s) that colours are represented as possessing. However, let's also assume that such intrinsic properties are not *candidate* properties to be the colours. Perhaps science says that only circular objects instantiate an intrinsic property. The intrinsic property may be a candidate for being the property of *circularity*, since all circular objects instantiate the property. But the intrinsic property would not be a candidate property for being a colour, since not all seemingly coloured objects are circular. With these minimum assumptions in place, we can understand the following sense in which the manifest image of colours does not fit into the scientific image:

MANIFEST-SCIENTIFIC PROBLEM: At least some aspect(s) that are perceptually attributed to colours are not possessed by any candidates to be the colours posited by science.

We can in principle have stronger assumptions by tweaking the richness of visual experience and/or tweaking the permissiveness of the scientific image. Let's consider the strongest formulation of the problem: this allows us to see the gradations between the extremes. We could think that visual experience veridically attributes *every* aspect possessed by colours. And we could also think that science does not posit the instantiation of *any* property with *any* of the aspects that are veridically attributed to colours. These stronger assumptions of course entail a

¹³ See Kalderon (2007: 564) and Levine (1983: 356-7) on the manifest-scientific problem. Similarly to the mind-body problem, the manifest-scientific problem can be expressed in different ways. My articulation is therefore not the only possible articulation of the problem.

stronger manifest-scientific problem: they entail that none of the aspect(s) veridically attributed to colours are possessed by any properties whatsoever posited by science.

Those who accept that there is a manifest-scientific problem typically respond in one of two ways. The first response is maintaining the completeness of the scientific image but resorting to colour eliminativism. The second response is maintaining colour realism but forsaking the completeness of the scientific image. Both responses involve forgoing a scientifically respectable metaphysics for colour. I take each in turn.

1.5.3. Reacting to the manifest-scientific problem: colour eliminativism

The eliminativist typically argues that science provides a complete explanation of reality, and that science can explain why objects are represented to be coloured by appeal to scientifically respectable properties such as microphysical properties, surface reflectance properties, and neural properties. But this scientifically-minded motivation concerning reality does not by itself lead us to eliminativism. After all, colours could be scientifically-motivated properties of objects such as microphysical properties or surface reflectance properties. The eliminativist therefore needs an extra reason to think that colours are not scientifically respectable properties of objects.

One reason invoked by the eliminativist is that no candidate property possesses all of the aspects that colours are visually represented to possess. The eliminativist's thought is that since science does not posit any candidate properties with all of the aspect(s) that colours are represented to possess, objects do not instantiate colours. The eliminativist therefore attempts to preserve the completeness of the scientific image by eliminating colours from our ontology. Indeed, Galileo was persuaded of eliminativism for precisely this reason. As Boghossian and Velleman put it:

‘Galileo seems to have found it very natural to say that the property an object appears to have, when it appears to have a certain colour, is an intrinsic qualitative property which, as science teaches us, it does not in fact possess’ (Boghossian and Velleman 1989: 81)

We can express the reasoning which leads to eliminativism more precisely as the following:

Eliminativism from distinct images

P1: Colours are represented to possess some aspect *F*.

P2: Colours possess aspect *F*.

P3: Science does not posit any instantiated properties with *F* which are candidate properties for being the colours.

P4: The properties instantiated by objects are only the properties posited by science (scientific image is exhaustive).

C: Objects do not instantiate colours (eliminativism).

The eliminativist forgoes motivations for a scientifically respectable metaphysics of colours, since they jettison colours having a metaphysics consistent with the scientific image. On the eliminativist's view, therefore, colours are uninstantiated properties which possess some aspect(s) which are not scientifically respectable. But the eliminativist can nonetheless maintain their *globally* motivated metaphysics: they can contend that reality is exhausted by the scientific image.¹⁴ Since the eliminativist foregoes the instantiation of colour, they commit visual experience and thought and language to universal visual error regarding the instantiation of colour. This is a significant cost of eliminativism.

1.5.4. Reacting to the manifest-scientific problem: realist colour primitivism

We can imagine a theorist who initially has a similar inclination to the eliminativist. They are inclined to think that the scientific image is an exhaustive description of reality. But they face the manifest-scientific problem: colours are represented to possess an aspect which is not possessed by any candidate property. They could become an eliminativist and conclude that objects do not instantiate colours. Or, they can forsake their initial inclination concerning the completeness of the scientific image and become a realist primitivist.

The hallmark of realist primitivism is that colours are properties of objects not identified with physical properties. Realist primitivism involves the thought that retaining the instantiation of colour is more important than retaining the completeness of the scientific image, and so the instantiation of non-physical colours is a price worth paying. We can understand the realist primitivist's motivation to retain realism: after all, colours play an important role in our perceptual and cognitive lives. The following is a more precise expression of the journey from the manifest-scientific problem to realist primitivism:

¹⁴ It is important to note this is simply one way in which the eliminativist may react to the manifest-scientific problem. I am not claiming that all eliminativists have their position motivated in this way.

Realist primitivism from distinct images

P1: Colours are represented to possess some aspect *F*

P2: Colours possess aspect *F*.

P3: Science does not posit any instantiated properties with *F* which are candidate properties for being the colours.

P4: The properties instantiated by objects are *not* only the properties posited by science (scientific image is incomplete).

C: Colours are instantiated non-physical properties (realist primitivism).

Similarly to eliminativism, realist primitivism forgoes motivations for a scientifically respectable metaphysics of colours. The realist primitivist and eliminativist agree that colours have the (non-scientifically-respectable) aspect(s) that experience represents them as having. The eliminativist and realist primitivist therefore both contend that experience only *veridically* attributes aspect(s) to colours. Unlike eliminativism, however, realist primitivism cannot maintain a global metaphysics which is consistent with the scientific image, since they posit the instantiation of non-physical (colour) properties.¹⁵ The realist primitivist does avoid the unattractive entailment of eliminativism that objects do not instantiate colours and that experience, thought, and language are universally erroneous regarding attribution of colour. But the consequence of realist primitivism is that the scientific image is an incomplete description of reality. This is viewed as a cost by scientifically-minded theorists.

1.5.5. Scientific realist error theories

The manifest-scientific problem is that some aspect(s) attributed to colours are not possessed by any candidate properties posited by science. In response to the problem, there seems to be something correct about the colour eliminativist attempting to preserve the completeness of the scientific image. There also seems something correct about the realist primitivist attempting to preserve colour realism. And there also seems something right about what both eliminativists and realist primitivists say about the aspect(s) attributed to colours. Furthermore, unlike eliminativism and realist primitivism, we may also wish to retain a motivated metaphysics for colour which is scientifically respectable. The desire to meet all of these ambitions motivates a certain formulation of realist error theory. I shall explain.

¹⁵ Once again, this is simply one way in which the realist primitivist may react to the manifest-scientific problem.

Consider the following case. We first hypothesise that colours are surface reflectance properties, but then reject the hypothesis on the basis that colours are visually represented to be primitive. A realist primitivist may conclude that colours are non-physical primitive properties of objects. Or, an eliminativist may conclude that colours are non-physical primitive properties not instantiated by objects. But we need not be persuaded of realist primitivism or eliminativism on the basis that experience attributes some aspect(s) to colours not possessed by any candidate properties. The realist error theorist argues that the problematic aspect(s) attributed to colours are not possessed by colours, and so our candidate properties need not be exhausted by only those properties which possess the aspect(s) attributed to colours. The key idea is this: we can expand the candidate properties by forsaking the thought that visual experience only involves veridical attribution of aspect. Consider how we might come to a realist error conclusion from the difference between the manifest and scientific image:

Realist error from distinct images

P1: Colours are represented to possess some aspect *F*.

P2: Objects instantiate colours.

P3: Science does not posit any instantiated properties with aspect *F* which are candidate properties for being the colours.

P4: The properties instantiated by objects are only the properties posited by science (scientific image is exhaustive).

C: Colours do not have the aspect *F* that they are represented to possess (realist error).

We can imagine a certain kind of realist error theorist who argues that colours are scientifically respectable properties (e.g., reflectance properties) which are erroneously represented to be primitive. For example, perhaps the greenness of a vase is a (non-primitive) reflectance property, but the greenness of the vase is erroneously represented to be primitive. The realist error theorist argues that such an erroneous representation concerning aspect does not entail that objects do not instantiate colours, and nor does it entail that visual experience universally involves erroneous attribution of colour. These realist error theories are:

SCIENTIFIC REALIST ERROR THEORIES: The only properties instantiated by objects are properties posited by science (the scientific image is exhaustive). Colours are always represented to possess an aspect *F* and science does not posit any candidate properties which possess aspect *F*. Colours are scientifically respectable properties of objects and all colour

experiences erroneously attribute aspect *F* to colours. Some colour experiences involve veridical attribution of colour, and some colour experiences involve erroneous attribution of colour.¹⁶

The manifest-scientific problem has persuaded many to adopt either realist primitivism or eliminativism. An important point of this paper, therefore, is that such realist primitivists and eliminativists need not be persuaded of their position on the basis of the manifest-scientific problem. The scientific realist error theorist argues that whilst at least some of the aspects attributed to colours are not possessed by any candidate properties, the colours that *objects* are represented as instantiating are nonetheless scientifically respectable properties of objects. If the realist primitivist and eliminativist forgo their commitment to properties possessing all of the aspects attributed to them by visual experience – as the realist error theorist does – then they can retain colours having a scientifically respectable metaphysics.

1.6. Further application of scientific realist error theories

This section is primarily concerned with exploring some further versions of the manifest-scientific problem and how scientific realist error theories address these versions of the problem.

1.6.1. Galileo.

Let's first consider Galileo's formulation of the manifest-scientific problem which also involves his motivation for eliminativism. His motivation for eliminativism came from the thought that science has no place for colours because colours are represented to have certain aspects, and science does not posit any properties which possess such aspects. As Boghossian and Velleman put it:

‘The question whether Galileo was right [that modern science implies that grass is not green] is not really a question about the content of modern scientific theory: aside from some difficulties concerning the interpretation of quantum mechanics, we know what properties are attributed to objects by physics. The question is rather about the correct understanding of colour concepts as they

¹⁶ Whether subject-dependent realist error theories are a sub-class of *scientific* realist error theories depends upon whether such subject-dependent properties are scientifically respectable. Some theorists may contend that they are not scientifically respectable, perhaps in virtue of their manifestation conditions (certain colour experiences) being non-physical. Others will argue that subject-dependent colour properties are scientifically respectable. I do not take a stand on this contentious issue in this paper, and so this paper remains neutral upon whether subject-dependent realist error theories are a sub-class of scientific realist error theories.

figure in visual experience: how do objects appear to be, when they appear to be green? Galileo seems to have found it very natural to say that the property an object appears to have, when it appears to have a certain colour, is an intrinsic qualitative property which, as science teaches us, it does not in fact possess' (Boghossian and Velleman 1989: 81)

Boghossian and Velleman ask the following question: 'how do objects appear to be, when they appear to be green?' (Boghossian & Velleman 1989: 81). They then outline how Galileo argued that the property that the object is represented to instantiate is an intrinsic qualitative property, and that science says that objects do not instantiate any such intrinsic qualitative properties. This is why Galileo concluded that objects do not instantiate colours.

However, the scientific realist error theorist (and realist error theorists more generally) argue that we have to be very careful with this question posed by Boghossian and Velleman. The scientific realist error theorist argues that when an object is represented to be green, the object of course is visually represented to be green, but it is a *further* question as to how the greenness is visually represented regarding aspect. Greenness may be represented to be intrinsic and qualitative, but this does not mean that the property that the *object* is visually represented to instantiate is intrinsic and qualitative. Perhaps the greenness that the object is visually represented to instantiate is non-intrinsic and non-qualitative, but that the greenness is visually represented to be intrinsic and qualitative. Thus, the question of whether modern science implies that grass is not green is not the question of what aspect(s) colours are represented to possess, and whether these aspect(s) are consistent with properties posited by science. Instead, the question of whether modern science implies that grass is not green is the question of what properties *objects* are represented to instantiate, and whether these properties are consistent with the properties posited by science. Importantly, the properties that objects are represented to instantiate may or may not have the aspect(s) that such properties are represented to possess. Indeed, the scientific realist error theorist argues that colours do not have the aspect(s) that they are represented to possess which are inconsistent with the candidate properties posited by science.

1.6.2. *Explanation.*

Another problem concerns whether the physical story can *explain* the aspect(s) that colours are represented to possess. Joseph Levine argues that the physical story cannot explain certain aspect(s) that are attributed to colours:

‘Let’s call the physical story for redness ‘R’ and the physical story for greenness ‘G’. My claim is this. When we consider the qualitative character of the colors of ripe McIntosh apples, as opposed to ripe cucumbers, the difference is not explained by appeal to G and R. For R doesn’t really explain why the apples have one kind of qualitative property and not the other’ (Levine 1983: 356-7)

One could use the above reasoning to motivate eliminativism or realist primitivism. One could argue that since the physical story for redness and the physical story for greenness do not explain the different qualitative properties of redness and greenness, objects do not instantiate colours, because (1) regarding ontology, the physical story is the entire story, and (2) colours possess the qualitative properties that they are represented to possess. Or one could argue that since the physical story for redness and the physical story for greenness do not explain the different qualitative properties of redness and greenness, colours are non-physical properties, since (1) objects instantiate colours, and (2) colours possess the qualitative properties that they are represented to possess. The scientific realist error theorist takes a different approach.

The scientific realist error theorist agrees that (1) regarding ontology, the physical story is the entire story, and that (2) the difference in the *seeming* qualitative properties of the colours is not explained by appeal to G and R. But nonetheless the scientific realist error theorist rejects eliminativism and realist primitivism. The scientific realist error theorist argues that the difference in the seeming qualitative properties of the colours is not explained by appeal to G and R, because G and R do not underlie the difference in qualitative property, since colours do not have the qualitative properties that they are represented to possess. The claim of the scientific realist error theorist is not that colours are not *represented* to have qualitative properties: they may be *represented* to have qualitative properties. Indeed, the difference in phenomenal character associated with an experience of redness and an experience of greenness is arguably (at least partly) explained by the different qualitative properties that colours are represented to have.

The claim of the scientific realist error theorist, instead, is that colours being represented to have the qualitative properties they seem to possess is erroneous. The scientific realist error theorist argues that the colour green, for example, is (in some way) the physical story for greenness – and that objects are represented to instantiate greenness – but colours, such as greenness, do not have the qualitative properties that they are represented to possess. The scientific realist error theorist stresses that colour experience can be ubiquitously erroneous along the dimension of *aspect* without being ubiquitously erroneous along the dimension of *instantiation*.

1.6.3. Realisation.

A further way of expressing the problem of the manifest and scientific image is in terms of whether the physical world can *realise* properties with the aspect(s) that colours are represented to possess. The seeming problem is that the physical world cannot realise properties with all of the aspects that colours are represented to have. The eliminativist concludes from this that objects do not instantiate colours, and the realist primitivist concludes that colours are non-physical properties. Kalderon has expressed the problem in terms of realisation:

‘The perceived nature of the colors may be important, but it is equally a problem. Prephilosophically we tend to conceive of the colors the way Hylas, in Berkeley’s Three Dialogues, initially does—as mind-independent qualities of material objects. It is a problem because it can be hard to understand how the colors, given their qualitative nature, could be materially realized by surfaces, volumes, and radiant light sources as they seem, prephilosophically, to be’ (Kalderon 2007: 564)

One may think that the world’s ontology is not exhausted by the properties posited by science, but nonetheless think that there is a problem of the manifest image and scientific image. For example, we may be prepared to admit properties to our ontology on the condition that they either (1) are identical to certain properties postulated by science, or (2) can be *materially realised* by properties postulated by science. Thus, on this view, the world’s ontology includes properties which are not postulated by science, but such properties can be materially realised by scientifically respectable properties. With these two conditions on our ontology, we might then think there is a problem regarding colours. We might think that colours are represented to possess a certain aspect which means that they are (1) not identical to scientifically respectable properties, and (2) are not of a type of property which could be materially realised by scientifically respectable entities. We could then conclude that objects do not instantiate colours. The scientific realist error theorist may have the same above requirements for their ontology, but not come to an eliminativist conclusion.

The scientific realist error theorist may argue that colours are represented to have an aspect which, *if* colours possessed such an aspect, would mean that colours could not be materially realised by scientifically respectable entities. But the scientific realist error theorist argues that colours do not have the non-materially-realizable aspect that they are represented to possess, and therefore colours can be properties which are materially realised by scientifically respectable entities. So, in response to the realisation version of the manifest-scientific problem, the scientific realist error theorist argues that colours can be materially

realised by surfaces, volumes, and radiant light sources, because colours do not have the qualitative aspects that they are represented to possess. Whilst colour experience is universally erroneous along the dimension of aspect, objects nonetheless instantiate colours, and colour experience is not universally erroneous along the dimension of instantiation.

1.6.4. Causation

One problem with realist primitivism is that it does not seem that the aspect(s) that the realist primitivist says are possessed by colours do causal work when it comes to colour experience. Our colour experiences seem to be caused by micro-physical properties of the surfaces of objects. Maund expresses this problem nicely:

‘One of the major problems, historically, concerns whether it is possible to reconcile the putative character of the intrinsic color features with such features having a causal role in our experiences of colors. The properties that do the causing of these experiences seem to be complex, micro-structural properties of surfaces of bodies’ (Maund 2022: §2.1)

In light of the causation problem, we may conclude that colours are intrinsic non-physical properties (rather than microphysical properties), and that they do not cause colour experiences. But this would seem to fly in the face of the fact that colours *do* seem to cause our colour experiences. We may instead conclude that micro-physical properties of objects cause colour experiences *and* non-physical colours also cause colour experiences. On this view, colour experiences are causally overdetermined. This is consistent with micro-physical properties causing colour experiences, but it introduces another property to do causal work which is already done by another property.

The scientific realist error theorist argues that this causal problem motivates their theory. It is hard to reconcile the represented aspect(s) of the colours with such aspect(s) playing a causal role regarding colour experience, precisely because colours do not have the problematic aspect(s) that they are represented to have. The scientific realist error theorist can argue that colours are complex micro-physical properties of the surface of the object which cause colour experiences. They can further argue that any aspect that colours are represented to possess which is not involved in causing colour experiences is not possessed by colours.

1.7. Realist Error Theories of property perception

This paper focused on the theoretical importance of realist error theories in central debates concerning colour. But realist error theories generalise to all properties whereby objects are represented as instantiating the property in question. To demonstrate, consider the following scenario. We have a suite of compelling motivations for a property possessing a certain metaphysical aspect/location, but perceptual experience attributes an aspect/location to the property that is seemingly inconsistent with this metaphysics. The realist error theorist regarding aspect and/or location says perceptual experience always *erroneously* attributes the aspect/location to the property, but says that perceptual experience is generally veridical regarding instantiation of the property. By holding this view, such a realist error theorist maintains the motivated aspect and/or location for the property. The following is a schematic conception of realist error theories in this wider context:

REALIST ERROR THEORIES OF PROPERTY PERCEPTION: For any property F for which it is true that objects are represented as instantiating F , it is possible that F is universally represented to possess an aspect/location that it lacks, but that perceptual experience sometimes veridically attributes F to objects and sometimes erroneously attributes F to objects.

An important lesson of this paper is that we need not abandon a motivated aspect and/or location for a property on the basis that perceptual experience attributes an aspect/location seemingly inconsistent with such an aspect/location. The property may possess the motivated aspect/location *in spite* of such a perceptual attribution of aspect/location. According to realist error theories generally, the way in which perceptual experience represents properties does not place a *limit* on the metaphysics of the property. Rather, perceptual attributions of aspect(s) and/or location are but one of many theoretical considerations in our quest to understand the metaphysics of properties.

A further important lesson is that perceptual experience being erroneous regarding some aspect(s)/location of a property is consistent with perceptual experience being generally veridical regarding attribution of the property. Realist error theories therefore maintain the pre-theoretic distinction between experiences which involve veridical attribution of the property and experiences which involve erroneous attribution of the property.

My hope is that realist error theories will come to sit alongside standard realism and standard eliminativism *qua* schools of thought regarding the veridicality and error involved in perceptual experience. In both historical and contemporary theorising, thinkers have primarily been concerned with whether objects have the properties that perceptual experience represents

them as instantiating. But it may well turn out that seemingly instantiated properties are not as experience represents them to be.

1.8. Conclusions

The most important results of the paper are as follows:

[1] Whilst theorists often talk loosely of ‘veridical colour experience’ and ‘erroneous colour experience’, there are three important dimensions upon which colour experience can be veridical/erroneous. These dimensions are instantiation of colour, location of colour, and metaphysical aspect(s) of colour. It is conceptually possible for a colour experience to involve a veridical attribution of colour but an erroneous attribution of location and/or aspect.

[2] Realist error theories of colour perception are a new class of theory concerning the perception of colour. The theories say that colour experiences generally involve veridical attribution of colour, but always involve erroneous attribution of location and/or aspect.

[3] We may have compelling motivations for a subject-dependent metaphysics of colour, but find that subject-dependence seemingly conflicts with colours being represented as subject-independent. The orthodox approach is to neglect the compelling motivations for subject-dependence and adopt a theory whereby colours are (instantiated or uninstantiated) subject-independent properties. Subject-dependent realist error theories maintain the motivated subject-dependence of colour by arguing that the attribution of subject-independence is erroneous.

[4] We may have captivating motivations for a scientifically respectable metaphysics of colour, but find that this seemingly conflicts with the aspect(s) attributed to colours. The manifest-scientific problem says that science does not posit any candidate properties to be the colours with all of the aspect(s) attributed to colours. The orthodox responses to the problem involve relinquishing the motivated scientific respectability of colour and resorting to eliminativism or realist primitivism. The scientific realist error theorist maintains the scientific respectability of colour by arguing that colours are *erroneously* represented as having some aspect(s) which are not possessed by any candidate properties posited by science.

[5] The explanation problem, realisation problem, and causation problem, are all problems in the philosophy of colour perception. They also all motivate scientific realist error theories, since they all involve some represented aspect(s) of colours conflicting with a scientifically respectable metaphysics of colour.

[6] One can in principle be a realist error theorist about any type of property which is seemingly instantiated by objects. Thus, whenever we have a conflict between the motivated metaphysics for a property and how the colour is represented (concerning either location or aspect), we can maintain the motivated metaphysics by holding that experience erroneously represents the location(s)/aspect(s) of the property. Thus, realist error theories generalise to the perception of all properties which are seemingly instantiated by objects.

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Paper 2. Veridicality and Error in Colour Perception

2.0. Abstract: This paper falls into two parts. In part one, I argue that extant subject-dependent theories of colour fail to provide an adequate account of veridicality and error in colour perception. The puzzle of perceptual variation is that the same object will often look to be a different colour all over to standard perceivers in standard conditions. For example, the same lime may look unique green all over to Gina, but yellowish-green all over to Yasmin. The *broad veridicality challenge* is categorising all colour experiences involved in perceptual variation as veridical, and categorising erroneous colour experiences as erroneous. I argue that Cohen's relationalism and classic dispositionalism both fail to meet the broad veridicality challenge, since they posit colour properties which range over the wrong groups of perceivers. I also argue that Cohen's relationalism faces a challenge concerning the medium of colour illusions, and a challenge concerning gradations in veridicality in colour experience. I argue that, unlike Cohen's relationalism, classic dispositionalism avoids these two worries. Part one therefore motivates the need for a novel subject-dependent theory of colour which is detailed in part two.

The primary focus of part two is motivating and defending a particular novel subject-dependent theory of colour: *mono-minimalism*. Mono-minimalism says that greenness, for example, is the property of being nomologically possible to cause phenomenal green* in *at least one* standard perceiver in *at least one* standard condition. I argue that mono-minimalism meets the broad veridicality challenge. The key to mono-minimalism meeting the broad veridicality challenge is colours having a scope which is determined by the criteria by which we delineate veridical colour experiences from erroneous colour experiences. Mono-minimalism entails that the representation of colours automatically cleaves the veridical from the erroneous. I also explain why mono-minimalism is preferable to another possible formulation of subject-dependent theory, outline some broader reflections about the nature of colour and perceptual variation, and sketch the main conclusions of the paper.

2.1. Introduction: part one

Perhaps one of the most important considerations in the philosophy of colour perception is the phenomenon of perceptual variation. Perceptual variation involves the same object looking to be a different colour all over to standard perceivers in standard conditions. For example, a tomato may look unique red all over to one standard perceiver in a standard condition, but orange all over to another standard perceiver in a standard condition. It is compelling to think that all colour experiences involved in perceptual variation are veridical (e.g., see Cohen (2009), Kalderon (2007), and Morrison (2020)). On this view, the experience of the tomato as unique red is veridical, and so is the experience of the tomato as orange. Therefore, a challenge

for those with this theoretical inclination is formulating a theory which categorises the colour experiences involved in perceptual variation as veridical. But there is another important challenge. Sometimes objects are represented as being a colour they are not, and so some colour experiences are *erroneous*. Thus, a further objective is classing erroneous colour experiences as erroneous. If our theory fails to account for both veridicality and error, then our theory fails to meet the *broad veridicality challenge*.

The focus of part one is whether extant subject-dependent theories of colour – notably Cohen’s relationalism and classic dispositionalism – meet the broad veridicality challenge. The plan is as follows. §2.2 outlines the puzzle of perceptual variation, why it is compelling to think that all colour experiences involved in perceptual variation are veridical, and the phenomenon of colour illusions. I also outline the broad veridicality challenge which arises from these considerations. §2.3 outlines prominent extant subject-dependent theories of colour. These include Cohen’s relationalism and classic formulations of dispositionalism. §2.4 outlines novel arguments to the effect that extant subject-dependent theories fail to meet the broad veridicality challenge. The problem concerns the *scope* of the properties that are posited. §2.5 argues that Cohen’s relationalism fails to class all colour illusions as colour illusions due to the medium of colour representation. The broader lesson is that at least some colour illusions persist regardless of the doxastic state of the individual. §2.6 outlines the gradation challenge which concerns providing an analysis of colour experience which vindicates our pre-theoretic understanding of gradations in veridicality. In brief, there is a difference between an experience which involves veridical attribution of colour and shade (e.g., red and crimson), veridical attribution of colour but erroneous attribution of shade, and erroneous attribution of colour and shade. I argue that Cohen’s relationalism does not meet the gradation challenge, whereas classic formulations of dispositionalism do. I then move on to part two of the paper which motivates some novel subject-dependent theories of colour, and advocates for a mono-minimalist approach to the metaphysics of colour.

2.2. Veridicality and error

In this section, I outline the puzzle of perceptual variation and why it is compelling to think that all colour experiences involved in perceptual variation are veridical. I then outline the phenomenon of colour illusions and the general contexts in which they occur. I finally outline the broad veridicality challenge which arises from the desire to categorise all colour

experiences involved in perceptual variation as veridical, and the desire to categorise erroneous colour experiences as erroneous.

2.2.1. *The puzzle of perceptual variation*

Before I outline the puzzle of perceptual variation, I first need to make clear what I mean by ‘veridical colour experience’, ‘erroneous colour experience’, and ‘colour illusions’. After all, in paper one I argued that there are different dimensions of veridicality and error involved in colour experience, and that the extant literature is often unclear regarding the dimension under consideration.¹⁷ By ‘veridical colour experience’ I mean a veridical representation of an object as instantiating a colour (veridical attribution of colour). And by ‘erroneous colour experience’ and ‘colour illusions’ I mean an erroneous representation of an object as instantiating a colour (erroneous attribution of colour).¹⁸

Let’s now consider the puzzle. A central challenge that philosophers interested in colour perception face is the puzzle of *perceptual variation*. The puzzle is that among standard perceivers in standard conditions, there is a vast amount of inter-personal and intra-personal variation in colour perception, and no seemingly principled way to single out some experiences as veridical at the expense of others. There is also inter-species variation, and no seemingly principled way of singling out the experiences of one species as veridical at the expense of the experiences of other species.

Let’s consider some cases. First, *inter*-personal variation: perceptual variation among different members of the same species. Imagine a lime and two human perceivers: Gina and Yasmin. The lime looks unique green (henceforth ‘green’) all over to Gina, but yellowish-green all over to Yasmin. Both Gina and Yasmin have standard visual systems relative to humans, and they are viewing the lime in the same standard viewing condition. This kind of variation occurs all the time: among standard human perceivers in standard conditions, the same object will vary in terms of what colour the object looks to be.¹⁹

¹⁷ Later on (in 2.12), I argue that it is not at all clear how we should understand the representations involved in perceptual variation, and thus it is not at all clear what the nature of perceptual variation is. But to avoid complication early on, I assume that perceptual variation involves seemingly conflicting attributions of colour. This smooths the discussion in earlier parts of the paper.

¹⁸ One view is that for an experience to be veridical it must not merely represent the world to be a way that it is, it must also be caused by the world being the way so represented. On my view, for an experience to be veridical, it need only represent the world to be the way that the world is, even if it is not caused by the world being such a way. I therefore agree with Lewis’s (1980) contention that a hallucination can be veridical.

¹⁹ See Kuehni (2004) for an overview of the empirical data on inter-personal variation.

There is also *intra*-personal variation: variation in colour perception that a single standard perceiver undergoes in different standard perceptual conditions. For example, let's imagine that Gina takes the lime into a different lighting condition that we would still consider standard, but in this different lighting condition, the lime looks yellowish-green to her. In this case, the same standard perceiver represents the same object as being a different colour in different standard perceptual conditions.

There is also a vast amount of *inter-species* variation: variation in colour perception between standard members of different species in perceptual conditions which are standard relative to the species.²⁰ For example, imagine a goldfish which has a standard visual system relative to its species. Goldfish have different visual systems to humans – they are typically tetrachromats, whereas humans are typically trichromats – and it is plausible to think that goldfish therefore (at least sometimes) represent objects as having different colours to those humans typically represent the same objects as having. For example, if the lime were dropped into the goldfish bowl, the goldfish may (we can assume for the sake of argument) represent the lime as purple.

Whenever we face the puzzle of perceptual variation, whether it be inter-personal, intra-personal, or inter-species variation, there are three main options when it comes to the veridicality of the colour experiences involved:²¹

ONE-ISM: One experience is veridical, and the other experience is erroneous.

NEITHER-ISM: Neither experience is veridical.

BOTH-ISM: Both experiences are veridical.

For example, a one-ism approach to the inter-personal variation regarding Gina and Yasmin would say that either Gina's experience of the lime as green is veridical, or Yasmin's experience of the lime as yellowish-green is veridical, but it is not the case that both Gina and Yasmin's experiences are veridical. A neither-ism approach says that neither Gina's nor Yasmin's experience is veridical. And a both-ism approach says that both of their colour experiences are veridical. We can see how these approaches also apply to intra-personal and inter-species variation. For example, a both-ism response to the above case of inter-species variation says that the goldfish's experience of the lime as purple is veridical, and so is the

²⁰ See Jacobs (1981) for an overview of the empirical data on inter-species variation.

²¹ I use Morrison's helpful labels of 'one-ism' and 'both-ism' (Morrison, 2020: 290-6).

colour experience any standard human perceiver would have of the lime in any standard condition. Similarly, a both-ism response to the above intra-personal variation says that Gina's experience of the lime as green is veridical and so is her experience of the lime as yellowish-green.

2.2.2. *Both-ism is preferable*

Let's assess the options in response to perceptual variation. One-ism says that only one of the colour experiences involved in perceptual variation is veridical. For example, if we consider the case of Gina and Yasmin, a one-ism approach might say that Gina's visual representation of the lime as green is veridical, but Yasmin's visual representation of the lime as yellowish-green is erroneous. The problem with one-ism is that there does not seem to be a well-motivated way of singling out one experience as veridical at the expense of the other. For example, there does not seem to be a well-motivated way of singling out Gina's experience as veridical at the expense of Yasmin's, or vice versa, considering that both Gina and Yasmin are standard perceivers viewing the lime in the same standard condition.²² However, one-ism is consistent with the object only instantiating one colour all over at the same time, and it is consistent with the realist position that objects instantiate colours.

Neither-ism says that none of the colour experiences involved in perceptual variation are veridical. This option is preferable for an *eliminativist*. Eliminativists argue that all our colour experiences are erroneous, since they argue that objects do not instantiate colours. But neither-ism is unappealing for a realist. For example, we could outline inter-personal variation as involving every colour experience that every standard perceiver would have of the lime in every standard condition. If the realist argued that all of these experiences are erroneous, then it is hard to see how realism is maintained, since every standard perceiver in every standard condition would universally represent objects as having colours that they do not instantiate.

Both-ism says that all the colour experiences involved in perceptual variation are veridical. There is an attraction to both-ism, since perceptual variation involves *standard* perceivers in *standard* conditions. This symmetry leads some of us to think all colour experiences involved in perceptual variation are veridical. But both-ism seems to entail that objects are multiply coloured all over at the same time. For example, if Gina and Yasmin's

²² On this concern, see Jackson and Pargetter (1987: 134), Hardin (1988: Ch. 2), Kalderon (2007: 566), and Cohen (2009: Ch. 2). A further concern for one-ism is that it leads to unknowable colour facts, since they may plead ignorance (e.g., Tye (2006: 177)) regarding which colour experience is veridical. Unknowable colour facts may also be a concern for both-ism (see Cutter (2021) for discussion).

experiences are both veridical, then arguably the lime is green all over and yellowish-green all over simultaneously. Therefore, the challenge for the theorist who prefers both-ism is to provide a theory which entails that an object can consistently be green all over and yellowish-green all over simultaneously.

Both-ism is compelling, but it is not always made wholly explicit why both-ism is compelling. Perceptual variation involves *standard* perceivers in *standard* conditions. The thought is that there is nothing non-standard about the perceivers or perceptual conditions which would lead us to think that one or both perceivers were having an erroneous colour experience. After all, if Yasmin had cerebral achromatopsia and was viewing the lime through coloured filters, but Gina was a nonanomalous trichromat viewing the lime in natural daylight, then one-ism might be more attractive, since the non-standard factors in Yasmin's situation may lead us to think that her experience was erroneous. But this wasn't the case: both Gina and Yasmin are standard perceivers in standard conditions. It is therefore the standardisation involved in perceptual variation which makes both-ism attractive. Let's now consider the phenomenon of colour illusions, and the circumstances in which we pre-theoretically think that colour illusions occur.

2.2.3. Colour illusions

Realists are inclined to think that *not all* colour experiences are veridical. Some colour experiences are *erroneous*: some experiences illusorily represent objects as instantiating colours that they do not instantiate.

One underlying thought regarding erroneous colour experience (or colour illusions) seems to be that there is something non-standard about the perceiver or perceptual condition which has caused the perceiver to represent the object as being a colour that it is not. For example, imagine you are under sodium vapour lighting and the t-shirt you are wearing looks blue, but when you go outside at midday in good lighting, the t-shirt looks pink. Arguably you have undergone a colour illusion. Under the sodium vapour lighting, the t-shirt was represented as blue, but this was shown to be erroneous because the t-shirt looked pink outside in good lighting. In this case, the non-standard *perceptual conditions* – the sodium vapour lighting – caused your visual system to represent the object as being a colour it is not. Now imagine a human with cerebral achromatopsia. Let's imagine that they are in standard lighting conditions, but they visually represent the same t-shirt as grey, and that no standard perceiver in a standard condition would represent the t-shirt as grey. The thought is that their non-standard *perceptual*

system has caused them to represent the t-shirt as being a colour (i.e., grey) that it is not. Thus, while both-ism in response to perceptual variation is compelling, there also seem to be cases in which objects do not instantiate the colours they are represented to instantiate.

2.2.4. The broad veridicality challenge

We therefore have two objectives on the table. The first is categorising all colour experiences involved in perceptual variation as veridical – in the spirit of a both-ism response to perceptual variation. And our second is categorising erroneous colour experiences as erroneous. When we put these objectives together, we have the:

BROAD VERIDICALITY CHALLENGE: Categorising all colour experiences involved in perceptual variation as veridical, and categorising erroneous colour experiences as erroneous.

The broad veridicality challenge will be the main focus of this paper. I will primarily be concerned with considering whether extant theories meet the broad veridicality challenge, and formulating some novel subject-dependent theories of colour which are inspired by meeting the challenge.

2.3. Subject-dependent theories

Subject-dependent theorists argue that colours are properties instantiated by objects which are relativised to perceivers and perceptual conditions. We shall explore whether extant subject-dependent theories of colour meet the broad veridicality challenge. But before we do that, I first outline prominent subject-dependent theories of colour. These include Cohen's relationalism and classic formulations of dispositionalism. Since Cohen's relationalism is of particular focus in this paper, I first provide a more detailed examination of the view. I then provide an outline of classic formulations of dispositionalism.

2.3.1. Cohen's fine-grained relations

Jonathan Cohen (2004, 2007, 2009, 2010) argues that colours are constituted by relations between objects and perceivers in viewing conditions. Central to Cohen's relationalism (henceforth 'relationalism') are particularly fine-grained colour relations. Consider the following example which will elucidate this type of relation. Our first perceiver, Rita, looks at an apple and it appears unique red (henceforth 'red') to her in condition one. 'Condition one' refers to the viewing conditions Rita is in when she views the apple. An entire description of the condition includes the lighting conditions, any contrast effects, the spatial position she occupies, etc. In this example, one fine-grained relation the apple bears to Rita is the following: red for Rita in *CI*. Let's now change Rita for someone else: Orla. Differently, the apple looks orange to Orla, and so a fine-grained relation the apple bears to Orla is the following: orange for Orla in *CI*. So, here we have a single apple bearing numerous relations to different perceivers in the same viewing condition. The object is red for Rita in *CI* and orange for Orla in *CI*. Cohen's view is that objects are only ever coloured in relation to perceivers, and this way of being coloured allows for an object to be red for Rita in *CI*, but orange for Orla in *CI*. Indeed, this view allows for an object to be green to one perceiver in one condition, but blue for another perceiver in another condition. As Cohen writes:

'According to the relationalist, an object is not merely red – it is red to one perceiver in one circumstance, blue to a second perceiver in a second circumstance, green to a third perceiver in a third circumstance, and so on (infinitely) into the night' (Cohen 2004: 470).

The central theoretical role of the fine-grained relations is to successfully deliver both-ism in response to perceptual variation. Whenever there is a case of perceptual variation, the object will bear a fine-grained relation to a perceiver (human or otherwise), and on Cohen's view, these fine-grained relations are veridically represented. For example, we have a case of perceptual variation regarding Rita and Orla. Rita and Orla are both standard perceivers viewing an apple in a standard perceptual condition. To Rita the apple looks red all over, and to Orla the apple looks orange all over. Cohen argues that the apple is red for Rita in the perceptual condition she is in, and orange for Orla in the perceptual condition she is in. Rita veridically represents the apple for her in *CI*, and Orla veridically represents the apple as orange for her in *CI*. Thus, Cohen's relationalism seems to deliver both-ism by invoking the instantiation and representation of fine-grained colour relations.

2.3.2. Cohen's equivocation

It will be helpful to attempt to get clear on the nature of the fine-grained relations. One point regarding this question is clear in Cohen's writing: Cohen is a *role*-functionalist about colours. So, Cohen does not, for example, identify red for a subject *S* in condition *C* with the property that realizes (if it is realized) the functional role of red for *S* in *C*. While Cohen is a role-functionalism regarding these fine-grained colour relations, Cohen seems to equivocate between two role-functionalism conceptions of the relation red for *S* in *C*. The first conception Cohen provides is the following:

'In this sense, role functionalism can be thought of as quantifying over first-order structural configuration types that realize the relevant functional role: red for *S* in *C* is the property of having some or other structural configuration type that realizes the functional role of disposing its bearers to look red to *S* in *C*' (Cohen, 2009: 179)

According to this above conception of red for *S* in *C*, the property red for *S* in *C* is identical to the higher-order property of having some structural property which realizes the functional role of disposing its holders to look red to *S* in *C*. However, Cohen also provides another conception of the relation red for *S* in *C*:

'Role functionalism holds that red for *S* in *C* is the functional role of disposing its bearers to look red to *S* in *C*' (Cohen, 2009: 182)

Cohen therefore also contends that red for *S* in *C* is to be identified with the functional role of disposing its holders to look red to *S* in *C*. Cohen therefore provides two conceptions of the relation red for *S* in *C*: on the first conception, red for *S* in *C* is identical to the higher-order property of having a realizer of the functional role of the disposition to look red to *S* in *C*, and on the second conception, red for *S* in *C* is identical to the functional role of disposing its holders to look red to *S* in *C*. Since Cohen does not delineate between these two conceptions, *perhaps* Cohen thinks that the higher-order property of having a realizer of the functional role of the disposition to look red to *S* in *C* is identical to the functional role of the disposition to look red to *S* in *C*.

Despite the equivocation, however, what is important for our purposes is that the higher-order property and the functional role are co-extensive, if we assume that the functional role always has a realizer. If the functional role always has a realizer, then the functional role

of the disposition to look red to *S* in *C* will be present *iff* the higher-order property of having a realizer of the functional role of the disposition to look red to *S* in *C* is present. So, whether an object bears the relation red to *S* in *C* will not be decided by which of Cohen's conceptions of the fine-grained relations is adopted.

2.3.3. Coarse-grained relations

Cohen also introduces the notion of coarse-grained colour relations, and these relations also do significant theoretical work in Cohen's account. Coarse-grained colour relations are relativized to a broader range of subjects and a broader range of viewing conditions. To help understand the coarse-grained colours, consider the following sentence:

The apple is red.

Cohen argues that when 'the apple is red' is uttered, the predicate 'is red' does not refer to a fine-grained colour relation. For example, if Rita were to utter 'The apple is red' whilst looking at an apple which looks red to her in condition one, the predicate 'is red' would not be referring to the relation red for Rita in *C1*. Instead, the predicate refers to a coarser grained colour relation. Cohen has provided two conceptions of coarse-grained relations in his work.

Cohen argues that when 'the apple is red' is uttered in context *G*, the predicate refers to the following relation: red for perceivers relevant to context *G* in perceptual circumstances relevant to those in context *G*. In more recent work, Cohen has cashed this notion out in terms of perceivers *similar* to the perceiver who views the apple and viewing conditions *similar* to those the perceiver is in ordinarily. So, for example, when Rita views the apple and utters 'the apple is red', the coarse-grained relation referred to by 'is red' is the property referred to by 'red for perceivers pretty much like herself in circumstances pretty much like those she normally encounters' (Cohen, 2007: 343). This is the 'similar conception' of the coarse-grained relations:

SIMILAR CONCEPTION: Coarse-grained colour relations range over similar perceivers in conditions that the perceiver ordinarily comes across. For example, coarse-grained purple is the relation of being purple for similar perceivers in conditions that the perceiver ordinarily comes across.

In earlier work, Cohen cashed out the coarse-grained relations in terms of *standard* perceivers in *standard* conditions. He writes a coarse-grained relation ranges over ‘S’ and C’, where S’ and C’ are the sorts of perceivers and viewing conditions we take to be normal’ (Cohen, 2004: 473). This is the ‘standard conception’ of the coarse-grained relations:

STANDARD CONCEPTION: Coarse-grained colour relations range over standard perceivers in standard conditions. For example, coarse-grained blueness is the relation of being blue for standard perceivers in standard conditions.

These two conceptions of the coarse-grained relations are particularly important later in this paper when we consider whether Cohen’s relationalism meets the broad veridicality challenge.

2.3.4. *Which relations are colours?*

Considering the positing of both the fine-grained relations and the coarse-grained relations, the following question comes to mind: are the colours constituted by the fine-grained colour relations or the coarse-grained colour relations? Cohen seems to contend that the coarse-grained relations are colour *properties*, just as the fine-grained colour relations are colour properties:

‘If [coarse-grained redness] and its ilk are indeed properties that are expressed by utterances of color predicates, this gives us good prima facie reason for taking them to be color properties – albeit typically less determinate/specific color properties than the fine grained colors’ (Cohen 2009: 109)

So, on Cohen’s view, the fine-grained colour relations are colour properties just as the coarse-grained colour relations are colour properties. So, if a perceiver represented a coarse-grained colour relation, they would represent a colour property, and if they represented a fine-grained colour relation, they would represent a colour property. Since Cohen contends that the fine-grained relations are colour properties just as the coarse-grained colour relations are colour properties, I take Cohen’s view to be that there are a host of fine-grained relations and coarse-grained relations which constitute colours. For example, I take it that on Cohen’s view, the relation red for Rita in *CI* constitutes a colour and the relation red for perceivers similar to Rita in viewing conditions similar to those Rita ordinarily comes across constitutes a colour.

2.3.5. *Classic dispositionalism*

We have explored Cohen's relational theory of colour. But let us now explore another subject-dependent theory of colour: *dispositionalism*. Formulations of dispositionalism involve colours being constituted by subject-dependent *dispositions*: in particular, dispositions to cause colour experiences in *standard* perceivers in *standard* conditions. The colour experience that colours are dispositions to cause can be spelled out in different ways. Let's consider some articulations of dispositionalism. Peacocke defines a colour (such as blue) with the disposition to cause the visual field to be colour' (such as blue') in the region where the object is presented. Peacocke writes:²³

"x is green" [is defined as] "x is disposed in normal circumstances to cause the region of the visual field in which it is presented to be green' in normal humans" (Peacocke, 1984: 375)

Gilbert Harman is also a dispositionalist. His articulation of dispositionalism involves a colour being identified with the disposition to be perceived as that colour by standard perceivers in standard conditions. Harman writes:

'an object's being a particular color C [is] its tendency to be perceived as C by normal observers viewing it under standard lighting conditions' (Harman, 1996: 2)

We may wonder what the differences are between Cohen's relationalism and classic dispositionalism. Indeed, with both of Cohen's role-functional conceptions of colour relations, he invokes dispositions. On the first conception, colour *F* for *S* in *C* is the property of having some structural configuration which realises the functional role of *disposing* its holders to look *F* to *S* in *C*. On the second formulation, colour *F* for *S* in *C* is the functional role of *disposing* its holders to look *F* to *S* in *C*. We may initially think that what distinguishes Cohen's relationalism from classic dispositionalism is that Cohen's relationalism does not *identify* colours with dispositions, whereas classic dispositionalism does. But I do not think this is a helpful way to distinguish the views. It is not as if the classic dispositionalist necessarily identifies colours with dispositions. Non-reductive dispositionalists may contend that colours are *constituted* (in some non-identity way) by dispositions to cause colour experiences in standard perceivers in standard conditions.

²³ Peacocke invokes primed colour properties to avoid a circularity worry for subject-dependent theories raised by Boghossian and Velleman (1989). I explore the circularity worry later. For now, I merely focus on formulations of dispositionalism.

We therefore seek a different way to distinguish Cohen's relationalism from classic dispositionalism. What distinguishes them is that Cohen's relationalism involves positing fine-grained colour relations, whereas classic dispositionalism *only* invokes dispositions which range over standard perceivers in standard conditions. The fine-grained relations – regardless of whether they are construed in terms of dispositions – are the hallmark of relationalism.

2.4. Scope-based challenges

As we know, the broad veridicality challenge is categorising all colour experiences involved in perceptual variation as veridical, and categorising erroneous colour experiences as erroneous. In this section, I argue that relationalism and classic dispositionalism fail to meet the broad veridicality challenge. This is due to the *scope* of the properties that are posited.

2.4.1. Fine-grained relations?

Cohen contends that there are particularly fine-grained colour relations between objects and perceivers. Crucially, these fine-grained colour relations are intended to account for the veridicality of colour experiences involved in perceptual variation. Consider Rita and Orla once again. Rita and Orla are standard perceivers viewing the same apple in a standard condition. To Rita, the apple looks red, and to Orla, the apple looks orange. On Cohen's view, Rita represents the apple as red for her in *CI*, and Orla represents the apple as orange for her in *CI*. Thus, both colour experiences are classed as veridical, since the relations obtain (in virtue of the apple looking the way it does), and the relations are veridically represented by Rita and Orla.

Indeed, whenever there is a case of perceptual variation, Cohen's relationalism will successfully class all the colour experiences involved as veridical. This is because whenever a standard perceiver has a colour experience of an object in a standard condition, the experience veridically represents the object as instantiating a fine-grained colour, since the object will be that colour for them in that perceptual condition (because the colour looks that colour to them in that perceptual condition). Relationalism therefore meets the first part of the broad veridicality challenge: categorising all the colour experiences involved in perceptual variation as veridical.

However, the fine-grained relations do not meet the second part of the broad veridicality challenge, since they do not classify erroneous colour experiences as erroneous. The problem is that the fine-grained relations categorise *all* colour experiences as veridical, and so therefore

fail to categorise erroneous colour experiences as erroneous.²⁴ For example, consider a perceiver viewing an object under sodium vapour lighting (which is a non-standard condition), and the perceiver represents the object as purple. Let us assume that we would pre-theoretically wish to class this colour experience as erroneous. Cohen's relationalism says that the perceiver *veridically* represents the object as purple for them in the perceptual condition they are in. Thus, the perceiver's colour experience is classed as veridical by the fine-grained relations. This generalises. All colour experiences which we pre-theoretically deem erroneous veridically attribute fine-grained colour relations. Therefore, whilst positing the fine-grained relations classes all the colour experiences involved in perceptual variation as veridical, merely positing the fine-grained relations fails to classify veridical colour experiences as veridical *and* erroneous colour experiences as erroneous.

2.4.2. *Similar perceivers?*

Cohen (2007) acknowledges that merely positing the fine-grained relations does not meet both elements of the broad veridicality challenge. Cohen attempts to class erroneous colour experiences as erroneous by also positing coarse-grained colour relations. As we know, in more recent work, Cohen (2007) has provided the similar conception of the coarse-grained relations. On this view, coarse-grained relations range over *similar* perceivers in conditions the perceiver ordinarily comes across. Cohen argues that whilst the representations of the fine-grained relations are always veridical, the representations of the coarse-grained relations are erroneous in the cases we deem erroneous. Falsely representing coarse-grained colour relations is what colour illusions are on Cohen's view.

Unfortunately, the similar conception of the coarse-grained relations fails to delineate the veridical from the erroneous. Let's consider a group of *possible* non-standard human perceivers. Let's imagine a group of non-standard perceivers that have a brain abnormality. The brain abnormality causes their visual system to process light very differently to standard human perceivers. The brain abnormality is called 'colouritis'. Due to colouritis, the colours these non-standard perceivers represent objects as having are very different to the colours standard perceivers in standard conditions represent the same objects as having. For example, let's imagine that all standard perceivers in standard conditions see an object *o1* as either being

²⁴ It is important to note that these claims regarding veridicality and error in my main text merely focus upon *non-deviantly* caused colour experiences (non-deviantly caused colour experiences are Cohen's main focus in his (2007)). I merely here focus upon 'ordinary illusion' in Cohen's parlance (Cohen 2007: 342). But I address deviant causation later (section 2.10.6., and footnote 24).

unique red or orange: this is the range of the perceptual variation involved with *oI* among standard perceivers in standard conditions. Let's now imagine that differently to standard perceivers, colouritis perceivers always see *oI* as *blue* in standard conditions. We can imagine too that the standard perceptual conditions are the conditions the colouritis perceivers typically come across.

Due to the colouritis, we would pre-theoretically class many of the colour experiences that colouritis perceivers undergo as involving colour illusions. For example, when they see *oI* as blue in standard conditions – when *oI* looks only either unique red or orange to standard perceivers in standard conditions – we would pre-theoretically class the experience of blueness as involving a colour illusion. The question is whether Cohen's similar conception of the coarse-grained relations classes the colour experiences of colouritis perceivers as involving colour illusions.²⁵

As we know, Cohen argues that when a perceiver undergoes a colour illusion, they veridically represent a fine-grained relation (e.g., blue for them in *C*), but they erroneously represent a coarse-grained relation (e.g., blue for perceiver similar to themselves in perceptual conditions they ordinarily come across). Let's now explore whether this analysis of colour illusions categorises the colour illusions the colouritis perceivers undergo as colour illusions. The colouritis perceiver who we will call 'Colby' sees a bicycle as blue in standard conditions due to their colouritis. Colby represents the bicycle as blue for them in *C*, and this representation is veridical. Colby also represents the bicycle as blue for perceivers similar to them in perceptual conditions they normally come across. Cohen argues that in cases of colour illusion, the representation of the coarse-grained relation is erroneous: indeed, false representations of coarse-grained colour relations is what colour illusions are on Cohen's view. However, problematically for relationalism, in cases involving colouritis, the representation of the coarse-grained relation is *veridical*: it is veridical because perceivers similar to Colby also

²⁵ Cohen also addresses colour illusions caused by what he calls 'deviant causation', such as those caused by telekinetic pathways. His analysis of these types of colour illusion is different to those which he deems to be ordinary colour illusions. Some may worry that the colour illusions caused by colouritis are caused by deviant causation. But this worry is misplaced. In Cohen's explanation of the error involved with illusions caused by deviant causation, Cohen (2007: 341) writes 'Why think that visual representations of color carry a commitment to the non-deviancy of their mode of production? Because it's hard to see why these representations count as *visual* if they can be brought about by non-visual (e.g., telekinetic) causal pathways...but that that commitment is in fact not satisfied, so the representation in question is erroneous.' Differently to colour illusions caused by deviant causation, the colour representations of those with colouritis are brought about by visual pathways – simply very abnormal visual pathways – and so the representations do count as visual. I'm unsure of what Cohen means by 'carry a commitment', but if the colouritis perceivers' representations do in some sense carry a commitment to the non-deviancy of their production, then this commitment *is* satisfied, precisely because the representation isn't caused by deviant (non-visual) means. Cohen's analysis of colour illusions caused by deviant causation is therefore not applicable to the colouritis cases.

have colouritis, and so they would also see the bicycle as blue in the perceptual conditions Colby ordinarily comes across. Cohen's relationalist analysis of colour illusions therefore does not categorise the colour illusions colouritis perceivers undergo as colour illusions.

The problem here for relationalism is that perceivers similar to colouritis perceivers such as Colby will also have colouritis, and so they will see the object as having the same colour that other colouritis perceivers (such as Colby) would see the object as having. This entails that when colouritis perceivers represent objects as bearing a coarse-grained relation, the representation will often be veridical, since the object often will be that colour for similar (colouritis) perceivers in conditions they ordinarily come across.

This is a challenge to Cohen's account which involves the *scope* of the coarse-grained colour relations. The issue here is that if the coarse-grained relations range over similar perceivers in conditions the perceiver ordinarily comes across, then some of the representations of the coarse-grained relations will be veridical when the non-standard perceiver is undergoing a colour illusion. Relationalism therefore faces the:

SIMILAR SCOPE CHALLENGE: If colours range over *similar* perceivers in perceptual conditions the perceiver ordinarily comes across, then the colour illusions of colouritis perceivers will not be classed as colour illusions, since the object will be that colour for similar (i.e., colouritis) perceivers in the perceptual conditions that the colouritis perceiver ordinarily comes across.

2.4.3. A just right story of similarity?

One question is the following: is there a 'just right' story of similarity that captures the experiences of the colouritis perceivers as erroneous, but the colour experiences of standard perceivers in standard conditions as veridical? Here's how such a story might go. When a colouritis perceiver represents an object as blue for perceivers similar to them in conditions they normally encounter, perhaps 'similar' refers to *standard* perceivers which are relatively similar to colouritis perceivers for which the object would *not* look blue in conditions the colouritis perceiver ordinarily comes across. This would class the colour experiences of colouritis perceivers as erroneous, since the similar perceivers (i.e., certain standard perceivers) would not represent the object as being that colour in such conditions.

Let's now extend this 'just right' story of similarity to standard perceivers in standard conditions. Imagine that a standard perceiver in a standard perceptual condition represents an

object as red. We want to classify such an experience as veridical due to our both-ism inclination. Perhaps when such a perceiver represents the object as red for similar perceivers in conditions they ordinarily come across, ‘similar’ refers to standard perceivers for which the object would look red in standard conditions. Thus, when a standard perceiver in a standard perceptual condition represents an object as coarse-grained red, this representation will be veridical, since ‘similar’ refers to standard perceivers for which the object would look red in conditions the perceiver ordinarily comes across.

On this view, colouritis perceivers are classed as undergoing colour illusions, whereas standard perceivers in standard conditions are classed as having veridical colour experiences.

The problem with this attempt at a ‘just right’ story of similarity is twofold. Firstly, we seem to have departed from *similar* perceivers, and so it does not seem that this is a just right story of *similarity*. Secondly, and more importantly, different notions of similarity are invoked in cases of colouritis perceivers compared to cases involving standard perceivers in standard conditions. In the case of colouritis perceivers, ‘similar’ refers to *standard* perceivers for which the object would not look that colour. This is problematic because presumably colouritis perceivers are more similar to colouritis perceivers than standard perceivers. Furthermore, in the case of standard perceivers in standard conditions, ‘standard’ refers to other standard perceivers in standard conditions, and not to colouritis perceivers. We therefore have a framework whereby what counts as being a similar perceiver is dependent upon the type of perceiver having the colour experience. And this is because what counts as being similar to a colouritis perceiver is different to what counts as being similar to a standard perceiver. This is an undesirable consequence. Thus, let’s consider another possible way in which Cohen may try to respond to the similar scope challenge.

2.4.4. *All perceivers?*

Cohen might try to respond to the similar scope challenge by insisting that in the context of the coarse-grained relations, ‘similar’ refers to a broader range of perceivers: perhaps *all* human perceivers. Colby’s representation of the bicycle as blue for all human perceivers in perceptual conditions Colby ordinarily comes across would then come out as false, since despite being blue for colouritis perceivers in perceptual conditions Colby ordinarily comes across, it is not blue for all human perceivers in perceptual conditions Colby ordinarily comes across.

However, this revision of the coarse-grained relations to instead range over *all* human perceivers is inadequate, since it renders too many representations of coarse-grained colour

relations as erroneous. For example, consider standard perceiver Rita and her experience of an apple as red in standard conditions. We wish to class this colour experience as veridical, considering that Rita is a standard perceiver in a standard condition. However, if her representation of the coarse-grained relation was red for *all* human perceivers in perceptual conditions Rita ordinarily comes across, this would come out false, since the group of perceivers would include colouritis perceivers who would see the apple as blue in the perceptual conditions Rita ordinarily comes across. Rita would therefore be in a state that Cohen would label as involving a colour illusion. But, importantly, Rita should not be categorised as being in such a state, since she is a standard perceiver viewing a coloured object in standard lighting conditions. Thus, changing the scope of the coarse-grained relations to range over all perceivers of that species would render the category of ‘colour illusions’ as including many colour experiences we wish to class as veridical.

2.4.5. *All standard perceivers?*

To avoid the problematic consequence that colouritis perceivers do not undergo colour illusions, I think we need to provide a conception of colour whereby colours do not range over similar perceivers in conditions they ordinarily come across. Classic dispositionalists argue that colours are dispositions which are relativised to standard perceivers and standard conditions. Furthermore, in earlier work of Cohen (2004), we see the *standard conception* of the coarse-grained colour relations whereby such relations range over standard perceivers in standard conditions. Indeed, Cohen argues that falsely representing coarse-grained colour relations (which are understood in terms of standard perceivers) accounts for colour illusions:

‘However, if S or C lie outside the conditions for normality presupposed by our ordinary thought and talk about color, then we can recognize a sense in which the way x looks to S in C can be erroneous; viz., that it does not match the way x looks to S’ in C’, where S’ and C’ are the sorts of perceivers and viewing conditions we take to be normal’ (Cohen, 2004: 473)

Prima facie, colours being relativised to *standard* perceivers in *standard* viewing conditions classes the colour illusions of colouritis perceivers as colour illusions. On this view, when colouritis perceiver Colby represents the bicycle as coarse-grained blue, he represents it as blue for standard perceivers viewing the bicycle in standard viewing conditions. And this representation is false, since whilst the bicycle may be blue for perceivers similar to Colby in viewing conditions Colby ordinarily comes across, the bicycle is not blue for standard

perceivers – a group which only includes non-colouritis perceivers – in standard conditions. Thus, perhaps understanding colours (either dispositions or coarse-grained relations) as being relativised to standard perceivers in standard conditions dissolves the worry raised by the similar scope challenge.

However, one natural way to understand the scope of these properties (either the dispositions or the coarse-grained relations) is in terms of them being relativised to *all* standard perceivers in *all* standard conditions. For example, green (either a disposition or relation) is green for all standard perceivers in all standard conditions. What has gone unnoticed, however, is that if colours are relativised to all standard perceivers in all standard conditions, then our theory of colour classes erroneous colour experiences as erroneous, but fails to class veridical colour experiences as veridical. Let me explain.

First consider how the approach classes erroneous colour experiences as erroneous. Consider any colour experience which we would pre-theoretically deem erroneous. If such an experience represents an object as colour *F* for all standard perceivers in all standard conditions, then this representation will be erroneous. After all, if the object were colour *F* for all standard perceivers in all standard conditions, then presumably we would not pre-theoretically class the colour experience as erroneous. For example, consider a non-standard perceiver in a non-standard condition who represents a pen as yellow, and let us assume that we pre-theoretically class this colour experiences as erroneous. If the perceiver represents the pen as yellow for all standard perceivers in all standard conditions, then the representation will be false, since the pen is not yellow for all standard perceivers in all standard conditions. Again, if the pen *were* yellow for all standard perceivers in all standard conditions, then presumably we would not pre-theoretically class the colour experience of the non-standard perceiver in the non-standard condition as erroneous. Thus, colours ranging over all standard perceivers in all standard conditions seems to class erroneous colour experiences as erroneous.

But let's now consider how this kind of view fails to class veridical colour experiences as veridical. Consider the apple which looks red all over to Rita but orange all over to Orla. In the spirit of both-ism, we want to classify both experiences as veridical. However, if Rita represented the apple as red for *all* standard perceivers in *all* standard conditions, then her representation would be erroneous, since the apple is not red to all standard perceivers in all standard conditions. The apple is, for example, orange to Orla in the standard perceptual condition that she is in. Therefore, if colours are relativised to all standard perceivers in all standard conditions, then many (if not all) colour experiences had by standard perceivers in

standard conditions will be classed as erroneous, since the object will rarely (if ever) be that colour for all standard perceivers in all standard conditions. Thus, it is the existence of perceptual variation which entails that if colours are relativised to all standard perceivers in all standard conditions, then colour experiences will nearly always (if not always) be erroneous. Subject-dependent theorists therefore face the:

STANDARD SCOPE CHALLENGE: If colours are properties which are relativised to *all* standard perceivers in *all* standard conditions, then colour experiences of standard perceivers in standard conditions are often (if not always) erroneous, since the object will rarely (if ever) be that colour for all standard perceivers in all standard conditions.

I now want to elucidate what the standard scope challenge is not. One influential objection which is often levied against invoking standard perceivers and standard conditions is Hardin's (1988: 67-82) thorny objection that there is no non-arbitrary way to delineate standard perceivers from non-standard perceivers and standard conditions from non-standard conditions. The standard scope challenge is very different from Hardin's objection. The standard scope challenge assumes that even if there is a non-arbitrary way of delineating the standard from the non-standard, if colours range over all standard perceivers in all standard conditions, then nearly all (if not all) colour experiences had by standard perceivers in standard conditions will be wrongly classed as erroneous.

We are now going to depart from scope-based challenges for subject-dependent theories of colour. I am now going to explore the medium in which colour properties are represented, with a particular focus upon how Cohen analyses the medium of colour representation. As will become clear, how we understand the medium of colour representation will bear upon whether our theory of colour meets the broad veridicality challenge.

2.5. The medium of colour illusions

This section is once again concerned with the broad veridicality challenge: in particular, categorising erroneous colour experiences as erroneous. I focus upon Cohen's articulation of the medium of colour illusions. But the lessons I draw are general. I explore three interpretations of relationalism. On the first interpretation, coarse-grained colour relations are only represented cognitively and doxastically. On the second interpretation, coarse-grained relations are represented visually in virtue of being represented cognitively and doxastically. I

argue that both interpretations face the same problem: some colour illusions occur when the perceiver fails to believe that the conditions are standard and/or fails to believe that they are a standard perceiver. I argue that the third interpretation avoids this problem, since it says that colours are represented cognitively but non-doxastically. The general lesson is that colour illusions cannot merely be erroneous doxastic representations, since some colour illusions persist regardless of the doxastic state of the individual.

2.5.1. *Just cognitive & doxastic*

In this section, I explore the interpretation of Cohen upon which the coarse-grained relations are only doxastic representations of the cognitive system. I argue that positing that colour illusions are only false doxastic cognitive representations of coarse-grained relations is problematic because some colour illusions occur when there are no such representations of coarse-grained relations to be false. Let's first consider Cohen's description of the medium in which the coarse-grained relations are represented:

'I am proposing that (the most important class of) color illusions occur only in the context of our thought and talk about color, and only against a background of presuppositions organizing this thought and talk. Plausibly, such presuppositions are contributions of the cognitive system, or at least the cognitive-cum-perceptual system as a whole rather than the visual system *per se*. And if that is right, then such illusions are not aptly described as errors of the visual system *per se*, but only as errors of the cognizing/perceiving system as a whole' (Cohen, 2007: 347)

Cohen is not always particularly explicit about where the fine-grained relations are represented, but he *seems* to contend that they are at least represented visually. He writes:

'when I visually represent objects as being green to me in my perceptual circumstance (or as bearing any color) ...' (Cohen, 2007: 341)

We therefore have a rather strange view whereby some colours are represented visually (fine-grained colours), and other colours are represented cognitively (coarse-grained colours).

Now, on one interpretation of the above larger quote concerning colour illusions, Cohen is claiming that colour illusions are false beliefs/presuppositions/thoughts about coarse-grained

relations, and colour illusions are not visual illusions.²⁶ We therefore have the following understanding of colour illusions on the table:

JUST COGNITIVE & DOXASTIC: The coarse-grained relations are only represented doxastically and cognitively but not visually, and so colour illusions are only false cognitive doxastic representations but not false visual representations.

Before getting to my argument against certain colours only being represented cognitively and doxastically, I first want to highlight some more remarks of Cohen. He anticipates one objection against his account which concerns the medium of representation. I think it is important – for the sake of clarity – to stipulate what my objection is not before getting to what my objections is. Cohen writes:

‘But, an opponent will suggest, this sort of derivatively erroneous status is not enough: what is needed is that there are illusions involving the representations of color in the visual system per se— i.e., in the visual system considered on its own, rather than considered as part of a larger cognitive/perceptual system. But I think this objection depends on treating our intuitions about error with much more evidential authority than they deserve’ (Cohen, 2007: 348)

The argument I now make against Cohen is not the one he has anticipated: I will not be arguing that colour illusions are visual illusions and that any theory which denies this fact is wrong, even though I do have sympathy with this line of reasoning. My argument will not therefore be relying upon so called ‘intuitions about error’. My argument, instead, is that relocating the error to the cognitive system has a more problematic consequence: such a move entails that Cohen’s relationalism fails to categorise some colour illusions as colour illusions. My central claim will be that some colour illusions occur even when the perceiver believes that the perceptual conditions are non-standard and/or when they believe that they are a non-standard perceiver, but that this group of colour illusions are not categorised as colour illusions by relationalism.

²⁶ In a recent paper, John Morrison (2020: 300) has assumed this interpretation and briefly noted that Cohen’s claim that colour illusions are not visual illusions is a problematic consequence of his explanation of colour illusions. Morrison notes that some colour illusions are entirely perceptual. The argument I make in this section is much more expansive. I explore the ramifications of the coarse-grained relations being represented cognitively and argue that such a position fails to categorise all colour illusions as colour illusions.

Let us first consider a case that Cohen utilises. Understanding this case, and particularly Cohen's comments of this case, will help elucidate the problem. Imagine a psychophysics lab with the abnormal lighting conditions. In the lab, a tomato looks red to Sally. However, in standard lighting conditions, the tomato would not look red to Sally or to any other standard perceiver. Regarding Sally in the lab, Cohen writes:

'As it happens, the tomato is red for Sally in C; so if she had represented only that it is red for her in C, she would have avoided error. But she did not so confine herself. Rather, because the experimental manipulation was subtle enough not to tip her off, she represented it less cautiously as being [coarse-grained red]—which it was not' (Cohen 2007: 343)

Sally is taken into a psychophysics lab and tricked into assuming that the conditions she is in are normal, but in fact the conditions are not normal, and this abnormality plays a role in causing the illusion. Cohen seems to suggest that it is because Sally believes that the conditions are normal – or at least that she fails to believe that the conditions are abnormal – that she represents the tomato as coarse-grained red. Cohen writes '*because* the experimental manipulation was subtle enough not to tip her off, she represented it less cautiously as being [coarse-grained red]' (emphasis added) (Cohen 2007: 343). The implied thought here is that the coarse-grained relations are represented cognitively and doxastically. If Sally believed that the perceptual conditions were *abnormal* – for example, if she believed that she was being tricked in a psychophysics lab – then she would not represent the tomato as coarse-grained red. She would not represent the tomato as red for standard perceivers in standard conditions, since she would not believe the conditions were standard. If this were to happen, then due to the lack of the representation of the coarse-grained colour relation, there would be no false representation of coarse-grained colour, since there would be no representation to be false. Sally would only represent the fine-grained colour relation – red for her in C – and this fine-grained relation would obtain.

This reasoning is problematic for Cohen and others sympathetic to relationalism. Let us now imagine a different case whereby Sally is told about the trick being played in the psychophysics lab: she was 'tipped off' in Cohen's phrase. Once she is told, Sally believes the perceptual conditions she is in are abnormal. In this case, therefore, Sally visually represents the tomato as red to her in the perceptual conditions she is in: she represents the fine-grained colour relation. But she does not cognitively and doxastically represent the tomato as coarse-grained red, precisely because she believes the perceptual circumstance is abnormal. There is

therefore no representation of coarse-grained relation in which to locate the colour illusion, since Sally does not believe that the tomato is red for similar/standard perceivers in standard viewing conditions (or viewing conditions she normally comes across, which are standard viewing conditions).

However, in this above example, whereby Sally visually represents the tomato as fine-grained red but fails to cognitively represent the tomato as coarse-grained red, we still pre-theoretically wish to class Sally as undergoing a colour illusion. Sally's colour experience is a case we would pre-theoretically deem as erroneous (we can assume that no standard perceiver in a standard condition would represent the tomato as red). Sally undergoes a colour illusion despite her belief that the perceptual condition she is currently in is abnormal. However, Cohen fails to categorise this case as a colour illusion. On Cohen's view, since Sally believes that the perceptual condition is abnormal, Sally only visually represents the fine-grained relation, and the fine-grained relation obtains. Sally does not cognitively and doxastically represent the coarse-grained relation, due to her beliefs at the time, and so on Cohen's view, there is no colour illusion. But there is a colour illusion! On the just cognitive and doxastic interpretation, therefore, Cohen's relationalism fails to appreciate that some colour illusions occur even when the perceiver believes the perceptual conditions they are in are abnormal.

The same reasoning can be applied in terms of beliefs concerning standard perceivers. We can imagine a case where, differently, Sally has colouritis, and she knows she has colouritis. Due to her colouritis, she sees an object as red for her in *C*, whereas standard perceivers would see the object as being a different colour in the same perceptual condition. Sally undergoes what we would pre-theoretically label as a colour illusion. However, due to Sally believing that she is a non-standard perceiver – due to her knowing she has colouritis – she does not cognitively and doxastically represent that the object is red for standard perceivers in standard conditions (if we assume the standard conception of the coarse-grained relations). Sally therefore does not doxastically represent a coarse-grained red relation. Since she does not represent the relation, on the just cognitive interpretation, Sally does not undergo a colour illusion. But Sally *does* undergo a colour illusion.

The problem I have raised for Cohen is that some colour illusions occur when the perceiver believes the perceptual conditions they are in are abnormal, and some colour illusions occur when the perceiver believes that they are not a standard perceiver. But the just cognitive interpretation of Cohen's account does not categorise such cases as colour illusions. This is because, according to this view, colour illusions are false doxastic cognitive representations of

coarse-grained colour relations. Problematically for relationalism, some colour illusions occur in the absence of such representations.

2.5.2. *Cognitive and doxastic and visual*

Let us now explore a different interpretation of Cohen and consider whether it avoids the objection I have raised for the just cognitive interpretation. On another interpretation of Cohen's account, Cohen argues that colour illusions are false visual representations, and such representations occur *in virtue of* doxastic cognitive representations. On this interpretation, then, the representations of the coarse-grained relations are not produced solely by the visual system: coarse-grained colour relations are represented by the cognitive system and these representations penetrate the visual system and the relations are then represented visually. Consider:

COGNITIVE (AND DOXASTIC) AND VISUAL: Coarse-grained relations are represented cognitively and doxastically, and these cognitive representations penetrate the visual systems such that the coarse-grained relations are then represented visually.²⁷

I am now going to argue that this interpretation faces the same problem as the first interpretation: some colour illusions occur in the absence of doxastic cognitive representations of coarse-grained colour relations. Let's imagine Sally in the psychophysics lab once again. The tomato is not red in standard perceptual conditions, but it looks red to Sally in the lab due to the psychophysicist manipulating the lighting conditions. Differently to the story outlined by Cohen, let's imagine that the psychophysicist informs Sally that it only looks red in the lab due to the non-standard lighting conditions, and that it would look to have a different colour in standard lighting conditions. Due to being informed of this, Sally does not form the belief that the tomato is red for standard perceivers in standard conditions: she therefore does not form the belief that the tomato is coarse-grained red. Since she does not form the belief that the tomato is coarse-grained red, there is no belief to penetrate her visual system, and so the coarse-grained red relation is not represented by her cognitive system *or* her visual system.

Despite the absence of these representations, however, Sally does undergo a colour illusion: the tomato only looks red in the lab due to the non-standard lighting conditions created by the psychophysicist. Sally is undergoing what we would pre-theoretically class as a colour

²⁷ One example of a philosopher who argues that colour experience is cognitively penetrated is Macpherson (2012: 38).
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illusion. Yet, importantly, the cognitive (and doxastic) and visual interpretation does not categorise Sally as undergoing a colour illusion, precisely because the coarse-grained colour relation is not represented cognitively or visually. Similarly, if Sally were informed that she had colouritis and so was therefore a non-standard observer, and that the tomato would not look red to standard observers in standard conditions, then Sally would not form the belief that the tomato is red for standard perceivers in standard conditions. Sally would therefore not cognitively represent the tomato as coarse-grained red, and so there would be no cognitive representation of the coarse-grained relation to penetrate her visual system. The coarse-grained relation would therefore not be represented cognitively or visually, and so according to this interpretation of relationalism, Sally does not undergo a colour illusion. But, as assumed, Sally does undergo a colour illusion.

So, regardless of which of the first two interpretations is correct, the central problem with the account is that some colour illusions occur when the coarse-grained relations are not represented cognitively. Some colour illusions occur when the perceiver believes that the conditions are non-standard and/or if they believe that they are not a standard perceiver. On Cohen's view, however, when a perceiver holds such a belief/beliefs, they do not produce the representation (cognitive and/or visual) which would be deemed to be erroneous, and so they are wrongly categorised as not undergoing a colour illusion. Relationalism therefore faces the:

THE COGNITIVE CHALLENGE: Some colour illusions occur when the coarse-grained colour relations are not represented doxastically. But, according to the (1) just cognitive and doxastic interpretation, and (2) cognitive (and doxastic) and visual interpretation, if the coarse-grained relations are not represented doxastically, then there is no colour illusion.

2.5.3. *Cognitive and non-doxastic?*

Perhaps Cohen would respond to my above arguments by arguing that the cognitive representations of coarse-grained relations are *non-doxastic* representations. Indeed, Cohen writes:

‘What I am suggesting, then, is that we represent the exemplification of colors on two simultaneous layers: we represent that x is red for S in C, and, often, we additionally represent that x is [coarse-grained red]. The illusions now under discussion occur when the subject makes the (subdoxastic) transition from the first representation, which is veridical, to the second representation, which is erroneous’ (Cohen, 2007: 344)

He argues here that subjects make a subdoxastic *transition* from the representation of the fine-grained relation to the representation of the coarse-grained relation. This of course doesn't entail that the representations themselves are subdoxastic: merely that the transition from one representation to the other is subdoxastic. But perhaps Cohen would go further and argue that the representations of the coarse-grained relations are cognitive but non-doxastic representations. This possibility provides us with the following third interpretation:

NON-DOXASTIC & COGNITIVE: The representations of the coarse-grained relations are cognitive non-doxastic representations. Thus, colour illusions are false non-doxastic cognitive representations of coarse-grained relations.

One initial problem with this approach is that it seems that the coarse-grained relations *can* be represented doxastically. For example, a perceiver can believe that the object is red for similar/standard perceivers in similar/standard conditions. Furthermore, it seems plausible that, *prima facie* at least, the beliefs regarding the coarse-grained relations can causally affect what coarse-grained relations are represented non-doxastically. For example, it seems plausible that (1) a perceiver could believe that an object is not red for similar/standard perceivers in similar/standard conditions, and that (2) this doxastic representation could cause them to *fail* to non-doxastically represent the object as red for similar/standard perceivers in similar/standard conditions. For example, if a perceiver believes that a chair is not brown for similar/standard perceivers in similar/standard conditions, then it is plausible that this would cause them to not form the non-doxastic cognitive representation that the chair is brown for similar/standard perceivers in similar/standard conditions. If this *could* occur, then the suggestion that coarse-grained relations are represented cognitively and non-doxastically does not evade my critique. This is because, as I have argued, some colour illusions occur when the perceiver believes that the object is not colour *F* for similar/standard perceivers in similar/standard conditions. Thus, *if* these beliefs can prevent there being cognitive non-doxastic representations of the object as *F* for similar/standard perceivers in similar/standard conditions, then Cohen's relationalism does not categorise all colour illusions as colour illusions.

Cohen may argue that whilst a subject may believe that the conditions they are in are non-standard, or at least fail to believe that the conditions are standard, then this does not affect their non-doxastic representation that the conditions they are in are standard. Cohen may argue that when a subject sees an object as red, for example, they non-doxastically represent the

object as coarse-grained red, and this non-doxastic representation is unaffected by any relevant beliefs the subject may hold. Cohen may argue that these cognitive non-doxastic representations are causally isolated from doxastic representations. This approach does not merely locate colour illusions in the cognitive system – which itself may seem rather radical – it rather says that colour illusions are false non-doxastic cognitive representations which are causally isolated from doxastic representations. This approach would evade my critique, since my argument is that colour illusions can persist regardless of the doxastic state of the individual. If colour illusions are false cognitive *non*-doxastic representations which cannot be causally affected by beliefs, then this is consistent with the datum that colour illusions persist regardless of the doxastic state of the individual.

The kind of view on the table says that fine-grained relations are represented visually, and coarse-grained relations are non-doxastic cognitive representations which are causally isolated from doxastic representations. The view is that colour illusions are false non-doxastic cognitive representations of coarse-grained relations. On this view, it is a further question as to whether the coarse-grained relations are also represented doxastically and/or visually. Perhaps Cohen would argue that a colour illusion occurs when there is a false cognitive non-doxastic representation of a coarse-grained relation, and a false visual representation of a coarse-grained relation. On this kind of view, colour illusions are visual and cognitive phenomena.

What I have argued in this section is that it is important that a theory of colour is consistent with colour illusions persisting through the doxastic state of the individual. If colour illusions are dependent on the perceiver having certain beliefs, then the broad veridicality challenge will not be met, since some colour illusions occur when the perceiver does not have the requisite belief(s). In order to meet the broad veridicality challenge, therefore, colour illusions can be merely false visual representations, false visual and false cognitive (non-doxastic) representations, or merely false cognitive (non-doxastic) representations. In order for a theory of colour to meet the broad veridicality challenge, the theory must contend that colour illusions occur in the above medium(s).

2.6. Gradations in veridicality.

So far, we have focused upon whether relationalism and classic dispositionalism successfully meet the broad veridicality challenge. I have argued that there are significant challenges concerning the scope of the colours and the medium in which colours are represented. This

section departs from the broad veridicality challenge to provide another veridicality-related desideratum for a theory of colour. I argue that we seem to have a pre-theoretic understanding of *gradations* in the veridicality of colour experiences. I outline such gradations and then consider whether relationalism and classic dispositionalism align with the pre-theoretic understanding of such gradations.

2.6.1. The gradations.

It is natural to think that we represent objects as instantiating colours (such as blueness) and as instantiating shades (such as azure). This is not to say that shades are not colours, but it is helpful to talk this way for the sake of this section. I think we have a pre-theoretic conception of colour experiences either being totally veridical, partially veridical, or totally erroneous. These gradations in veridicality relate to the representation of colours and shades. Let us start with the totally veridical cases. Imagine that you see an apple before you and the apple looks both crimson and red. If the apple is both crimson and red, then the colour experience is totally veridical, since the representation of the apple as crimson is veridical and the representation of the apple as red is veridical. These cases involve:

TOTAL VERIDICALITY: An object is veridically represented as instantiating a colour and veridically represented as instantiating a shade.

Now consider a case whereby you look at an apple and it looks crimson and red to you, but to your friend the apple looks scarlet and red. Perhaps you both agree that the apple is red, but you disagree about the shade of the apple: your friend thinks it is scarlet whereas you think it is crimson. You both decide to take the apple into better lighting conditions – conditions we may consider standard – and the apple now looks scarlet to both you and your friend. You now agree with your friend that the apple is not crimson, despite the initial appearance to the contrary. We might think that in the poor lighting conditions you veridically represented the apple as red but erroneously represented the apple as crimson. This case therefore involved:

PARTIAL VERIDICALITY: An object is veridically represented as instantiating a colour but erroneously represented as instantiating a shade.

Let us now consider the totally erroneous cases. Consider once again a case where you look at an apple and the apple looks crimson and red to you. But let us imagine that you are viewing

the apple in unusual lighting conditions and in standard lighting conditions the apple would look green to you. We may think in this case that the apple is neither crimson nor red, and so your colour experience is totally erroneous with respect to colour and shade. In these cases, the experience does not veridically attribute a colour to an object. These cases involve:

TOTAL ERROR: An object is erroneously represented as instantiating a colour and erroneously represented as instantiating a shade.

We may wonder if there are cases whereby the object is veridically represented as instantiating a shade but erroneously represented as instantiating a colour. I do not think such cases are conceptually possible. The perceiver could not veridically represent an object as crimson but erroneously represent the object as green, for example. And this is because an object cannot be represented as both crimson and green (not in the same location, anyway). If an object is represented as instantiating a colour all over, then it is conceptually possible that the object is represented as instantiating a shade of that colour, but it is not conceptually possible that the object is represented as instantiating a shade of a different colour. Let's now consider how relationalism fares in providing an analysis of gradations in veridicality which satisfies our pre-theoretic conception of such gradations.

2.6.2. Relationalism & gradation analysis.

Cohen does not provide an explicit analysis of total veridicality, partial veridicality, and total error. I therefore extrapolate from his theory to provide an analysis. It turns out that the way in which relationalism can distinguish between such gradations is very complicated. Indeed, not only is the account more complicated than our pre-theoretic understanding, but it is also fundamentally different our pre-theoretic conception of gradations in veridicality.

In the case of total veridicality, Cohen's relationalism can say that the experience veridically attributes a fine-grained shade relation (e.g., shade *F* for *S* in *C*), a fine-grained colour relation (e.g., colour *F* for *S* in *C*), a coarse-grained shade relation (e.g., shade *F* for similar/standard perceivers in similar/standard conditions), and a coarse-grained colour relation (e.g., colour *F* for similar/standard perceivers in similar/standard conditions). Thus, Cohen can say that all attribution of colour is veridical in cases of total veridicality. In the case of partial veridicality, Cohen's relationalism can say that the experience veridically attributes a fine-grained shade relation, a fine-grained colour relation, and a coarse-grained colour relation, but

erroneously attributes a coarse-grained shade relation. There is here a sense in which there is partial veridicality, considering that some attributions are veridical whereas others are not. And in the case of total error, Cohen's relationalism can say that the experience veridically attributes a fine-grained shade relation, a fine-grained colour relation, but erroneously attributes a coarse-grained colour relation and a coarse-grained shade relation.

There are two ways in which this relationalist analysis does not accord with our pre-theoretic understanding of the gradations. Firstly, Cohen's analysis does not accord with the *number* of properties we pre-theoretically think are attributed. We pre-theoretically think that total veridicality, partial veridicality, and total error all involve attribution of two properties (a colour and a shade). Cohen would say that it involves attribution of *four* properties (two fine-grained relations and two coarse-grained relations). We might think that my initial set up was not completely thorough given that we arguably attribute properties less determinate than colours and properties more determinate than certain shades. For example, we might attribute *reddish* to a property as well as the colour red. And we might attribute *crimson* δ (a determinate of crimson) to an object, as well as attributing crimson to the object. The issue with relationalism is that wherever we pre-theoretically think that there is attribution of one colour/shade to an object, relationalism says that there is attribution of two colour/shade properties (a fine-grained colour/shade and a coarse-grained colour/shade).

Secondly, and much more importantly, relationalism does not accord with our pre-theoretic understanding of when a colour/shade is veridically attributed to an object. When we pre-theoretically think that a colour experience is *totally* erroneous, we think that the experience erroneously attributes a colour and a shade to the object, and that there is *no* veridical attribution of a colour/shade. According to relationalism, however, colour experience always veridically attributes a fine-grained shade relation and a fine-grained colour relation. This is an explicit commitment of relationalism, not merely an argument I have made in this paper. Thus, according to relationalism, the class of colour experiences falling under 'total error' all involve veridical attribution of colours/shades. Therefore, an explicit commitment of relationalism entails that it does not accord with our pre-theoretic understanding of gradations in veridicality.

2.6.3. *Classic dispositionalism & gradation analysis.*

Similarly to Cohen's relationalism, the classic dispositionalist has not provided an explicit analysis of total veridicality, partial veridicality, and total error. But we can imagine how such

an analysis might go. The classic dispositionalist can argue that in the case of total veridicality, there is veridical attribution of the disposition to look colour F to standard perceivers in standard conditions, and veridical attribution of the disposition to look shade F to standard perceivers in standard conditions. They could argue that partial veridicality involves veridical attribution of the disposition to look colour F to standard perceivers in standard conditions, and erroneous attribution of the disposition to look shade F to standard perceivers in standard conditions. And they can lastly argue that total error involves erroneous attribution of the disposition to look colour F to standard perceivers in standard conditions, and erroneous attribution of the disposition to look shade F to standard perceivers in standard conditions.

The classic dispositionalist fares better than Cohen's relationalism in terms of the number of properties we pre-theoretically think are attributed to objects. The classic dispositionalist argues that all colour experiences involve an attribution of a colour and an attribution of a shade (unlike Cohen's relationalism which says that there is attribution of at least four colour/shade related properties). When we pre-theoretically think that a colour/shade is attributed to an object, classic dispositionalism vindicates the thought that there are not two colour properties attributed to the object.

An explicit commitment of relationalism is that all colour experiences involve veridical attribution of fine-grained colours. Thus, by the own admission of relationalism, the theory does not accord with our pre-theoretic understanding of total error. This is different to classic dispositionalism. It is not an explicit commitment of classic dispositionalism that all colour experiences involve veridical attribution of colour or erroneous attribution of colour. To this end, the explicit commitments of classic dispositionalism align with our pre-theoretic understanding of the gradations in veridicality in colour experience, unlike the explicit commitments of relationalism. I'll now introduce part two of this paper.

2.7. Introduction: part two

Part two of this paper is primarily concerned with formulating a subject-dependent theory of colour which meets the broad veridicality challenge. §2.8. takes stock and outlines the task at hand. The primary task is to provide a theory of colour which meets the broad veridicality challenge: this involves meeting the scope-based challenges and the medium challenge. A further challenge is meeting the gradation challenge. §2.9. outlines a novel subject-dependent theory of colour named 'scope-change theory'. Scope-change theory meets the broad

veridicality challenge in virtue of the scope of the represented colours changing dependent upon whether the colour experience is veridical or erroneous. Scope-change theory also meets the gradation challenge. But the theory comes at two seeming costs: (1) the veridicality of colour experience is more fundamental than what is represented, and (2) the potentially absurd consequence that we do not know what colours are represented until we know if the colour experience is veridical/erroneous.

§2.10. develops the main result of this paper: *mono-minimalism*. Mono-minimalism is also a subject-dependent theory of colour. According to the mono-minimalist, satisfying the broad veridicality challenge involves providing precise criteria which delineate veridical colour experiences from erroneous colour experiences. After all, if we are not clear which colour experiences are veridical or erroneous, then we cannot be sure that our theory succeeds in carving the veridical from the erroneous. Providing these criteria involves closely examining why it is compelling to think that the colour experiences involved in perceptual variation are veridical. It is compelling because the perceivers are *standard*, and the perceptual conditions are *standard*. If the perceivers or conditions were non-standard, then we would be more inclined to think that the colour experiences are erroneous. Given the importance of standardisation in perceptual variation, my suggestion is that the colour experiences of standard perceivers in standard conditions provide the criteria for whether a colour experience is veridical. A colour experience is veridical *iff* it would *match* the colour experience of at least one standard perceiver in at least one standard condition, and erroneous *iff* it would not do so. For example, if a lemon looks yellow all over, then the colour experience is veridical *iff* the lemon would look yellow all over to at least one standard perceiver in at least one standard condition, and erroneous *iff* it would not. These criteria class all colour experiences involved in perceptual variation as veridical, and class some colour experiences lacking standardisation as erroneous.

How do these criteria illuminate a *theory* which classes veridical colour experiences as veridical and erroneous colour experiences as erroneous? The criteria invoke perceivers and perceptual conditions in determining veridicality. It is therefore unsurprising that the criteria inspire a theory whereby colours are relativised to perceivers and perceptual conditions. The novel theory is named ‘mono-minimalism’ because the view says that colours range over at least one standard perceiver in at least one standard condition. For example, the colour blue is the property of being nomologically possible to cause phenomenal blueness* in at least one standard perceiver in at least one standard condition. Since the scope of the colours is

determined by the criteria which delineate the veridical from the erroneous, categorising veridical colour experiences as veridical and erroneous colour experiences as erroneous is built into the essence of colours.

§2.11. and §2.12. outline some broader reflections about the nature of colour and perceptual variation. §2.11. argues that what is important for meeting the broad veridicality challenge is colours having a scope which is informed by the criteria by which we delineate the veridical from the erroneous. Thus, whether colours are *dispositional* or *relational*, for example, is not adjudicated by the broad veridicality challenge. §2.12. closely examines the nature of perceptual variation, and surveys four possible ways of understanding the problem. The first concerns colour location, the second concerns parthood-colour instantiation, the third concerns aspect of colour, and the fourth concerns colour identity. I suggest that there are methodological challenges in adjudicating between the different understandings: in particular, phenomenal character cannot be used to adjudicate between them, since the phenomenal characters of the relevant colour experiences would be the same in each case. I suggest some possible ways of adjudicating between the representations which includes the explanatory power of the representations and the simplicity of the representations. I then conclude.

2.8. Taking stock: the task at hand

Before exploring two novel formulations of subject-dependent theory, it will be helpful to take stock and briefly outline the challenges outlined in part one.

The broad veridicality challenge involves categorising veridical colour experiences as veridical and erroneous colour experiences as erroneous. We have seen two ways in which it is difficult for a subject-dependent theory of colour to meet the challenge. The first way concerns the scope of the subject-dependent properties that are posited. If the properties range over the perceiver having the colour experience in the perceptual condition in question (such as with fine-grained relations), then all colour experiences will be classed as veridical, since the relation obtains whenever the object looks that colour to that perceiver in that condition. Thus, these properties fail to class erroneous colour experiences as erroneous. If the properties range over all standard perceivers in all standard conditions, then most (if not all) colour experiences will be classed as erroneous, since the object will rarely (if ever) be that colour for all standard perceivers in all standard conditions. Thus, these properties fail to class all veridical colour experiences as veridical. If the properties range over similar perceivers in conditions the perceiver ordinarily comes across, then the experiences of colouritis perceivers will not be

classified as erroneous, since perceivers similar to them also have colouritis. Thus, these properties fail to class all erroneous colour experiences as erroneous. This general challenge for a subject-dependent theory of colour therefore is the:

SCOPE CHALLENGE: The scope of the colours is such that veridical colour experiences are classed as veridical, and erroneous colour experiences are classed as erroneous.

The second way in which it is difficult for a subject-dependent theory of colour to meet the broad veridicality challenge concerns the *medium* of representation concerning colours. If colours are subject-dependent properties which are represented only cognitively and doxastically, then we will not cleave the veridical from the erroneous, since sometimes the perceiver will believe that the object is/is not that colour for x perceivers in x conditions. For example, if coarse-grained relations are only represented cognitively and doxastically, then the theory will not delineate the veridical from the erroneous. This is because some colour illusions, for example, will occur even if the perceiver fails to believe that the object is colour F for x perceivers in x conditions. If colours are subject-dependent properties which are represented visually in virtue of being represented cognitively, then, for the same reason, we will not delineate the veridical from the erroneous (since sometimes there will not be a doxastic representation of the relevant property, since sometimes perceivers fail to believe that the object is colour F for x perceivers in x conditions). Another option is that subject-dependent colours are represented cognitively and non-doxastically, such that beliefs about colour are causally isolated from the non-doxastic cognitive representation. This can in principle cleave the veridical from the erroneous, since it is consistent with colour illusions persisting despite the doxastic state of the individual. But it does so at the unintuitive consequence that colour illusions are erroneous non-doxastic cognitive representations. If we want to meet the broad veridicality challenge and avoid the unintuitive consequence that colour illusions are false non-doxastic cognitive representations, then we face the following challenge:

MEDIUM CHALLENGE: The representation of colour is in a medium such that colour illusions can persist despite the beliefs held by the perceiver. It is not the case that colours are only represented in the realm of non-doxastic cognitive representations.

I also introduced a further challenge for a theory of colour which is not strictly speaking associated with broad veridicality challenge. I argued that we have a pre-theoretic

understanding of gradations in veridicality in colour experience. These gradations arise from considering the representation of colours and shades. These gradations include total veridicality, partial veridicality, and total error. The challenge for a theory of colour is to provide an analysis of such gradations which aligns with the veridicality and error involved in each gradation. For example, our theory should deliver that, in cases involving total veridicality, there is no erroneous attribution of a colour or shade. We saw that relationalism fails to provide an analysis which aligns with gradations in veridicality, since relationalism is committed to all colour experiences involving veridical attribution of colour. This challenge is the:

GRADATION CHALLENGE: Our theory vindicates our pre-theoretic understanding of total veridicality, partial veridicality, and total error. Vindicating our pre-theoretic understanding involves vindicating the thought that there is genuine total veridicality, partial veridicality, and total error.

The scope challenge and medium challenge are both closely associated with the broad veridicality challenge – which is to class the colour experiences involved in perceptual variation as veridical, and erroneous colour experiences as erroneous. Given that the broad veridicality challenge encompasses an important research project generally in the philosophy of colour perception, the medium challenge and (especially) the scope challenge are weighted more heavily than the gradation challenge. In the next section, we consider our first novel formulation of subject-dependent theory of colour which is motivated by the above challenges: *scope-change theory*.

2.9. Scope-change theory

In this section, I first outline scope-change theory. I then outline how the theory meets the scope challenge, medium challenge, and gradation challenge. I then outline a potential *reductio* of scope-change theory and provide an assessment of the costs and benefits of the theory.

2.9.1. The theory.

One broad strategy one could take when formulating a subject-dependent theory of colour would be to stipulate that the scope of the represented properties changes depending upon whether the colour experience is veridical or erroneous (hence *scope-change theory*). The

motivation for this bifurcation would be to capture the veridical cases as veridical and the erroneous cases as erroneous. In our case, since we are aiming to meet the broad veridicality challenge, the motivation is to capture the colour experiences involved in perceptual variation as veridical, and erroneous colour experiences as erroneous.

Crucially, this approach takes the veridicality of colour representations as more fundamental than what is represented, and therefore takes the subject-dependent colour properties represented by such representations as derivative of the veridicality status of the experience. This is a radical and unorthodox approach. The orthodoxy has it that the veridicality status of a colour experience is derivative of the colour properties represented by the experience (in combination with how the world is).

Let us first consider veridical colour experiences: these include all the colour experiences involved in perceptual variation. What I have in mind is that when a perceiver has a veridical colour experience, the represented subject-dependent colour ranges over all perceivers (in that species) for which the object would look that colour in that particular viewing condition. So, for example, if a perceiver has a veridical red colour experience of an object, then they veridically represent the object as red for a group of perceivers – a group for which the object would also look red in the same viewing condition – in the viewing condition they are in. So, when a perceiver has a veridical colour experience, the represented subject-dependent property ranges in the following way:

VERIDICAL RANGE: When a human perceiver (for example) has a veridical colour experience of an object in perceptual condition *C*, the represented subject-dependent property ranges over all human perceivers for which the object would look that colour in *C*. For example, if a human veridically represents a mug as pink, then they represent the mug as pink for all human perceivers for which the mug would look pink in the perceptual condition that the human is in currently.

Now, as well as maintaining veridical range, the scope-change theorist argues the following regarding colour illusions. The key thought is that when someone has a colour illusion, the represented subject-dependent property ranges over all human perceivers for which the object would *not* look that colour in that viewing condition. So, for example, if a human perceiver has a redness colour illusion of an object, they erroneously represent the object as red for a group of human perceivers – a group for which the object would *not* look red in the same viewing condition – in the viewing condition they are in. And this representation would be false,

precisely because the object does not look that colour to that group of human perceivers in that viewing condition. So, when a perceiver has a colour illusion, the represented coarse-grained relation ranges in the following way:

ERRONEOUS RANGE: When a human perceiver (for example) has a colour illusion regarding an object in perceptual condition *C*, the represented subject-dependent property ranges over all human perceivers for which the object would *not* look that colour in *C*. For example, if a human erroneously represents a cup as green, then they represent the cup as green for all human perceivers for which the cup would *not* look green in the perceptual condition that the human is in currently.

Scope-change theory involves the thought that the group of human perceivers over which the represented colours range is dictated by whether the colour experience is veridical or illusory. We must first ask whether the colour experience is veridical or illusory, and once we know the answer to that question, we know the group of perceivers over which the represented colour properties range. This is different to relationalism and classic dispositionalism. According to relationalism and classic dispositionalism, we know the perceivers over which the represented coarse-grained relations range before we know whether the colour experience in question is veridical or erroneous. And this is because, according to these theories, the group of perceivers over which the represented colours range is the same in cases of veridical colour experiences and cases of colour illusions.

An important difference, therefore, is the following: with relationalism and classic dispositionalism, we work out whether the colour experience is veridical by working out whether the representation of the properties are veridical, but with scope-change theory, we work out what subject-dependent property is represented by working out whether the colour experience is veridical.

One interesting element of scope-change theory, therefore, is that it is the veridicality (or lack thereof) of the colour representation which determines which property is represented by the colour representation. This is at odds with how philosophers typically think about colour representations, or indeed visual representations in general. The orthodoxy is that the experiential representations (in combination with how the world is) determines the veridicality (or lack thereof) of the experiential representations. For example, if an experience represents an object as squared and the object is squared, then the representation of the object as squared is veridical. Differently, scope-change theory says that the veridicality status of a colour

representation determines which property is represented by that representation. For example, according to scope-change theory, if a human representation of an object instantiating redness is veridical, then the redness property represented is one which ranges over all human perceivers for which the object would look red in that viewing condition. And if a human representation of an object instantiating redness is erroneous, then the redness property represented is one which ranges over all human perceivers for which the object would not look red in that viewing condition.

We could in principle adopt scope-change theory but nonetheless think that the visual representation of shapes and other non-colour properties followed the orthodoxy (the orthodoxy being that the experiential representations in combination with how the world is determines the veridicality of the representations). If we held this view of visual experience, then we would have a picture of visual experience whereby the veridicality of colour representations determines the properties represented by colour representations, but the properties represented by non-colour representations (in combination with how the world is) determines the veridicality of non-colour representations. Therefore, adopting scope-change theory but maintaining an orthodox view of non-colour representations would entail a view whereby (1) the veridicality of some visual representations are *determined* by the properties that are represented by those representations in combination with how the world is, but (2) the veridicality of other representations *determines* the properties that are represented by those representations. This picture of visual experience would entail a bifurcation regarding what is more fundamental about visual representations. On the one hand, what is more fundamental about colour representations is their veridicality, and on the other hand, what is more fundamental about non-colour representations are the properties they represent.

Differently, we could maintain scope-change theory alongside a similarly unorthodox view of non-colour representations. For example, we could think that for all visual representations, the veridicality of the representations determines which properties are represented by the representations. This view would therefore have it that for non-colour properties such as shape, the veridicality of these representations determines which property is represented. This picture of visual experience would entail a *unity* regarding what is more fundamental about visual representations. On this view, what is more fundamental about all visual representations is their veridicality. What is important for this paper, however, is that scope-change theory says that the colour properties represented by colour experiences are determined by the veridicality status of the colour experience.

2.9.2. *The scope challenge: scope-change theory*

Scope-change theory is primarily motivated by satisfying the scope challenge, which in turn is motivated by the broad veridicality challenge. The theory dissolves the worries raised by the standard scope challenge and the similar scope challenge. Let me explain.

Veridical range captures all the colour experiences involved in perceptual variation as veridical. The thought is that whenever a standard human perceiver in a standard perceptual condition represents an object as being a certain colour, they represent the object as that colour for all the human perceivers for which the object would look that colour in that perceptual condition. For example, consider Gina who sees a lime as green all over in a standard condition. And consider Yasmin who sees a lime as yellowish-green all over in a standard condition. Scope-change theory says that Gina represents the lime as green for all human perceivers for which the lime would look green in the perceptual condition she is in, and Yasmin represents the lime as yellowish-green for all human perceivers for which the lime would look yellowish-green in the perceptual condition she is in. Both representations are veridical. Scope-change theory therefore satisfies the first (veridicality) element of the broad veridicality challenge.

Erroneous range classes all the cases we pre-theoretically deem erroneous as erroneous. Consider a perceiver with cerebral achromatopsia who sees a cup and represents the cup as grey. We may pre-theoretically class this colour experience as erroneous, since the perceiver has a very non-standard visual system and no standard perceiver in a standard condition would represent the cup as grey. Scope-change theory successfully classes this erroneous colour experience as erroneous. The theory says that the perceiver with cerebral achromatopsia represents the cup as grey for all human perceivers for which the cup would *not* look grey in the perceptual condition that the perceiver is in. This representation is false, since the cup would not look grey for such perceivers in such a condition. Scope-change theory therefore satisfies the second (error) element of the broad veridicality challenge.

I now want to make explicit how scope-change theory dissolves the worries raised by the similar scope challenge and the standard scope challenge. The similar scope challenge says that if the subject-dependent colours range over similar perceivers in conditions the perceiver ordinarily comes across, the colour experiences of (non-standard) colouritis perceivers will be wrongly classed as veridical, since the object will be that colour for similar (colouritis) perceivers in conditions the colouritis perceiver ordinarily comes across. Scope-change theory successfully classes the colour experiences of colouritis perceivers as erroneous. Since the

represented properties do not – by their definition at least – range over similar perceivers in similar conditions, when any perceiver (such as a colouritis perceiver) undergoes what we would pre-theoretically deem to be a colour illusion, they are correctly classed as undergoing a colour illusion. This is because the represented property ranges over every human perceiver for which the object would *not* look that colour in that viewing condition.

Scope-change theory also meets the standard scope challenge. According to scope-change theory, the colours do not – by their definition at least – range over all standard perceivers in all standard conditions. It is therefore not the case that scope-change theory categorises veridical colour experiences as erroneous. This is because it is not the case that, in cases of veridical colour experience, the representations of the colours are rendered erroneous by the perceptual variation among standard perceivers in standard conditions. The existence of perceptual variation is perfectly consistent with veridical colour experiences, because in cases of veridical colour experiences, the represented properties only range over perceivers (standard or otherwise) for which the object would look that colour in that viewing condition.

2.9.3. The medium challenge: scope-change theory

The medium challenge is formulating a theory of colour whereby colour illusions persist regardless of the doxastic status of the perceiver. For example, it needs to still be possible that a perceiver erroneously represents an object as red, even if they fail to believe that the object is red for x perceivers in x conditions.

The scope-change theorist says that colours are represented visually and that colour illusions are erroneous visual representations. Indeed, according to the scope-change theorist, veridical colour experiences are veridical visual representations of objects instantiating colours. Consider a perceiver who sees an object as red and assume that we pre-theoretically deem this case as involving a colour illusion. Let us also assume that for whatever reason she fails to believe that the object is red for perceivers for whom the object would not look red in the perceptual condition that the perceiver is in. The scope-change theorist says that she nonetheless undergoes a colour illusion, since the visual representation of the object as being red for such perceivers in such a condition is not dependent on her holding the belief that the object is red for such perceivers in such a condition. The scope-change theorist is neutral upon whether properties such as purple for perceivers for whom the object would not look purple in this condition are represented cognitively and doxastically and/or cognitively and non-doxastically. Such properties *may* be represented cognitively and doxastically and/or

cognitively and non-doxastically, just as they *may* at times be represented doxastically. The key point is that colour illusions are merely identified with erroneous *visual* representations of such properties, and this entails that colour illusions can persist independently of the doxastic state of the individual.

2.9.4. *The gradation challenge: scope-change theory*

The gradation challenge is providing a theory of colour which vindicates our pre-theoretic understanding total veridicality, partial veridicality, and total error. Scope-change theory meets the gradation challenge. In cases of total veridicality, scope-change theory says that the following properties are veridically attributed: colour *F* for all perceivers for which the object would look that colour in that perceptual condition, and shade *G* for all perceivers for which the object would look that shade in that perceptual condition. The following is involved in cases of partial veridicality: veridical attribution of colour *F* for all perceivers for which the object would look that colour in that perceptual condition, and erroneous attribution of shade *G* for all perceivers for which the object would not look that shade in that perceptual condition. And finally, total error involves erroneous attribution of colour *F* for all perceivers for which the object would not look that colour in that perceptual condition, and shade *G* for all perceivers for which the object would not look that shade in that perceptual condition.

This analysis vindicates the number of colours/shades we pre-theoretically think are attributed. And, more importantly, the analysis involves only total veridicality in cases we pre-theoretically deem totally veridical, only partial veridicality in cases we pre-theoretically deem partially veridical, and only total error in cases we pre-theoretically deem totally erroneous. Scope-change theory therefore meets the scope challenge, medium challenge, and gradation challenge. Let's now consider an argument against scope-change theory.

2.9.5. *A potential reductio?*

We shall now consider a potential *reductio* of scope-change theory. The core claim of the *reductio* is that we know what colour an object is represented as having before we know whether the representation is veridical. As I set out, however, scope-change theory is arguably committed to the view that we do not know what colour the object is represented as having before we know whether the representation is veridical. This is arguably an absurd consequence of the theory.

Let us forget about scope-change theory for a moment. Imagine that you see an apple before you and you see the apple as red. Now, before we know whether the apple is red, and therefore before we know whether your experience is veridical, it certainly seems that we can know that your visual experience *represents the apple as red*. One potential problem for scope-change theory, however, is that the theory may entail that we *do not know* which colour is represented before we know whether the experience is veridical/erroneous (i.e., before we know which colour(s) the object instantiates).

Scope-change theory says that the colour properties that are represented is determined by whether the colour experience is veridical or erroneous. For example, if a red colour experience is veridical, then the experience represents a colour property which ranges over all perceivers for which the object would look that colour in that viewing condition. And if a red colour experience is erroneous, then the experience represents a colour property which ranges over all perceivers for which the object would not look that colour in that viewing condition. Importantly, according to scope-change theory, *these properties are colours*. Therefore, if we do not know which colour properties are represented before we know whether the colour experience is veridical/erroneous, then since these properties are colours, we do not know *which colours* are represented before we know whether the colour experience is veridical/erroneous. But this seems an absurd consequence of a theory of colour. We do know which colours are represented by colour experiences before we know whether the colour experience is veridical/erroneous. For example, when we see an apple as red – when an apple appears red to us – we know that the experience represents the apple as red before we know whether the colour experience is veridical/erroneous (that is, before we know whether the apple instantiates the colour in question).

The broader worry concerns the veridicality status of an experience being more fundamental than what is represented, rather than scope-change theory *per se*. If we have a theory about a type of property whereby the veridicality status of an experience determines which property is represented, then we will not know which property is represented until we know the veridicality status of the experience. But this seems to run contrary to us knowing which properties are represented before we know whether the experience is veridical/erroneous.

2.9.6. *Assessing scope-change theory.*

Scope-change theory meets the scope challenge. This is because the scope of the colours is determined by the cases we deem veridical and the cases we deem erroneous. Thus, all colour experiences involved in perceptual variation are deemed veridical by scope-change theory, and the colour experiences we deem erroneous are classed as erroneous by the theory. The theory also meets the medium challenge, since the view is that colours are represented visually and such visual representations are not dependent upon the doxastic state of the individual. The broad veridicality challenge is therefore met by scope-change theory. Furthermore, scope-change theory meets the gradation challenge, since the analysis of colour experience aligns with our pre-theoretic understanding of total veridicality, partial veridicality, and total error.

But scope-change the theory comes at certain costs. The first (and perhaps most important) cost is that veridical colour experiences represent colours with a different scope to the colours that erroneous colour experiences represent. The second cost is found in the *reductio*: arguably scope-change theory is committed to us not knowing which colour an object is represented as instantiating before we know whether the colour experience is veridical/erroneous. The following is a cost/benefit analysis of scope-change theory:

Table 4

Benefit	Standard scope challenge ✓	Similar scope challenge ✓	Medium challenge ✓	Gradation challenge ✓	Broad veridicality challenge ✓
Costs	(1) The veridicality of the colour experience is more fundamental than the colour properties represented by the experience, and (2) <i>Reductio</i> : do not know which colour is represented until we know the veridicality status of the experience.				

2.10. Mono-minimalism

This section outlines my preferred novel subject-dependent theory of colour: *mono-minimalism*. I first outline precise criteria for whether a colour experience is veridical/erroneous. The criteria are inspired by both-ism and the desire to provide an intuitive account of when a colour experience is erroneous. I then explain the theory and how it is inspired by the veridicality criteria. I then outline how the theory meets the scope challenge, medium challenge, and gradation challenge. I finally outline why mono-minimalism is preferable to scope-change theory.

2.10.1. The veridicality criteria

Earlier in this paper I argued that both-ism is the preferable response to perceptual variation, and thus it is preferable to categorise the colour experiences of standard perceivers in standard conditions as veridical. I also suggested that colour illusions occur when the perceiver is non-standard and/or the perceptual conditions are non-standard.

But I am yet to provide precise criteria for when a colour experience is veridical or erroneous. It is crucial that we do this, because if we do not have precise criteria which delineate the veridical from the erroneous, then we cannot be sure that our theory successfully cleaves veridical colour experiences from erroneous colour experiences.²⁸ First, some housekeeping. Consider a non-standard perceiver in a standard condition, a standard perceiver in a non-standard condition, and a non-standard perceiver in a non-standard condition. Let's call the colour experiences of such perceivers in such conditions 'colour experiences with non-standardness'. And let's call the colour experiences of standard perceivers in standard conditions 'colour experiences with standardness'.

If we take a both-ism response to perceptual variation, as I think we should, then we think that all colour experiences with standardness are veridical. This is because perceptual variation involves the colour experiences of standard perceivers in standard conditions, and a perceptual variation case could be set up with every colour experience with standardness. Thus, we want our theory to class all colour experiences with standardness as veridical: this is exactly what both-ism demands. I have also suggested that colour experiences with non-standardness are erroneous, since the lack of standardisation sometimes causes the visual system to represent an object as being a colour that it is not. But I am yet to outline exactly which colour experiences with non-standardness are erroneous.

It is important to do this because it is not the case that *all* colour experiences with non-standardness are erroneous. Certain colour experiences with non-standardness are veridical. Let me explain. Imagine a standard perceiver in a standard condition who sees a rose and represents the rose as red. Now imagine that a non-standard perceiver with blue-yellow colour blindness sees the same rose in the same standard perceptual condition and also represents the rose as red. It would seem incorrect to argue that the non-standard perceiver undergoes a colour illusion, purely in virtue of them having blue-yellow colour blindness. After all, the standard perceiver in the standard condition represents the rose as red, and so the non-standard perceiver has represented the rose as having the same colour that the standard perceiver in a standard

²⁸ On the assumption that veridical colour experiences represent colour properties with the same scope as the colour properties represented by erroneous colour experiences.

condition represents the rose as having. Indeed, if the non-standard perceiver's representation of the rose as red is erroneous, then considering that the standard perceiver also represents the rose as red, the standard perceiver's experience would presumably also be erroneous. Instead, we think that the standard perceiver's experience *veridically* represents the rose as red, and this leads us to think that the experience with non-standardness is also veridical, since the experience with non-standardness also represents the rose as red. Therefore, some colour experiences with non-standardness are veridical.

What we are starting to see is a test to determine the veridicality of a colour experience. In the example of the rose, we thought that the experience with non-standardness was veridical *because* an experience with standardness also represented the rose as red. This reasoning generalises. The colour experiences of standard perceivers in standard conditions act as a guide by which we work out whether a colour experience with non-standardness is erroneous. On my view, all colour experiences *with standardness* are veridical, and whether a colour experience with non-standardness is veridical depends upon whether *at least one* colour experience with standardness would represent the same object as instantiating the same colour. If there is at least one colour experience with standardness which has represented the object as that colour, then the object instantiates that colour, precisely in virtue of our commitment to both-ism. If a colour experience with non-standardness therefore represents the object as that colour, then they have represented the object as instantiating a colour that it instantiates. This reasoning provides us with the:

VERIDICALITY CRITERIA: A colour experience is veridical *iff* at least one standard perceiver in at least one standard condition would represent the object as having the colour that is represented by the experience. A colour experience is erroneous *iff* it is *not* the case that at least one standard perceiver in at least one standard condition would represent the object as having the colour that is represented by the experience.

My aim in this section is to simply demonstrate that the veridicality criteria is intuitively appealing even without a theoretically laden conception of standardisation. But I sketch my conception of 'standard' when I outline mono-minimalism.

It is important to note that there is a modal element to the veridicality criteria. If the veridicality criteria were that a colour experience is veridical *iff* there is a standard perceiver in the actual world in a standard condition in the actual world who has represented the object as the same colour, then this would not successfully carve the veridical from the erroneous.

Consider Bob the carpenter who has colour blindness and thus is non-standard. Bob has crafted a table and painted it blue, and has visually represented the table as blue. But he is the only person to have set eyes on the table and is therefore the only person to have represented the table as blue. If the veridicality criteria were indexed to what actual standard perceivers in actual standard conditions have represented, then Bob's experience would be wrongly classed as erroneous, because no standard perceiver in a standard condition has set eyes upon the table. Crucially, however, Bob's representation is veridical because at least one standard perceiver in at least one standard condition *would* represent the table as blue *if they were* to set eyes upon the table. It is the truth of this possibility which entails that Bob's colour experience is veridical.

The type of possibility is *nomological possibility*. Bob's representation of the table as blue is veridical *iff* it is nomologically possible that the table is represented as blue by at least one standard perceiver in at least one standard condition. And Bob's representation is erroneous *iff* it is not nomologically possible that the table is represented as blue by at least one standard perceiver in at least one standard condition. In this case, it is nomologically possible that the table is represented as blue by at least one standard perceiver in at least one standard condition (since we have stipulated that it was painted blue), and so Bob's representation is veridical.

Furthermore, the veridicality criteria involve standardisation which is relativised to each species. For example, the standard goldfish visual system is different to the standard human visual system, and the standard perceptual conditions for goldfish are different to those for humans. Thus, whether a goldfish has a veridical colour experience will be dependent upon whether at least one goldfish colour experience with standardness would²⁹ represent the object as being that colour.

The purpose of providing the veridicality criteria is not to provide a revisionary understanding of veridicality and error in colour perception. The criteria are not intended to conflict with our current practice of delineating the veridical from the erroneous, but instead to usher in more verdicts than practice does currently. Without precise criteria which delineates veridical colour experiences from erroneous colour experiences, we cannot be sure that our theory succeeds in delineating the veridical from the erroneous, since it would be unclear in the first place which experiences we wish to deem erroneous or veridical. We need to be clear where the target lies in order for our theory to hit the target. The veridicality criteria elucidate two challenges. The first is the:

²⁹ 'would' refers to the nomological possibility involved in the veridicality criteria.

VERIDICALITY CHALLENGE: Our theory categorises the following as veridical: (1) all colour experiences with standardness (in the spirit of both-ism), and (2) colour experiences with non-standardness whereby it *is* the case that at least one standard perceiver in at least one standard condition would represent the object as having the colour that is represented by the experience.

The second is the:

ERROR CHALLENGE: Our theory categorises the following as erroneous: (1) colour experiences with non-standardness whereby it is *not* the case that at least one standard perceiver in at least one standard condition would represent the object as having the colour that is represented by the experience, and (2) no colour experiences with standardness.

In my view, the veridicality and error challenge put together compose a more precise way of understanding the broad veridicality challenge.

2.10.2. Addressing circularity

As Boghossian and Velleman (1989) argued, one challenge that subject-dependent theorists face is to provide an account of colour that is non-circular. Consider dispositionalism: the view that colours are dispositions such as the disposition to look green to standard perceivers in standard conditions. Consider relationalism: the view that colours are relations such as green for *SI* in *CI*. Whilst not always made explicit, the dispositions and relations are typically intended to be metaphysically prior to the colours. For example, on the dispositional view, what it is to be green is to be disposed to look green to standard perceivers in standard conditions. And on the relational view, what it is to be green is to be green for *SI* in *CI*. The problem of circularity is that the disposition to look green to standard perceivers in standard conditions, and the relation green for *SI* in *CI*, both invoke greenness. Therefore, the disposition and relation are both individuated by appeal to the colour green. Such theories therefore fail to provide a theory of colour in non-colour terms.

As we know, Peacocke defines a colour (such as yellow) with the disposition to cause the visual field to be *colour'* (such as yellow') in the region where the object is presented. Peacocke writes: "'x is green" [is defined as] "x is disposed in normal circumstances to cause the region of the visual field in which it is presented to be green' in normal humans'" (Peacocke, 1984: 375). Therefore, on Peacocke's view, the colour yellow is not individuated by appeal to the colour yellow. Instead, the colour is individuated by appeal to *yellow'*: a property of the

visual field which is not the colour yellow. Thus, Peacocke succeeds in providing a theory of colour in non-colour terms (rather in colour' terms).

The mono-minimalist invokes a different kind of property to avoid circularity. It is important to distinguish between the colours that objects look to have and the phenomenal properties that are involved in the experiences of such objects. For example, when Gina sees the apple as green, the apple looks green to Gina, but her experience also has a certain *phenomenal green*^{*30} property. Phenomenal colour properties are what-it-is-like properties of experiences which are associated with certain colours. For example, there is something it is like to have an experience of greenness, and this what-it-is-like property is *phenomenal greenness**. There is also something it is like to have an experience of redness, and this what-it-is-like property is *phenomenal redness**. What it is like to have an experience of redness is different to what it is like to have an experience of greenness, and so phenomenal redness* is different to phenomenal greenness*.

It is important to note that the mono-minimalist does not take a stand on the exact nature of phenomenal colour properties. Thus, if the phenomenal properties associated with experiences of colours – such as *phenomenal blueness** – turn out to be properties of the visual field, then mono-minimalism is similar to Peacocke's view in that both views invoke properties of the visual field. However, phenomenal colour properties may turn out *not* to be properties of the visual field, in which case mono-minimalism invokes different properties to Peacocke's view. The overarching claim of the mono-minimalist invokes phenomenal colour properties, but does not make an assumption about the nature of such phenomenal properties.

Furthermore, one possibility is that in some possible worlds phenomenal colour properties are properties of the visual field, and in other possible worlds they are not. If this were true, then mono-minimalism would be closer to Peacocke's view in some possible worlds but not in others. I am not arguing that phenomenal colour properties differ in different possible worlds, merely that this is possible and, if it were so, then the similarity between mono-minimalism and Peacocke's view would be dependent upon the possible world in question. The key thought, however, is that according to mono-minimalism, in every possible world colour *F* is understood (in a way to be explained) in terms of *phenomenal colour F**.

I am yet to outline the scope of the properties posited by mono-minimalism, but let's firstly see in more detail how the view invokes phenomenal colour properties to circumvent

³⁰ The star simply illustrates that these properties are phenomenal properties rather than colours.

circularity. Instead of arguing that colours are properties such as *green* for x perceivers in x conditions, the mono-minimalist argues that colours are properties such as *phenomenal green** for x perceivers in x conditions. The mono-minimalist circumvents circularity because they argue that colours are properties which invoke *phenomenal* colour properties rather than colours themselves. I here take a view on a contentious issue: I assume that phenomenal colour properties are metaphysically prior to colours. This is why mono-minimalism avoids problematic circularity. With the colour green, for example, the view is that: (1) what it is for an object to be green is for the object to cause phenomenal greenness* in x perceivers in x conditions, and (2) the property phenomenal greenness* for x perceivers in x conditions is metaphysically prior to greenness. Wading into the debate of whether phenomenal colours are metaphysically prior to colours will take us too far afield. But I will say this in favour of the position: if we think that phenomenal colours are metaphysically prior to colours, then we can get a nice theory of colour (or so I hope to demonstrate). Since having a nice theory of colour would itself be a very good thing, it follows that we have good reason to investigate the kind of approach to colour fleshed-out in what follows.

2.10.3. *The scope*

Let's now consider how the mono-minimalist understands the scope of the colours. It is the scope of the properties posited by mono-minimalism which is crucial for meeting the veridicality and error challenge (and thus the broad veridicality challenge). The mono-minimalist argues that colours are relativised to *at least one standard perceiver in at least one standard condition*. For example, the colour blue is the property *phenomenal blue* for at least one standard perceiver in at least one standard condition*.

It is important to note that when a perceiver represents a colour such as the subject-dependent property *phenomenal blue* for at least one standard perceiver in at least one standard condition*, they do not represent the object as instantiating phenomenal blueness. Instead, they represent the object as instantiating the subject-dependent property *phenomenal blue* for at least one standard perceiver in at least one standard condition*. When I write that an object is represented as instantiating phenomenal colour F for at least one standard perceiver in at least one standard condition, then this is to be taken as the claim that the subject-dependent property itself is represented, and not as the claim that the object is represented as instantiating the phenomenal property.

Similarly to the veridicality criteria, the subject-dependent property phenomenal colour F^* for at least one standard perceiver in at least one standard condition has a modal element. The property is that it is *nomologically possible* that the object causes phenomenal colour F^* in at least one colour experience with standardness. Thus, for an object to be blue, for example, it need not be the case that the object has actually caused phenomenal blueness* in at least one standard perceiver in at least one standard condition. Instead, if an object is blue, then it is nomologically possible that the object causes phenomenal blueness* in at least one standard perceiver in at least one standard condition. Consider:

MONO-MINIMALISM: A colour is a subject-dependent property understood as the property phenomenal colour F^* for at least one standard perceiver in at least one standard condition. For example, the colour green is the following property: phenomenal green* for at least one standard perceiver in at least one standard condition.³¹

Before we explore how mono-minimalism meets the veridicality and error challenge, let's address the question of what it is for a perceiver and condition to be standard. There is no consensus on this question. And everyone who conceptualises 'standard' will face Hardin's (1988) thorny objection that preferring one method of standardisation over another will be arbitrary. In this paper, I do not expect to demonstrate that my conception of 'standard' is the best, and nor do I hope to assuage the worry raised by Hardin. Instead, I sketch my conception of 'standard' and leave the above debates for another occasion.

On my view, what makes a perceiver standard will be a function of two factors. The first factor is the *typicality* of the visual system in that species. The second factor will be how closely the visual system of that perceiver *matches* the optimal visual system for that species. Here, 'optimal visual system' denotes the visual system which is best designed for that environment, relative to that species. Thus, the most standard human perceiver, for example,

³¹ I have invoked phenomenal properties. But it is important to note that, in principle, we could have a different type of mono-minimalism which invoked *non-phenomenal* properties. For example, the phenomenal eliminativist could argue that blue, for example, is *computational-state-1* for at least one standard perceiver in at least one standard condition. Such properties (such as computational state properties) would need to be (1) metaphysically prior to colours, and (2) correctly line up with the representations of the colours (e.g., with the above example, it would need to be the case that a perceiver represents an object as blue *iff* the perceiver is in computational-state-1). The core insight of the mono-minimalist is that whether a colour experience is veridical depends upon whether it is nomologically possible that at least one standard perceiver in at least one standard condition has the requisite property. But whether we understand that property in terms of phenomenal character or computational state (or some other property) can be a topic of disagreement amongst reasonable mono-minimalists.

will be the perceiver for which there is most cross-over between the typicality of their visual system and the optimality of their visual system. The most optimal may not be the most typical. For example, being a tetrachromat *may* be the most optimal, but it certainly isn't the most typical. And the most typical may not be the most optimal. For example, being a nonanomalous trichromat is the most typical, but it may not be as optimal as being a tetrachromat.

Similarly, what makes a perceptual condition standard will be a function of the typicality of that perceptual condition for the species in question and how closely the perceptual condition matches the optimal perceptual condition for that species. Here, 'optimal perceptual condition' denotes the perceptual condition which is most suited to the design of the visual system, relative to that species. Thus, the most standard perceptual condition for humans, for example, will be the perceptual condition for which there is most cross-over between the typicality of the perceptual condition and the optimality of the perceptual condition. Again, the most optimal may not be the most typical. Perhaps natural daylight at midday is the most optimal, but given how much time we spend indoors, it may not be the most typical. And perhaps certain artificial lighting is the most typical, but it may not be the most optimal.³²

In my explanation of mono-minimalism, I have not provided a specification of the entire nature of the colours. I have not specified that mono-minimal properties are to be construed as *dispositions*, rather than *relations*, for example. This is deliberate: mono-minimalism is a thesis which can be adopted by different subject-dependent theorists. For example, dispositionalists can understand a colour to be a disposition to cause phenomenal colour F^* in at least one standard perceiver in at least one standard condition. And relationalists can understand a colour to be a relation phenomenal colour F^* for at least one standard perceiver in at least one standard condition. What will become apparent from the next couple of sections is that it is mono-minimalism as a *general thesis* which is important for meeting the veridicality challenge and error challenge, rather than further specification of the nature of such mono-minimal properties. I return to this point later.

2.10.4. *The scope challenge: veridicality*

I first need to make explicit an assumption which is required for mono-minimalism to meet the veridicality challenge and error challenge. Mono-minimalism says that colours are properties

³² I have here focused on lighting conditions. But it is important to note that the entire description a given perceptual condition will include other factors such as contrast effects. And the same dual-factor method is to be applied to determine whether a contrast effect is standard. Different contrast effects will have difference levels of typicality and optimisation.

such as the subject-dependent property *phenomenal blue** for at least one standard perceiver in at least one standard condition. But the veridicality criteria says that a colour experience is veridical *iff* at least one standard perceiver in at least one standard condition *represents* the same object as instantiating that *colour*. I therefore make an assumption which links phenomenal colour properties with colours and representations. I assume that a perceiver represents an object as colour *F* *iff* the object causes a phenomenal *F** property in that perceiver. For example, an object is represented as green by at least one standard perceiver in at least one standard condition *iff* the object causes phenomenal greenness* in at least one standard perceiver in at least one standard condition. I take this assumption to be relatively uncontroversial (among representationalists at least).

Let's now consider colour experiences with standardness. According to mono-minimalism, if a standard perceiver in a standard condition has a colour experience of an object, then their colour experience is automatically veridical. Imagine that a standard perceiver in a standard condition represents a pen as blue. According to mono-minimalism, the perceiver represents the pen as having the subject-dependent property *phenomenal blue* for at least one standard perceiver in at least one standard condition*. Once again, the mono-minimalist remains neutral upon whether this subject-dependent property is a relation or a disposition.

Since the perceiver in question is themselves standard and the viewing condition is standard, the veridicality condition for the colour is satisfied. The veridicality condition is satisfied by the standard perceiver having the experience they are having in the standard condition they are in, since the pen causes phenomenal blue* in them, and so the pen is phenomenal blue* for at least one standard perceiver in at least one standard condition. So, if a standard perceiver in a standard condition has a colour experience, then this is sufficient for their colour experience being veridical, since the veridicality condition for the represented colour is met by such a perceiver having the experience in such a condition. Thus, all colour experiences with standardness are categorised as veridical by mono-minimalism.

Let's now consider colour experiences with non-standardness. If there is a colour experience with non-standardness which represents an object as colour *F*, and the object would cause phenomenal *F** in at least one colour experience with standardness, then the experience with non-standardness will be veridical. This is because when the perceiver represents the object as colour *F*, they represent the object as phenomenal *F** for at least one colour experience with standardness, and so if the object *is* phenomenal colour *F** for at least one

colour experience with standardness, then the experience is veridical, since the veridicality condition is fulfilled.

Mono-minimalism therefore categorises all of the following colour experiences as veridical: (1) colour experiences with standardness, and (2) colour experiences with non-standardness which represent an object as having a colour that the object would also be represented as having by at least one colour experience with standardness. Mono-minimalism therefore meets the veridicality challenge, since the veridicality challenge says that a colour experience is veridical *iff* at least one colour experience with standardness would represent the object as having the colour that is represented by the experience.

Mono-minimalism also dissolves the worry raised by the standard scope challenge. The standard scope challenge is that if the represented properties range over *all* standard perceivers in *all* standard conditions, then standard perceivers in standard conditions will undergo colour illusions all the time, since the object will rarely be that colour for all standard perceivers in all standard conditions. According to mono-minimalism, however, colours do not range over all standard perceivers in all standard conditions, and so for colour experiences to be veridical, it need not be true that the object is that phenomenal colour for *all* standard perceivers in *all* standard conditions. Instead, for the representation to be veridical, it need only be true that the object would be that phenomenal colour for at least one standard perceiver in at least one standard condition.

2.10.5. *The scope challenge: error*

The error challenge says that a colour experience is erroneous *iff* it is *not* the case that at least one standard perceiver in at least one standard condition would represent the same object as instantiating the colour that is represented by the experience. We therefore want a theory which only categorises certain colour experiences with non-standardness as erroneous: specifically, colour experiences which represent an object as having a colour that the object would *not* be represented as having by at least one colour experience with standardness.

Mono-minimalism meets the error challenge. This is because a representation of a colour – phenomenal colour F^* for at least one colour experience with standardness – will be erroneous *iff* the object does not cause phenomenal colour F^* in at least one colour experience with standardness (and therefore it will be erroneous when the object is not represented as colour F by at least one colour experience with standardness). For example, imagine a non-standard perceiver who represents an object as blue and no colour experience with standardness

would represent the object as blue. Mono-minimalism entails that this colour experience is erroneous. This is because the representation of the object as phenomenal blue* for at least one colour experience with standardness will be false, since the object is not phenomenal blue* for at least one standard perceiver in at least one standard condition.

Mono-minimalism meets the similar scope challenge. The similar scope challenge is that if the properties range over similar perceivers in conditions they ordinarily come across, then the colour experiences of the colouritis perceivers will be wrongly categorised as veridical, since the object in question will often be that colour for similar (colouritis) perceivers in similar conditions. The experience of the colouritis perceiver will be categorised as erroneous by mono-minimalism, since whilst the object may be phenomenal colour F^* for *similar* (colouritis) perceivers in similar conditions, the object will not be phenomenal colour F^* for at least one standard perceiver in at least one standard condition. As assumed, colouritis perceivers represent objects as having very different colours to the colours that colour experiences with standardness represent such objects as having. Thus, when a colouritis perceiver represents an object as having a certain colour, no colour experience with standardness would represent that object as having that colour. Therefore, the representation of the object as having the subject-dependent property phenomenal colour F^* for at least one standard perceiver in at least one standard condition would be false (since for no standard perceiver in a standard condition would the object be phenomenal colour F^*).

2.10.6. *Deviant causation*

I earlier stipulated that we would be focusing upon colour experiences which are not caused deviantly, but I now want to consider how the mono-minimalist addresses deviantly caused colour experiences. It will be helpful to first consider Cohen's (2007) example of a colour experience caused deviantly and his analysis of such a case.

Cohen (2007: 341) argues that colour experiences which involve deviant causation are erroneous. He gives the example of a tomato which has the capacity to look red, but which can also cause itself to look green via a telekinetic pathway. Cohen argues that the experience of the tomato as green would be erroneous because 'my representation of T's [fine-grained green] color, qua visual, carries a commitment to the non-deviancy of its etiology ... but that that commitment is in fact not satisfied, so the representation in question is erroneous' (Cohen 2007: 341). The thought seems to be that for a representation of a fine-grained colour to be veridical, the representation needs to be caused non-deviantly, since it is an element of the veridicality

condition of the experience that the representation is not caused deviantly. Thus, I *think* Cohen's view is that *every* representation of a fine-grained relation caused deviantly is erroneous, since one element of the veridicality condition (non-deviant causation) is never fulfilled when the colour experience is caused deviantly.

According to the mono-minimalist, colour experiences caused deviantly do not involve a *standard perceptual condition*, since such cases involve very little crossover between typicality concerning perceptual condition and optimisation concerning perceptual condition. Given that colour experiences caused deviantly do not involve a standard perceptual condition, such experiences are not *automatically* classed as veridical by the veridicality criteria. Per the veridicality criteria, a colour experience which is deviantly caused is veridical *iff* it matches at least one colour experience with standardness. Thus, on my view, some deviantly caused colour experiences are veridical and some are erroneous. I think this is the correct result. Consider the example of the tomato outlined by Cohen. Imagine if the tomato would look green to many standard perceivers in many standard perceptual conditions. Now imagine that a perceiver represents the same tomato as green, but this time, the experience is caused deviantly by telekinetic pathways. The veridicality criteria class this experience as veridical, since whilst the representation of the tomato as green is caused deviantly, the experience nonetheless represents the tomato as instantiating a colour that it instantiates (after all, the tomato looks green to many standard perceivers in many standard conditions).

Now consider the properties posited by the mono-minimalist, such as phenomenal green* for at least one standard perceiver in at least one standard condition. When the tomato telekinetically causes a representation of it as green, the perceiver represents the tomato as phenomenal green* for at least one standard perceiver in at least one standard condition. This representation will be veridical *iff* the tomato would cause phenomenal greenness* in at least one standard perceiver in at least one standard condition, and erroneous *iff* the tomato would not cause phenomenal greenness* in at least one standard perceiver in at least one standard condition. Thus, regardless of whether the colour experience under consideration is caused deviantly, the veridicality of the experience is determined by whether it would match the colour experience of at least one standard perceiver in at least one standard condition.

2.10.7. *The medium challenge: mono-minimalism*

The mono-minimalist argues that the mono-minimal properties (the colours) are represented visually. They further argue that veridical colour experiences are veridical representations of

objects instantiating colours, and erroneous colour experiences (colour illusions) are erroneous representations of objects instantiating colours. The medium challenge is that colour illusions can persist through varying doxastic states of the individual. Mono-minimalism is consistent with colour illusions persisting through varying doxastic states, because the visual representation of such mono-minimal properties can persist despite beliefs that the perceiver holds. For example, even if the perceiver fails to believe that the object is phenomenal red* for at least one colour experience with standardness, it is still possible that the perceiver visually represents the object as phenomenal red* for at least one colour experience with standardness, and so it is still possible that the perceiver illusorily represents the object as phenomenal red* for at least one colour experience with standardness.

2.10.8. The gradation challenge: mono-minimalism

The gradation challenge is to provide an analysis of total veridicality, partial veridicality, and total error which aligns with our pre-theoretic understanding of these gradations. Mono-minimalism completes this task. The theory says that cases we pre-theoretically deem to be totally veridical involve veridical attribution of a colour (e.g., phenomenal red* for at least one colour experience with standardness), and veridical attribution of a shade (e.g., phenomenal scarlet* for at least one colour experience with standardness). The theory also says that cases we pre-theoretically deem partially veridical involve veridical attribution of colour and erroneous attribution of shade, and cases we pre-theoretically deem totally erroneous involve erroneous attribution of colour and shade.

2.10.9. Mono-minimalism vs scope-change theory

Mono-minimalism and scope-change theory both meet the broad veridicality challenge – in virtue of meeting the scope challenge and the medium challenge – and they also both meet the gradation challenge. However, scope-change theory comes at the unappealing cost that the scope of the colours is different in cases of veridical colour experiences compared to cases of erroneous colour experiences. Furthermore, scope-change theory is seemingly subject to an epistemic *reductio*. The reduction is that, if we assume scope-change theory, then we do not know which colour is represented until we know whether the colour experience is veridical/erroneous. This seems to fly in the face of the fact that we do know which colours are represented before we know whether the colour experience is veridical/erroneous.

Mono-minimalism does not have these unattractive consequences. Firstly, the scope of the colours does not change depending upon the veridicality of the colour experience, since the scope of the represented mono-minimal properties is the same regardless of whether the colour experience in question is veridical/erroneous. And mono-minimalism is not subject to the *reductio*, since we can know which colour is represented before knowing whether the colour experience is veridical (since the scope of the colours is uniform). Mono-minimalism is therefore my preferred theory of colour and is (in my view) the main result of this paper. I shall now outline some broader reflections about the nature of colour and perceptual variation.

2.11. The nature of colour

§2.11 and §2.12 focus upon broader questions regarding perceptual variation. My hope is that each section constitutes a substantial research project in its own right. §2.11 focuses upon what is necessary from our theory of colour to meet the broad veridicality challenge. I have previously contended that, beyond colours being subject-dependent properties with a certain scope, mono-minimalism is neutral upon the nature of the colours. This section outlines why mono-minimalism is neutral in this way. The key point is that further specification of such mono-minimal (subject-dependent) properties is not required for such properties to meet the broad veridicality challenge.

2.11.1. Subject-dependent conceptions of colour

Many pages of philosophy have been devoted to developing the view that colours are subject-dependent *dispositions*, and the same applies for the view that colours are subject-dependent *relations*. We have seen how these construals may not cleanly come apart. For example, our construal of subject-dependent relations may invoke subject-dependent dispositions, and *vice versa*. For example, *a la* Cohen (2009), perhaps we understand the relation red for *SI* in *CI* as the functional role of being disposed to look red to *SI* in *CI*.

Let's now survey some conceptually possible ways in which the subject-dependent theorist can understand the nature of colour. It is possible that colours are *identified* with subject-dependent dispositions, or that colours are *constituted* (in some non-identity way) by subject-dependent dispositions. These subject-dependent dispositions may or may not be construed in terms of subject-dependent relations. It also possible that colours are identified with subject-dependent relations, or that colours are constituted (in some non-identity way) by subject-dependent relations. Once again, these subject-dependent relations may or may not be

construed in terms of subject-dependent dispositions. Furthermore, colours may be identified with the *higher-order property* of having some subject-dependent disposition/relation, or with the *functional role* of the subject-dependent disposition/relation.

These are merely some dimensions upon which we can understand the nature of colour if we are a subject-dependent theorist. Thus, in principle, there is a myriad of different ways in which we may formulate our subject-dependent theory of colour.

2.11.2. *The relevant consideration: scope*

Prima facie, we may think that the above considerations concerning the nature of colour are relevant to whether our theory meets the broad veridicality challenge. For example, we may think that in order to meet the broad veridicality challenge, it is important that colours be understood as relations rather than dispositions, for example. But when it comes to meeting the broad veridicality challenge, such specification of the nature of subject-dependent mono-minimal properties is irrelevant.

For example, consider the property of being nomologically possible to cause phenomenal purple* in at least one colour experience with standardness. The mono-minimalist argues that colours are properties such as these. Let's imagine two construals of this property. On the first construal, the property is identified with the higher-order property of having the disposition to cause phenomenal purple* in at least one colour experience with standardness – whereby the disposition is understood in terms of nomological possibility. On the second construal, the property is constituted (in some non-identity way) by the relation phenomenal purple* for at least one colour experience with standardness – whereby the relation is understood in terms of nomological possibility. Let us assume that, if the first construal is a true theory of colour, then perceivers represent some objects as having the higher-order property of being disposed to cause phenomenal purple* in at least one colour experience with standardness. And let us assume that if the second construal is a true theory of colour, then perceivers represent some objects as bearing the relation phenomenal purple* for at least one colour experience with standardness. The key point is that, whilst these subject-dependent properties are different regarding the order of the property, the constitution of the property, and the relationality/dispositionality of the property, when it comes to the broad veridicality challenge, these properties do the same theoretical work. Let me explain.

Consider a perceiver who represents a chair as having the higher-order property of being disposed to cause phenomenal purple* in at least one colour experience with

standardness. This representation will be veridical *iff* it is nomologically possible that the chair causes phenomenal purple* in at least one colour experience with standardness, since the chair has the higher-order property of being disposed to cause phenomenal purple* in at least one colour experience with standardness *iff* the chair is disposed to cause phenomenal purple* in at least one colour experience with standardness. Positing that colours are such subject-dependent higher-order properties therefore meets the veridicality and error challenge. For example, in the case of the chair, the experience will be veridical *iff* the chair causes phenomenal purple* in at least one colour experience with standardness, and thus one colour experience with standardness represents the chair as purple.

Now consider a perceiver who represents the same chair as having the relation phenomenal purple* for at least one colour experience with standardness, whereby purple is constituted in some non-identity way by the relation. Similarly to the higher-order property of being disposed to cause phenomenal purple* in at least one colour experience with standardness, this representation will be veridical *iff* it is nomologically possible that the chair causes phenomenal purple* in at least one colour experience with standardness. This type of property also meets the veridicality and error challenge. This is because, similarly to the previous property, in the case of the chair, the experience will be veridical *iff* the chair causes phenomenal purple* in at least one colour experience with standardness, and thus one colour experience with standardness represents the chair as purple.

The key point is that the representation of both properties have a common element to their veridicality condition: with both properties, for the representation of the property to be veridical, the object would need to cause phenomenal purple* in at least one colour experience with standardness. Thus, when it comes to our subject-dependent theory meeting the broad veridicality challenge, what is important for such a theory is the *scope* of the subject-dependent properties. It is colours having a scope which is fixed by the colour experiences we deem veridical and the colour experiences we deem erroneous. This is because the scope of the colours fixes the veridicality condition. If the veridicality condition matches our criteria by which we delineate the veridical from the erroneous, then the scope of the colours will class veridical colour experiences as veridical and erroneous colour experiences as erroneous. This is why mono-minimalism is neutral upon the nature of mono-minimal properties beyond the scope of the colours, since further specification of the nature of such properties is not adjudicated by the desiderata set for the theory.

An important lesson, therefore, is that satisfying the broad veridicality challenge will not distinguish between different subject-dependent theories which all understand colours as having a mono-minimal scope. For example, the question of whether colours (1) are subject-dependent dispositions or relations, or (2) higher-order properties or functional roles themselves, or (3) identical to subject-dependent properties or merely constituted (in a non-identity way) by them, will need to be settled by theoretical considerations beyond the broad veridicality challenge.

2.12. What is perceptual variation?

The primary focus of this paper has been exploration of the contexts in which we think colour experience is veridical or erroneous. This exploration inspired a critique of extant subject-dependent theories of colour, and motivated scope-change theory and mono-minimalism. Whilst I have heavily focused on the *contexts* in which colour experiences are veridical/erroneous, I have not examined the nature of perceptual variation (indeed, I implicitly assumed at the outset that perceptual variation involves attribution of colour). But it turns out that there are numerous possible representational understandings of perceptual variation. Indeed, some representational understandings of the problem are more innocuous than others.

2.12.1. Colour identity and parthood-colour instantiation

In paper one, I introduced three ways in which colour experience can represent the world. Objects can be represented as instantiating colours (such as greenness), can be represented as being in locations (such as being over the surfaces of objects), and can be represented as possessing some aspect(s) (such as being primitive or subject-independent). These are attributions of colour, location, and aspect respectively. Attributions of colour, location, and aspect can in principle be veridical or erroneous. Perhaps certain types of attribution are systematically veridical/erroneous, or are periodically veridical/erroneous, or are not even involved in experiences of colour. Before we explore the possible contents involved in perceptual variation, and thus survey the conceptual possibilities regarding the nature of perceptual variation, I first outline two further ways in which colour experience can represent the world. This will allow us to consider four understandings of the problem of perceptual variation.

Firstly, it is possible that colours are represented as being *identical* to colours. For example, consider a case whereby a green object is erroneously represented as being yellowish-green. In such a case, as well as the object being represented as instantiating a colour it does not instantiate, perhaps also *greenness* is erroneously represented as being identical to yellowish-greenness. We can understand this thought by imagining contents as involving existential quantification over colours. For example, as well as involving other contents, perhaps the above colour experience represents that there exists an x , such that $x = \text{yellowish-greenness}$.³³ Thus, perhaps colour experiences involve:

ATTRIBUTION OF IDENTITY: A colour is represented as being identical to a colour. Such a representation can be veridical or erroneous.

A further way in which colour experience can represent the world is by representing *parts* of objects as instantiating colours. For example, when Gina represents the lime as being green, perhaps she also represents the *surface* of the lime as instantiating greenness. Or, when Gina can only see the top half of the lime, perhaps she represents the top half of the lime (a proper part of the lime) as green. We can understand this thought by imagining contents involving existential quantification over parts of objects. For example, as well as involving other contents, perhaps the above colour experience represents that there exists an x , such that x instantiates greenness (whereby ‘ x ’ refers to a part of an object). Therefore, perhaps colour experiences involve:

ATTRIBUTION OF COLOUR (PART): A part of an object (such as the surface of the object) is represented as instantiating a colour. Such a representation can be veridical or erroneous.

Now that we have the relevant attributions on the table, let’s survey some conceptually possible understandings of the problem of perceptual variation.

³³ I am not arguing that for an experience to involve an attribution of identity, it needs to involve a content with existential quantification. Rather, thinking of colour experiences as involving existential quantification in this way is merely a useful tool for understanding the type of attribution in question.

2.12.2. Four understandings of the problem

Prima facie, we may think that merely considering attributions of colour to objects can generate a problem of perceptual variation. For example, consider the lime that looks green all over to Gina, but yellowish-green all over to Yasmin. We may initially contend that the problem of perceptual variation is that Gina attributes greenness to the lime, whereas Yasmin attributes yellowish-green to the lime, and so the puzzle is whether the lime can simultaneously instantiate greenness and yellowish-green.

But, upon reflection, I think attribution of colour to objects is insufficient for generating the problem of perceptual variation. Consider a second case whereby, to Gina, the top half of the lime looks green, but the bottom half looks yellowish-green. Similarly, this second case involves attribution of two colours to the same object, and thus, *prima facie*, we may think that this case involves the problem of perceptual variation. But this case does not involve the problem of perceptual variation: we do not take issue with the top half of an object merely looking one colour to a perceiver and the bottom half of the same object looking a different colour to the same perceiver.

Perhaps we may respond by saying that perceptual variation occurs when *distinct* perceivers attribute distinct colours to the same object. But this claim is not sufficient for generating the problem of perceptual variation. Consider a case whereby we have a lime, but the bottom half is occluded from view to Gina, and the top half of the same lime is occluded from view to Yasmin. The top half of the lime looks green to Gina, and the bottom half looks yellowish-green to Yasmin. Gina attributes greenness to the lime, and Yasmin attributes yellowish-green to the lime. Thus, distinct perceivers attribute distinct colours to the same object, and the thought under consideration is that this is sufficient for generating the problem of perceptual variation. But, once again, this does not seem to generate a problem of perceptual variation: we do not take issue with the top half of an object looking one colour to one perceiver, and the bottom half of the same object looking a different colour to a different perceiver.

We therefore need to invoke some other representations in order to generate the problem. I survey four different possible understandings of the problem of perceptual variation, and each is inspired by a different way in which colour experience may represent the world. A natural first understanding of the problem is that colours are represented as being in *locations*, and the problem of perceptual variation occurs when distinct colours are represented as being in the same location. For example, we might say that the problem of perceptual variation occurs

when Gina represents greenness as being spread out all over the surface of the lime, and Yasmin represents yellowish-green as being spread out all over the surface of the same lime. With this understanding of the problem, if we wish to adopt both-ism, the challenge is whether two colours can be in the same location. Consider the:

LOCATION UNDERSTANDING: The problem of perceptual variation occurs when distinct colours are represented as being in the same location over an object by standard perceivers in standard conditions.

But we can imagine a conceptually distinct understanding of perceptual variation. When the lime looks green all over to Gina, perhaps she represents all the *surface* of the lime as instantiating greenness. And perhaps when the lime looks yellowish-green all over to Yasmin, perhaps she represents all the *surface* of the lime as instantiating yellowish-green. Thus, perhaps the problem of perceptual variation occurs when the same part of the same object is represented as instantiating distinct colours. With this understanding of the problem, if we wish to adopt both-ism, the challenge is whether the same part of the same object can instantiate distinct colours simultaneously. Consider the:

PART UNDERSTANDING: The problem of perceptual variation occurs when the same part of the same object is represented as instantiating distinct colours by standard perceivers in standard conditions.³⁴

We have so far been working under the assumption that perceptual variation involves representations of *distinct* colours³⁵: for example, with the location understanding, Gina and Yasmin represent distinct colours as being located over the surface of the same object. But this may not be the case. In cases of perceptual variation, we may think that there are different representations of the *same* colour. For example, in the case of the lime, perhaps Gina

³⁴ One may simultaneously adopt the location understanding and part understanding of perceptual variation. For example, we may think that colours are represented as being in locations and that parts of objects are represented as instantiating colours, and that the problem of perceptual variation occurs when distinct colours are represented as being in the same location over an object, and the same part of the object is represented as instantiating distinct colours. Indeed, we may think that whether the same part can instantiate multiple colours hinges on whether distinct colours can be located in the same location over the object, or that whether distinct colours can be located in the same location over the object hinges on whether the same part can instantiate multiple colours.

³⁵ We have been working under assumption one (see 1.2.3. in paper one).

represents the same colour differently to Yasmin, and the pertinent question is whether the same colour is that way that both representations represent it to be. A natural thought would be that if Gina's and Yasmin's experiences are about the same colour, then they are about a colour instantiated by the object. The explanation of why their experiences are about the same colour would be that their experiences both stand in appropriate causal relations with the same colour.³⁶ The thought that perceptual variation involves different experiences of the same colour is found in the extant literature. For example, whilst not a representationalist, Kalderon argues that perceptual variation involves the same colour being perceived as having different *aspects*:

‘when Norm and Norma have phenomenally different experiences of an identical colour *c*, there are, nevertheless, different things present in their respective experiences that can explain this phenomenal difference – *c* presents different aspects of its nature to Norm and Norma in the circumstances of perception’ (Kalderon 2011: 248)

Furthermore, Block (1999) also argues that perceptual variation involves experiences as of the same colour. However, rather than contending that the same colour is perceived to have different aspects, he contends that the same colour is experienced under different *modes of presentation*. Kalderon (2007) nicely articulates Block's view in the context of perceptual variation:

‘according to Block's (1999) "phenomenism" - the view that phenomenal properties are subjective monadic qualities of experience ... The quality, unique green, is no part of what appears to the subject; rather, that quality is a matter of how the color of the chip appears to the subject. Norm and Norma veridically perceive the same color-the phenomenal difference between them is a difference in how that color appears. The qualitative character of color appearance is less a perceptual presentation than a perceptual mode of presentation’ (Kalderon 2007: 568)

Kalderon and Block do not subscribe to experience *representing* the world. But they both subscribe to perceptual variation involving different experiences of the same colour. The

³⁶ As an analogy: we do not take issue with distinct experiences being about the same object but representing the same object differently. Indeed, this happens all the time.

following two representational understandings of perceptual variation assume that perceptual variation involves distinct experiences of the same colour. The first understanding concerns aspect, similarly to Kalderon's proposal.

Let's consider Gina and Yasmin once again and the third understanding of perceptual variation. The thought behind the third understanding is that Gina and Yasmin both represent the same colour, but they represent the same colour as having different aspects. We shall assume that the colour is represented as possessing different *qualitative* properties. For example, Gina represents the colour as having a qualitative property associated greenness: QualitativeG. Yasmin represents the colour as having a qualitative property associated with yellowish-green: QualitativeYG. The problem of perceptual variation occurs when standard perceivers in standard conditions represent the same colour as possessing distinct qualitative properties. With this understanding of the problem, if we wish to adopt both-ism, the challenge is whether the same colour can possess distinct qualitative properties. Consider the:

ASPECT UNDERSTANDING: The problem of perceptual variation occurs when the same colour is represented as possessing distinct qualitative properties by standard perceivers in standard conditions.

Let's now consider the fourth understanding of the problem. Once again, let's assume perceptual variation involves distinct experiences of the same colour. Let's assume that Gina represents the colour as being identical to greenness, and Yasmin represents the colour as being identical to yellowish-green. On this view, the problem of perceptual variation occurs when the same colour is represented as being identical to distinct colours. With this understanding of the problem, if we wish to adopt both-ism, then the challenge is whether the same colour can be identical to two seemingly distinct colours. Consider the:

IDENTITY UNDERSTANDING: The problem of perceptual variation occurs when the same colour is represented as being identical to distinct colours by standard perceivers in standard conditions.

2.12.3. *Distinct families*

At this point, it is helpful to consider whether there is an approach the both-ism theorist can take to perceptual variation which solves the problem regardless of which understanding of the problem is true. In my view, there is an underexplored passage from Kalderon which addresses what is required from both-ism to meet the challenge of perceptual variation:

‘Notice that it is the claim that the perceived colors are from distinct families that resolves the paradox. The perceived colors, unique green for Norm and yellowish green for Norma, are from distinct families of colors, and exclusion relations hold only within these families. That is why unique green for Norm and yellowish green for Norma are compatible qualities ... From the fact that Norm and Norma are perceiving colors from distinct families, it follows that they do not exclude one another’ (Kalderon 2007: 583)

The suggestion from Kalderon is that what is required from both-ism is that when perceptual variation occurs, the colours perceived are from distinct families, and this is what allows both colour experiences to be veridical. An analogy may help here. We do not take issue with a perceiver veridically representing the same object as square and blue, since the property of squareness and blueness are from distinct families, and so an object can simultaneously be square and blue. Similarly, if the colours that Gina and Yasmin represent are from distinct families, then perhaps this is what is important in allowing both of their experiences to be veridical. For example, consider the location understanding and the part understanding. We may think that for distinct colours to be in the same location, and for the same part of an object to instantiate distinct colours, what is important is that the distinct colours are from distinct families: this is what entails that they do not exclude each other.

Now consider the aspect understanding. This understanding is a little more complex, since it involves distinct experiences of the same colour. Imagine that Gina represents a colour as possessing qualitativeG, and Yasmin represents the same colour as possessing qualitativeYG. We might say that what is important for both of their experiences to be veridical is that qualitativeG and qualitativeYG are from distinct families. QualitativeG and qualitativeYG being from distinct families allows the same colour to simultaneously possess the two aspects, and so when distinct perceivers represent the distinct aspects, they do so veridically.

Let’s now consider the identity understanding. Imagine that Gina represents the colour of the lime as being identical to greenness, and Yasmin represents the colour of the lime as being identical to yellowish-green. Unfortunately, if this is the correct understanding of

perceptual variation, it does not seem that colours (or aspects) being from distinct families can vindicate a both-ism response to the problem. Even if green and yellowish-green are from distinct families, this does not entail that the same colour can be *identical* to green and yellowish-green. Thus, even if colours (such as green and yellowish-green) are from distinct families, this does not necessarily vindicate a both-ism response to perceptual variation, since if the identity understanding is true, colours being from distinct families does not entail that the same colour can be identical to distinct colours.

Indeed, if the identity understanding of perceptual variation is true, then it does not seem that mono-minimalism (or indeed any subject-dependent theory of colour) is successful in providing a both-ism response to perceptual variation. Imagine that Gina represents the colour of the lime as being identical to greenness (and the mono-minimalist identifies greenness with the property phenomenal green* for at least one colour experience with standardness). Now imagine that Yasmin represents the colour of the lime as being identical to yellowish-green (and the mono-minimalist identifies yellowish-green with the property phenomenal yellowish-green* for at least one colour experience with standardness). It is not the case that both representations can be veridical, since by transitivity of identity, if both representations were veridical, then phenomenal green* for at least one colour experience with standardness = phenomenal yellowish-green* for at least one colour experience with standardness. But this identity does not hold: after all, phenomenal green* and phenomenal yellowish-green* are distinct properties.

2.12.4. Methodological challenges

Ideally, we could come to know which understanding of perceptual variation is true. After all, if the identity understanding is true, then it does not seem that both-ism is a viable response to the problem. However, one central difficulty associated with adjudicating between the four different understandings of perceptual variation is that they all predict the same phenomenal characters involved in perceptual variation. It therefore does not seem that we can use the phenomenal character of colour experience to adjudicate between the different understandings. Let me demonstrate.

Imagine that Gina's colour experience represents in the following way: greenness is spread out all over the surface of the lime. Now imagine that her experience represents in this way: all the surface of the lime instantiates greenness. Now imagine her experience represent the following: there exists an x , such that x is spread out over all the surface of the lime, and x

has qualitativeG. And finally imagine that she represents in the following way: there exists an x , such that x is spread out over all the surface of the lime, and $x = \text{greenness}$. My hypothesis is that these four possible experiences with differing representations would all have the same phenomenal character. For example, the phenomenal character associated with representing greenness as being spread out all over the surface of the lime is the same as the phenomenal character associated with representing that there exists an x , such that x is spread out over all the surface of the lime, and $x = \text{greenness}$. This is why they are all viable understandings of perceptual variation: the phenomenal character associated with each representation is consistent with the phenomenal character of colour experience involved in perceptual variation. But this is problematic for our purposes, since we cannot use the phenomenal character of colour experience involved in perceptual variation to work out which understanding of the problem is true.

I want to end by noting some possible strategies going forward which may be fruitful in deciphering which understanding of perceptual variation is true. Firstly, we may look to phenomenal differences in other colour experiences and explore which representations can explain these phenomenal differences. If one representation (e.g., colour location representation) can explain more phenomenal contrasts than another representation (e.g., colour identity representation), then we may posit that the representation which does more explanatory work is involved in colour experience, but the representation that does less explanatory work is not. If two representations are tied in the explanatory work they do regarding phenomenal contrasts, then we may prefer the representation that is simplest. For example, if attributions of location and attributions of aspect do the same theoretical work regarding phenomenal contrast, then we may posit that the representation which is simplest is involved in colour experience, and the more complex representation is not. I think this approach has promise.

2.13. Conclusions

The key results of this paper are the following:

[1] Extant subject-dependent theories of colour, such as Cohen's relationalism and classic dispositionalism, fail to meet the broad veridicality challenge due to issues concerning the scope of the colours. The problem is that the posited properties range over the wrong groups of perceivers. If the properties range over similar perceivers, then the colour illusions of

colouritis perceivers will be wrongly classes as veridical. If the properties range over all standard perceivers, then veridical colour experiences will be wrongly classed as erroneous.

[2] Some colour illusions persist regardless of the doxastic state of the individual. This arguably runs contrary to relationalism, since plausible interpretations of relationalism involve colour illusions being false doxastic representations (or false visual representations which occur *in virtue* of false doxastic representations). The broader lesson is that our theory should not identify colour illusions with erroneous *doxastic* representations, or with erroneous *visual* representations which occur in virtue of false doxastic representations.

[3] We have a pre-theoretic understanding of gradations in veridicality in colour experience. These gradations include total veridicality, partial veridicality, and total error, and they fall out of distinguishing between a veridical attribution of a colour and a veridical attribution of a shade. The explicit commitments of relationalism do not align with the pre-theoretic understanding of such gradations, since relationalism commits to all colour experiences involving veridical attribution of colour. However, the explicit commitments of classic dispositionalism do so align.

[4] Scope-change theory is a novel subject-dependent theory of colour which says that the scope of the represented colours changes dependent upon whether the colour experience is veridical or erroneous. The theory meets the broad veridicality challenge and the gradation challenge. But it comes at two costs: (1) a lack of unity concerning the scope of the colours, and (2) (arguably) we do not know which colour (i.e., scope-change property) is represented until we know whether the colour experience is veridical/erroneous.

[5] Mono-minimalism is another novel subject-dependent theory of colour. The theory says that colours are properties such as being nomologically possible to cause phenomenal pink* in at least one standard perceiver in at least one standard condition. The theory meets the broad veridicality challenge and the gradation challenge. Mono-minimalism also maintains a unity concerning the scope of the colours, and is not subject to the argument that we do not know which colour is represented until we know whether the colour experience is veridical/erroneous.

[6] What is important for meeting the broad veridicality challenge is colours having a scope which is determined by the colour experiences we wish to deem veridical/erroneous. Whether these properties are construed in terms of dispositions or relations, or understood as identical or merely constituted by such properties, is not important for our theory of colour meeting the broad veridicality challenge. This is because the veridicality condition for the experience will be the same regardless of such further specification of the nature of colours.

[7] When we closely examine the nature of perceptual variation, we see that there are four representational understandings of the problem. If the identity understanding is true, then arguably we cannot take a both-ism response to the problem, since distinct colours are not identical to each other. One difficulty is that all four understandings are consistent with the phenomenal character of colour experience, and so we'll need to invoke different theoretical considerations in our adjudication. My hope is that consideration of the explanatory power of the relevant representations, and the simplicity of the representations, will be a fruitful way of deciphering which representations are involved in colour experience.

The most important result is mono-minimalism. Mono-minimalism successfully classes all colour experiences involved in perception as veridical, while providing an intuitive account of when a colour experiences is erroneous. The theory completes this task by directly invoking the veridicality criteria in the scope of the colours. The question of whether mono-minimalism is a true theory of colour is a further question which does not simply hinge upon the theory meeting the broad veridicality challenge and gradation challenge. Indeed, there are different theoretical considerations which may lead us to reject that colours are *subject-dependent* properties at all. What I do hope to have demonstrated, however, is that mono-minimalism succeeds where extant subject-dependent theories fail, since mono-minimalism provides a successful account of veridicality and error. To this end, mono-minimalism is a very promising theory of colour.

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Paper 3. Steady and Unsteady Colours

3.0. Abstract: This paper explores the difference between steady colours – such as those displayed by leaves and t-shirts – and unsteady colours – such as those displayed by the backs of CD’s and shimmering water. An important question is whether steady colours have a different metaphysics to unsteady colours; and, if so, how this metaphysical difference is spelled out. Some have argued that steady colours are subject-independent, but unsteady colours are subject-dependent. This poses a challenge for the subject-dependent theorist: explaining the difference between steady and unsteady colours in wholly subject-dependent terms. I argue that the subject-dependent theorist can account for the metaphysical difference between steady and unsteady colours in entirely subject-dependent terms. They can posit that steady and unsteady colours are both subject-dependent properties, but steady colours range over a wider collection of standard perceptual conditions than unsteady colours.

3.1. Introduction

Consider the main theories about the metaphysics of colour: relationalism, dispositionalism, physicalism, primitivism, and mental property theories. These theories are generally viewed as theories about the nature of *all* colours. For example, the typical physicalist argues that whilst there are metaphysical differences between red, green, and blue, for example, all colours are nonetheless classes of surface spectral reflectance properties. The typical physicalist therefore does not argue that red and green are classes of surface spectral reflectance, but blue is a primitive property, for example. The other main theories of colour also typically apply this uniformity regarding the metaphysics of colour.

Now, as we know, one way in which we taxonomise colour is into the different hues: we separate colours into hues such as yellow, blue, and purple, for example. Indeed, the separation of colours into hues is the orthodox way in which we think about the categorisation of colour. But there is a further way in which we can taxonomise colour: different colours have different levels of *steadiness*. Some colours, such as those displayed by footballs and tennis balls, are steady features. Whereas other colours, such as those displayed by aluminium foil and bodies of water, are unsteady features. We therefore have examples of redness which are steady, and examples of redness which are unsteady.

Whilst the main theories of colour are generally thought to be universally applied to the different hues – in the sense that a theory either is true of all hues or of none of them – it is

unclear whether they universally apply to colours with differing levels of steadiness. Indeed, one underexplored idea is that the metaphysical difference between steady and unsteady colours is understood in terms of one theory of colour being true of steady colours, but a different theory of colour being true of unsteady colours. For example, one possibility is that steady colours are subject-independent, but unsteady colours are subject-dependent.³⁷

This paper explores the idea that steady colours have a different metaphysics to unsteady colours and examines the nature of this metaphysical difference. I argue that we need not endorse the extant idea that steady colours are subject-independent, whereas unsteady colours are subject-dependent. Instead, we subject-dependent theorists can argue that all colours are subject-dependent – and thus subject-dependence is a unifying feature of the colours – but steady colours have a different scope to unsteady colours. I further argue that this bifurcation in the scope of colours is consistent with mono-minimalism.

The plan is as follows. In §3.2, I argue that steadiness does not directly map onto colour constancy, unlike some theorists have suggested. I then provide a novel characterisation of colour steadiness. In §3.3, I attempt to pinpoint why some theorists think that unsteady colours are subject-dependent, whereas steady colours are subject-independent. The basic thought is that, in the case of unsteady colours, the manifestation of colour is (in a sense to be described) present in the content of experience. But this is not the case with steady colours. In §3.4, I provide a novel subject-dependent explanation of the metaphysical difference between steady and unsteady colours. My suggestion is that steady colours are subject-dependent properties which range over a broader range of standard perceptual conditions than unsteady colours. I then outline how this picture is consistent with mono-minimalism. I lastly conclude.

3.2. Characterising steadiness

Consider an experience of a green leaf in natural daylight. Now consider an experience of the back of a CD. The colour experience involving the leaf involves an experience of a steady colour, and the colour experience involving the back of the CD involves an experience of some unsteady colour(s). This example gives us a *prima facie* understanding of the difference between steady and unsteady colours. But it turns out that it is unobvious as to how we provide a *precise* characterisation of steady and unsteady colours. Let's first consider Johnston's and Allen's characterisations:

³⁷ Some prominent philosophers (e.g., Johnston (1992)) endorse this view, so it is not simply a notional possibility.

‘A basic phenomenological fact is that we see most of the colors of external things as "steady" features of those things, in the sense of features which do not alter as the light alters and as the observer changes position. (This is sometimes called "color constancy".) ... Contrast the [unsteady colors] ... They change as the observer changes position relative to the light source’ (Johnston 1992: 226)

‘Roughly speaking, colour constancy is the phenomenon whereby the colours of objects are perceived to remain constant throughout variations in the conditions under which they are perceived, and so throughout variations in the way that objects appear as the perceptual conditions vary Although the colours of many physical objects are perceived to remain constant throughout variations in the conditions, as Johnston (1992: 141) notes, merely apparent ‘unsteady’ or ‘transient’ colours, like coloured highlights and the colours on the backs of compact discs, do appear to change with the viewing conditions’ (Allen 2016: 16-9)

Firstly, there is an important way in which the passages above are scope ambiguous. Indeed, this scope ambiguity is found in a lot of the literature on steady and unsteady colours. Johnston (1992: 226) argues that ‘we *see* most of the colors of external things as "steady" features’ (emphasis added). And Allen (2016: 16-9) argues that ‘colours of many physical objects are *perceived* to remain constant’ (emphasis added). From these passages, it is unclear whether these philosophers are contending that (1) colours are *represented* as having the property that a colour has when the seeming instantiation of the colour continues through changes in illumination, or (2) colour experiences are experiences *of* colours – the seeming instantiation of which continues through changes in illumination. For now, we shall assume (2), since it is less controversial, and nothing hangs on assuming (1) for the purposes of this section. I now want to explore a hypothesis which is more explicitly stated in the above passages: a hypothesis concerning the connection between steady colours and *colour constancy*.

The thought of the above philosophers is that an experience of a steady colour involves the phenomenon of colour constancy. This is contrasted with an experience of an unsteady colour which does not involve the phenomenon of colour constancy. In my view, the distinction between steady colours and unsteady colours does not cleanly map on to the distinction between colour constancy and colour inconstancy. And therefore, colour steadiness and unsteadiness cannot be conceptualised in terms of colour constancy and colour inconstancy.

We therefore require a different conceptualisation of what is for a colour to be steady and what it is for a colour to be unsteady. Let me explain.

Consider a possible object: *funky cube*. Funky cube changes colour every minute and changes to a completely random colour. Let's therefore consider the visual representations involving funky cube. Sometimes, funky cube is represented as blue, and blueness is represented as being spread out all over its surface, and at other times funky cube is represented as red, and redness is represented as being spread out all over its surface. The colours that funky cube is represented to possess do not change depending upon the lighting conditions and the perceiver's spatial position. If you took the cube into different lighting conditions, the seeming colour of funky cube would not change in virtue of this lighting change: it merely changes colour regularly (perhaps in virtue of the time, or perhaps in virtue of something else which coincides with regular times). Thus, the colour that funky cube seems to possess is insensitive to changes in perceptual conditions – which includes spatial position and lighting conditions – but is sensitive to changes in time conditions. The pertinent question is: do the colours attributed to funky cube admit of colour constancy? The answer is yes. Firstly, if we adopt the traditional invariantist conception of colour constancy, then we adopt the following:

‘In particular, on this view (henceforth, invariantism), colour constancy is an invariance of apparent colour across changes in illumination. Invariantism has become the de facto standard understanding of colour constancy in both philosophical and scientific work on colour’ (Cohen 2008: 64)³⁸

Some (e.g., Cohen (2008), Craven and Foster (1992), and Noë (2004)) have argued that invariantism does not adequately capture the phenomenon of colour constancy, because whilst there is a sense in which colour constancy involves invariance of seeming colour across changes in illumination, there is also a sense in which there is some change in represented colour. The challenge is characterising the nature of this change. However, even these objectors to invariantism nonetheless maintain that colour constancy in *some sense* involves invariance of represented colour across changes in illumination, even if there is a sense in which there is not invariance of represented colour across changes in illumination. Thus, perhaps a less controversial conception of colour constancy is the following:

³⁸ Once again, there is a scope ambiguity in the above quote. On one reading, the claim is that visual experience represents that there is invariance of apparent colour across changes in illumination. But on another reading, the claim is that, across changes in illumination, visual experience represents the same apparent colour. We shall assume that Cohen is making the latter claim, since the first claim is more controversial and not required by invariantism.

‘As viewing circumstances change, there is more constancy in the way a particular object looks, in respect of color, than one would predict based on the changes in the nature of the light from those objects that reaches our retinas’ (Gert 2010: 669)

For ease, I talk as though invariantism is the correct understanding of colour constancy, but my argument is consistent with Gert’s more permissive conception of colour constancy.

Now, paradigmatic cases of colour constancy do not involve an object changing colour at regular intervals. For example, the leaf would be green in a broad array of standard perceptual conditions and perceiver spatial positions, and it does not randomly change colour at regular time intervals. Of course, we could intervene and paint the leaf a different colour at regular times, but it is not in the *nature* of the colour or the leaf to regularly change colour. Whilst there is this difference between the leaf and funky cube, there is also a similarity between the two objects. When funky cube is a particular colour, the represented colour of the cube does not change depending upon lighting conditions. Within the minute that funky cube is represented as being a particular colour, you can take funky cube to a broad range of perceptual conditions, and it will be represented as having the same colour. Thus, funky cube displays colour constancy, since the represented colours of funky cube are constant across changes in illumination.

But are the colours of funky cube *steady*? Intuitively not: the colours of funky cube are not displayed for a long enough period to count as steady. If you are reticent to contend that the colours of funky cube are not steady, then consider *funkier* cube: a possible cube that changes to a random colour every second. Funkier cube displays colour constancy because there is an invariance of represented colour across changes in illumination. But it seems incorrect to contend that the colours involved with funkier cube are steady.

So, if the steadiness of colour does not directly map on to colour constancy, what is it for a colour to be steady? We might say that a colour is steadier than another colour if its visual representation tolerates more conditions – which includes lighting conditions, perceiver spatial position, and time conditions – than the other colour. On this conception of steadiness, the greenness of the leaf is most steady, the colours of funky cube are less steady, and the colours of funkier cube are least steady. Indeed, the colours of funky cube and funkier cube may justifiably be described as ‘unsteady’. Consider the revised conception of ‘steadiness’:

STEADINESS: The extent to which, across a range of conditions, a colour is visually represented.

Now consider again a colour experience of the back of a CD. This colour experience involves unsteady colours, because the colours are not visually represented across a broad range of conditions: in particular, lighting conditions and perceiver spatial positions. The colours visually represented on the back of the CD are unsteady for a different reason to the unsteady colours seemingly visible on funky cube and funkier cube. The former are unsteady due to their visual representation not tolerating many differences in lighting conditions and perceiver positions, but the latter are unsteady due to their visual representation not tolerating many differences in time conditions.³⁹ Thus, there can be different reasons for the unsteadiness of colour. The colours represented on the back of the CD are named ‘perceiver-light-unsteady colours’ in virtue of the following reason for their unsteadiness:

PERCEIVER-LIGHT-UNSTEADY COLOURS: Colours, the visual representation of which does not tolerate many changes in lighting conditions and perceiver spatial positions.

The seeming colours on funky cube and funkier cube are named ‘time-unsteady colours’ in virtue of the following reason for their unsteadiness:

TIME-UNSTEADY COLOURS: Colours, the visual representation of which does not tolerate many changes in time conditions.

An important point is that we can think of perceiver-light-unsteady colours and time-unsteady colours as determinates of the determinable *unsteady colours*. Just as crimson and scarlet are determinates of redness, perceiver-light unsteady colours and time-unsteady colours are determinates of unsteady colours. There will be further determinates of unsteady colours since perceiver position, lighting conditions, and time will not exhaust the factors that can make a colour unsteady. We shall mainly focus upon perceiver-light-unsteady colours, since perceiver-light-unsteady colours have been of particular focus in the literature. But I shall invoke time-unsteady colours at certain relevant points.

³⁹ If one fixed viewing and lighting conditions fully, so that they remain perfectly constant across a stretch of time, the colours displayed on the back of the CD will continue to be visually represented (and the same for other perceiver-light unsteady colours). But even if you fix the viewing and lighting conditions fully, the colours displayed by funky and funkier cube will not continue to be visually represented.

3.3. Dispositionalism & the manifestation requirement

In this section, I outline the view that perceiver-light-unsteady colours are represented as (subject-dependent) dispositional properties and attempt to pinpoint why some theorists have thought this. I then outline a possible consequence of this reasoning which has been endorsed by some theorists. The consequence is that steady colours are (subject-independent) non-dispositional properties, whereas certain unsteady colours are (subject-dependent) dispositional properties.

3.3.1. The manifestation requirement

There is a seeming difference in phenomenal character between an experience of perceiver-light-unsteady colour(s) and an experience of some steady colour(s). Examples of perceiver-light-unsteady colours are the ones involved in experiences of the backs of CD's and other glossy materials like aluminium foil, oil slicks on the ocean, etc. Some philosophers have argued that perceiver-light-unsteady colours are represented as dispositional/relational and that this contrasts with steady colours which are not represented as dispositional/relational. The thought is that it is this difference in representation which accounts for the phenomenal contrast between an experience of a perceiver-light-unsteady colour and an experience of a steady colour. Consider Johnston on this point:

'Thus there is some truth in the oft-made suggestion that (steady) colors don't look like dispositions; to which the natural reply is "Just how would they have to look if they were to look like dispositions?"; to which the correct response is that they would have to look like ... unsteady colors, e.g., the swirling evanescent colors that one sees on the back of compact discs' (Johnston 1992: 226-7)

We see a similar thought found in Boghossian and Velleman's work:

'If colours looked like dispositions...then they would seem to come on when illuminated, just as a lamp comes on when its switch is flipped...But colours do not look like that; or not, at least, to us' (Boghossian and Velleman 1989: 86)

Consider the leaf. According to Johnston and Boghossian and Velleman, the colour of the leaf is not represented as a disposition, because the manifestation of the disposition does not

seemingly occur before the perceiver. There is once again an ambiguity: in this case, an ambiguity concerning what is meant by ‘seems’. Perhaps Boghossian and Velleman mean that if colours *visually* seemed to come on, then they look like dispositions. Or perhaps Boghossian and Velleman mean that if colours *cognitively* seemed to come on, then they would look like dispositions (perhaps in virtue of cognitive penetration). What is important for our purposes is the idea that a colour visually *or* cognitively seeming to come on is necessary for colours looking like dispositions. Thus, ‘seems’ in this context remains neutral upon these two understandings.

Boghossian and Velleman do not frame their thought in terms of the difference between steady colours and perceiver-light-unsteady colours. But their thought is that if colours were represented as dispositions, then it would have to be as though the manifestation of the disposition occurred before the perceiver. As Byrne writes:

‘Boghossian and Velleman’s idea seems to be that if the colours of objects appeared to ‘come on’ when illuminated, *it would appear that the manifestation of the disposition was occurring*, just as it appears that the manifestation of fragility occurs when the wine glass hits the floor’ (Byrne 2001: 244)

This is similar to Johnston’s thought regarding perceiver-light-unsteady colours. The thought is that when a perceiver changes spatial position and has an experience of a perceiver-light-unsteady colour, it is as though the manifestation of a disposition occurs before the perceiver. Johnston provides the following necessary requirement upon a colour being represented as a disposition:

‘A property cannot appear as a disposition unless it appears as being a relation of the bearer of the disposition to the manifestation of the disposition *and* the circumstances of manifestation’ (Johnston 1992: 227) (emphasis added)

Consider funky cube. We may think there is a sense in which the colours of funky cube seem to come on when funky cube changes colour, but I do not think that Boghossian and Velleman and Johnston would contend that the colours of funky cube are perceived as dispositions to look coloured to standard perceivers in standard perceptual conditions. Let me explain. The dispositional view of colour says that colours are dispositions to cause certain experiences in certain perceivers in certain perceptual conditions. When funky cube changes colour, there is

no change to the perceiver and/or the lighting conditions, and so whilst there may be a sense in which they seem to come on, they do not seem to come *in virtue of* some change/satisfaction of the conditions of manifestation.

This is different to perceiver-light-unsteady colours, for example. When a perceiver changes spatial position and/or the lighting changes, some perceiver-light-unsteady colour(s) may seem to come on, and thus perhaps they seemingly come on in virtue of some change/satisfaction of the conditions of manifestation. This reasoning in the context of colours provides us with a very general requirement for a property being represented as a disposition:

MANIFESTATION REQUIREMENT: For a property to be visually represented as a disposition, there needs to be a time when the manifestation of the disposition is not visually represented, and a time when the manifestation of the disposition is visually represented, and the difference between when the manifestation is not represented and is represented is explained by the fact that there is some change/satisfaction of the elements involved in the manifestation conditions of the disposition.

For example, if we accept the manifestation requirement, for fragility to be represented as a disposition, there needs to be a time when the object is not represented as breaking, a time when the object is represented as breaking, and the difference between when the object is not represented as breaking and is represented as breaking is explained by the fact that there is some change/satisfaction of the manifestation conditions (for example, the object being dropped from a height). Furthermore, if we adopt the manifestation requirement, we may think that the seeming colours of funky cube are represented as dispositions to cause x experiences in y *time* conditions, since there is a time when the colour is not visually represented, and a time when the colour is visually represented, and the difference between when the property is not represented and is represented is that there is some change/satisfaction of the elements involved in the manifestation conditions of the disposition (I.e., the time conditions). We can now see the manifestation requirement at work in the context of colours and dispositionalism:⁴⁰

COLOUR MANIFESTATION REQUIREMENT: For a colour to be represented as a disposition to look colour F to y perceivers in z conditions, there needs to be a time when colour F is not

⁴⁰ For ease, I assume the formulation of dispositionalism which says that the colour yellow, for example, is the disposition to look yellow to y perceivers in z conditions.

represented by the perceiver, and a time when colour F is represented by the perceiver, and the difference between when the colour is not represented and is represented is explained by the fact that there is a change/satisfaction regarding y perceivers and/or z conditions.

The hypothesis is that perceiver-light-unsteady colours are represented as dispositions since they meet the colour manifestation requirement. But steady colours and some unsteady colours such as time-unsteady colours are not represented as dispositions, since they do not meet the colour manifestation requirement. This hypothesis has a possible and underexplored consequence: that steady colours have a subject-independent metaphysics, but perceiver-light unsteady colours have a subject-dependent metaphysics. We explore this next.

3.3.2. *Non-dispositionalism & bifurcated metaphysics*

We may think that perceiver-light unsteady colours are represented as dispositions, and think that steady colours are represented as having a different aspect, but think that perceiver-light unsteady colours are *erroneously* represented as dispositions. If we thought this, then we could think that perceiver-light-unsteady colours are represented as dispositions, but steady colours are represented as intrinsic, for example, but nonetheless think that all colours are intrinsic. This is because we could think that perceiver-light-unsteady colours were erroneously represented as dispositions, but steady colours were veridically represented as intrinsic. The thought would be that perceiver-light unsteady colours are intrinsic despite their representation as dispositional.

However, there is a common extant assumption which entails that perceiver-light unsteady colours are not erroneously represented as dispositions, and this may lead us to think that steady colours have a different metaphysics to perceiver-light unsteady colours. The assumption is what Byrne (2001: 245) calls ‘infallibility’: *if* colours are represented as possessing a certain aspect, then they have the aspect that they are represented as having. Thus, if we hold infallibility, and we think that perceiver-light-unsteady colours are represented as dispositional, but steady colours are represented as intrinsic, for example, then we think that perceiver-light-unsteady colours have a different metaphysics to steady colours: so long as we assume that a property being dispositional precludes it from being intrinsic, and *vice versa*. Indeed, Johnston explicitly holds the view that there is a bifurcation in the metaphysics of steady and perceiver-light-unsteady colours. Consider:

‘A course of experience as of the steady colours is a course of experience as of light-independent and observer-independent properties ... Contrast the [perceiver-light-unsteady colours]: a course of experience as of the [perceiver-light-unsteady colours] reveals their relational nature. They change as the observer changes position relative to the light source’ (Johnston 1992: 226)

Johnston argues that perceiver-light-unsteady colours are light-dependent and observer-dependent relational properties, whereas steady colours are light-independent and observer-independent. Keith Allen does not explicitly advocate for the view that steady and unsteady colours are *represented* or *perceived* as having aspects, and so it is not infallibility that motivates him to think that steady colours have a different metaphysics to perceiver-light-unsteady colours. But he does argue that the obvious explanation for why steady colours are steady is that they have a certain metaphysics:

‘The obvious explanation of why ‘steady’ or ‘constant’ colours are not perceived to change with changes in our experience due to changes in the conditions under which they are perceived is that these colours are mind-independent properties of physical objects, whose nature and existence is independent of our psychological responses to them’ (Allen 2016: 19)

A natural question for Allen is whether the obvious explanation for why certain unsteady colours are perceiver-light-unsteady is because they are mind-*dependent* properties. If we think that the obvious explanation for why certain colours are steady is that they are mind-independent, then in order to avoid a seemingly *ad hoc* asymmetry in explanation, we may answer ‘yes’. This entails a similar view to that of Johnston: that some colours are mind-independent whereas other colours are mind-dependent.

Now, theories of colour typically entail that different colours have a different metaphysical makeup: that is, different colours have different properties. For example, a typical theory will entail that blueness has different properties to redness. However, whilst we do not want to take issue with different colours having a different metaphysics, we may also want to provide an account of colour *qua* kind, and, in this account, we may want to pinpoint some unifying property (or properties) of colour. The unifying property would at least be a *candidate* for being the essence of colour. *Prima facie*, we may think that aspects such as mind-independence (in the case of Allen) and observer-independence and light-independence (in the case of Johnston) are strong candidates for being unifying features of the colours. If some

colours are mind-independent whereas others are not, however, then mind-independence does not fix the *essence* of colour, since mind-independence is not a unifying feature of colours.

Johnston and Allen could in principle contend that mind-independence is not an essential property of colours. Indeed, Allen argues that colours are primitive properties, and so in principle his position could be that all colours are primitive, but some colours are primitive and mind-independent, yet others are primitive and mind-dependent. This is not Allen's (2016) position – he contends that all colours mind-independent – but perhaps he could in principle hold this view.⁴¹

The broader and more important point, however, is that any difference in aspect that accounts for the difference between steady colours and perceiver-light-unsteady colours cannot be an essential property of colours, since by assumption not all colours would have the aspect in question. Thus, our posited metaphysical difference between steady and perceiver-light-unsteady colours cannot coincide with our posited unifying feature of the colours. This poses a challenge for the subject-dependent theorist who wishes to contend that subject-dependence is a candidate for fixing the essence of colour, and thus a unifying feature of the colours. The challenge is to explain the difference between steady and perceiver-light unsteady colours in entirely subject-dependent terms.

3.4. Subject-dependence & bifurcated metaphysics

This section outlines a subject-dependent explanation of the difference between steady colours and perceiver-light unsteady colours. I suggest that steady and perceiver-light unsteady colours are all subject-dependent, but they have different manifestation conditions. I then outline how steady and perceiver-light-unsteady greenness, for example, are determinates of the same colour: *greenness*. I lastly outline how the bifurcation in the scope of the colours is consistent with mono-minimalism about colour.

3.4.1. The bifurcation

As we have seen, one extant proposal is that steady colours are subject-independent, and perceiver-light unsteady colours are subject-dependent. Thus, the challenge for the subject-

⁴¹ This may be a little trickier than I have suggested. Consider the mind-dependent property phenomenal green* for at least one standard perceiver in at least one standard condition. We might think that this property is not primitive, since instances of the property require for their existence the existence of perceivers, and these perceivers may be metaphysically independent of the property. Thus, perhaps subject-dependent properties are not (or perhaps *cannot*) be primitive.

dependent theorist is to provide an account of steady and perceiver-light unsteady colours which vindicates that they are different, but maintains that colours are subject-dependent properties. Indeed, Levin seems to hint at a subject-dependent approach along these lines. She writes:

‘The perceiver-dependence of the “steady” colors is treated by almost any dispositional theory as quite different from the perceiver-dependence of the color highlights. If steady colors are supposed to be dispositions to look (steadily) colored to normal perceivers under standard conditions, then dispositionalism implies that they will remain the same (that is, steady) throughout changes in such variables as position and lighting. It would be unwarranted, then, to expect them to seem relational – that is, perceiver-relative – *by virtue of producing different effects on us when position or lighting varies*’ (Levin 2000: 156-7)

The key sentence for our purposes is ‘The perceiver-dependence of the “steady” colors is treated by almost any dispositional theory as quite different from the perceiver-dependence of the color highlights’ (Levin 2000: 156).⁴² In my view, the subject-dependent theorist should say that steady colours have a different scope to perceiver-light unsteady colours. They should say that steady colours are dispositions/relations to cause a certain kind of colour experience in standard perceivers in a *wide* array of standard perceptual conditions, but that perceiver-light-unsteady colours are dispositions/relations to cause a certain kind of colour experience in standard perceivers in a *limited* range of standard perceptual conditions. In Levin’s parlance, this is the way in which the perceiver-dependence of steady colours is different to the perceiver-dependence of unsteady colours.

For example, consider an eggcup which displays steady purple, and consider the back of a CD which displays perceiver-light-unsteady purple. The thought is that the steady purple displayed by the eggcup is the disposition/relation to cause a certain kind of (purple) colour experience in standard perceivers in a wide range of standard conditions. After all, the eggcup does indeed cause a certain kind of (purple) colour experience in standard perceivers in a wide

⁴² Levin then goes on to suggest that steady colours could be identified with dispositions to look steadily coloured to standard perceivers in standard conditions. Presumably she would contend that unsteady colours could be identified with dispositions to look unsteadily coloured to standard perceivers in standard conditions. There is a scope ambiguity again. On one interpretation, the claim is that colours look to be steady. However, in my view, it seems unnecessary to build into our dispositional theory that objects look steadily coloured or perceiver-light unsteadily coloured. The dispositionalist can explain the difference between steady and perceiver-light-unsteady colours without committing to a contentious claim concerning whether objects are represented as being steadily coloured and perceiver-light-unsteady colours are represented as being perceiver-light unsteadily coloured.

range of standard conditions. And the thought is that the perceiver-light-unsteady purple displayed by the back of the CD is the disposition/relation to cause a certain kind of (purple) colour experience in standard perceivers in a more limited range of standard conditions. After all, the CD does indeed cause a certain kind of (purple) colour experience in standard perceivers in a more limited range of standard conditions (in this case, more limited because it does not cause a certain kind of (purple) colour experience in as many standard spatial and lighting conditions).

Interestingly, the subject-dependent theorist can give a similar analysis of the difference between steady colours and time-unsteady colours, such as those displayed by funky cube. The subject-dependent theorist can argue that time-unsteady colours are properties to cause a certain kind of colour experience in standard perceivers in a limited range of standard conditions, whereby the range is more limited along the dimension of time conditions. On this view, all colours are subject-dependent, and so subject-dependence is a unifying feature of the colours. But this view says that steady colours have different manifestation conditions to perceiver-light-unsteady colours and time-unsteady colours. We shall call the view that says that all colours are subject-dependent, but steady colours have a different scope to unsteady colours, ‘SD bifurcation theory’:

SD BIFURCATION THEORY: All colours are subject-dependent properties. Steady colours and unsteady colours both range over standard perceivers, but steady colours range over a broad range of perceptual conditions, whereas unsteady colours range over a more limited range of perceptual conditions.

Different subject-dependent theorists can cash out SD bifurcation theory in different ways. For example, the relationalist may argue that steady redness is the relation *red for standard perceivers in a wide range of perceptual conditions*, and perceiver-light unsteady redness is the relation *red for standard perceivers in a more limited range of perceptual conditions*. Furthermore, the dispositionalist may argue that steady blueness is the disposition to look blue to standard perceivers in a wide range of standard conditions, and perceiver-light-unsteady blueness is the disposition to look blue to standard perceivers in a more limited range of perceptual conditions. Thus, SD bifurcation theory can be adopted by different subject-dependent theorists of colour, since the claim concerns a bifurcation in the *scope* of subject-dependent properties, rather than a bifurcation regarding the type of subject-dependent property.

3.4.2. *Distinct colours?*

Here is a *prima facie* worry for SD bifurcation theory. We may think that perceiver-light unsteady blueness, such as that displayed by a sheet of aluminium, and steady blueness, such as that displayed by a mug, are both the same colour. They are both examples of blueness. But we may worry that my proposal entails that they are different colours – since they are properties with differing scopes – and that this flies in the face of the intuitive and common sense thought that they are both cases of blueness.

In response to this worry, I want to consider how perceiver-light unsteady blueness and steady blueness are determinates of the same colour: *blueness*. Just as different shades of blue are determinates of blueness, steady blueness, time-unsteady blueness, and perceiver-light-unsteady blueness are also determinates of blueness. Thus, when we represent time-unsteady blueness and subsequently represent steady blueness, we represent the colour blue on each occasion, but we simply represent different determinates of the colour blue. Thus, when we represent an unsteady colour and then its steady analogue, we represent the same colour, but we simply represent different determinates of the same colour. Let's now consider how SD bifurcation theory is consistent with mono-minimalism.

3.4.3. *Mono-minimalism*

In paper two, I advocated for a mono-minimalist theory of colour. The mono-minimalist argues that the colour red, for example, is the property of being nomologically possible to cause phenomenal redness* in at least one standard perceiver in at least one standard condition. My suggestion in this paper is that steady redness and perceiver-light unsteady redness are determinates of redness. Thus, when this is combined with mono-minimalism, the thought is that steady redness and perceiver-light-unsteady redness are both determinates of the property of being nomologically possible to cause phenomenal redness* in at least one standard perceiver in at least one standard condition.

I have also argued for SD bifurcation theory which entails the view that steady redness has a different scope to perceiver-light-unsteady redness. Thus, one substantive question is whether these differences in scope are consistent with steady redness and perceiver-light unsteady redness both being determinates of the mono-minimal property. A necessary requirement on them both being determinates of the mono-minimal property is that their scope includes at least one standard perceiver in at least one standard condition: after all, if they did

not, then it is hard to see how they are determinates of a property whose scope involves at least one standard perceiver in at least one standard condition. Fortunately, the different scopes that steady redness and perceiver-light-unsteady redness possess are consistent with them both being determinates of mono-minimal redness (I.e., the colour red). I shall explain.

Steady redness and perceiver-light unsteady redness include at least one standard perceiver and at least one standard condition in their scope. For example, consider perceiver-light-unsteady redness displayed on the back of a CD. The mono-minimalist should say that this redness is a subject-dependent property which ranges over at least one standard perceiver and a more limited range of standard perceptual conditions, and so the scope includes at least one standard perceiver and at least one standard perceptual condition. According to the mono-minimalist, an object does not instantiate perceiver-light unsteady redness if it is not nomologically possible to cause phenomenal redness* in at least one standard perceiver in at least one standard condition.

Furthermore, consider steady redness displayed on the back of a ladybird. The mono-minimalist should say that this steady redness ranges over at least one standard perceiver in a wider array of standard perceptual conditions. Once again, this scope nonetheless includes at least one standard perceiver in at least one standard condition. The mono-minimalist says that an object does not instantiate steady redness if it is not nomologically possible for the object to cause phenomenal redness* in at least one standard perceiver in at least one standard condition.

One consequence of this picture is that there is a higher bar on an object instantiating steady redness than the same object instantiating redness, since the scope of steady redness includes a wide range of standard perceptual conditions, rather than merely at least one standard perceptual condition. What I mean by 'higher bar' is that the instantiation of steady redness involves a detailed condition, compared to the instantiation of redness which involves a less detailed condition. There is also a higher bar on an object instantiating perceiver-light-unsteady redness than the same object instantiating redness, since the scope of perceiver-light-unsteady redness includes a limited range of standard perceptual conditions (which we can assume in most cases involves more than at least one standard perceptual condition). Once again, the instantiation of perceiver-light unsteady redness involves a detailed condition, whereas the instantiation of redness involves a less detailed condition.

Prima facie, this may seem an odd consequence. But I do not think it is. Consider an analogy with the shades of a given colour. Similarly to steady and unsteady colours, the shades of a given colour are determinates of the colour. Consider the shade azure and its determinable

the colour blue. There are fewer situations in which an object is azure than situations in which an object is blue: the instantiation of azure therefore involves a more detailed condition than the instantiation of blue. Thus, steady and perceiver-light unsteady colours stand in the determinate-determinable relation with the (mono-minimal) colours, just as the shades stand in the determinate-determinable relation with the colours.

3.5. Conclusions

The conclusions of this paper are the following:

[1] The steadiness of colour does not directly map on to the phenomenon of colour constancy, unlike some theorists have thought. This is because a possible object – funky cube – displays colour constancy but does not display steady colours, since the colours displayed by funky cube change at regular times. A better conception of steadiness is one that says that steadiness is the extent to which, across a range of conditions, a colour is visually represented.

[2] Some have argued that perceiver-light unsteady colours are subject-dependent properties, and that steady colours are subject-independent properties. This entails a bifurcation in the nature of colour such that neither subject-dependence nor subject-independence are unifying features of the colours. Furthermore, the proposal poses a challenge to the subject-dependent theorist: accounting for the difference between steady and perceiver-light-unsteady colours in wholly subject-dependent terms.

[3] I argued that the subject-dependent theorist can account for the difference between steady and perceiver-light-unsteady colours by arguing that they are both subject-dependent properties, but steady colours have a different scope to perceiver-light-unsteady colours. Steady colours are subject-dependent properties to cause colour experiences in standard perceivers in a wide range of standard perceptual conditions, whereas perceiver-light unsteady colours are subject-dependent properties to cause colour experiences in standard perceivers in a more limited range of standard perceptual conditions.

[4] I argued that this subject-dependent bifurcation in the metaphysics of colour is consistent with mono-minimalism. My suggestion is that steady and perceiver-light-unsteady greenness, for example, are both determinates of the property of being nomologically possible to cause

phenomenal greenness* in at least one standard perceiver in at least one standard condition. Even though steady greenness has a different scope to perceiver-light unsteady greenness, they are both determinates of the mono-minimal property, since their scopes include at least one standard perceiver and at least one standard condition.

3.6. Reference list

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Concluding remarks

In paper one of this thesis, I outlined and motivated a novel way of thinking about the nature of colour experience. This novel way of thinking emerged from distinguishing between attribution of colour, attribution of aspect, and attribution of location. Realist error theories of colour experience say that colour experience is generally veridical regarding the instantiation of colour, but universally erroneous regarding aspect and/or the location of colour. Subject-dependent realist error theories unify the motivations for a subject-dependent metaphysics of colour with the appealing thought that colours are represented as subject-independent. Scientific realist error theories unify the motivations for a scientifically based metaphysics of colour with the compelling thought that the manifest image of colour is in tension with the scientific image of the world. Furthermore, both formulations of realist error theory possess the virtue that colour experience is generally veridical regarding the instantiation of colour.

In paper two, I argued against extant subject-dependent theories and motivated and defended a novel subject-dependent theory of colour. I argued that relationalism and classic dispositionalism fail to class colour experiences involved in perceptual variation as veridical and class erroneous colour experiences as erroneous (I.e., they fail to meet the broad veridicality challenge). I then motivated two novel formulations of subject-dependent theory. Scope-change theory says that the scope of the represented colour is different dependent upon whether the colour experience is veridical or erroneous. Mono-minimalism says that colours are properties such as phenomenal yellow* for at least one standard perceiver in at least one standard condition. I argued that mono-minimalism is preferable to scope-change theory, since it does not come at the consequence that the veridicality status of the colour experience is more fundamental than what is represented. I further argued that whether colours are *relational* mono-minimal properties or *dispositional* mono-minimal properties will not be adjudicated by whether it is relational/dispositional properties that cleave veridical colour experiences from erroneous colour experiences, since the relations and dispositions do the same theoretical work. I also argued that there are different possible understandings of the nature of perceptual variation, and that there are methodological challenges in adjudicating between these understandings.

In paper three, I argued that the subject-dependent theorist can provide an explanation of the difference between steady and perceiver-light unsteady colours in entirely subject-dependent terms. I argued that steady colours range over a broader range of standard perceptual conditions than unsteady colours: I named this 'SD bifurcation theory'. I argued that the

bifurcation in scope is consistent with mono-minimalism. This is because steady and perceiver-light-unsteady colours both have a scope which includes at least one standard perceiver and at least one standard condition, and thus they are both determinates of (mono-minimal) colours, since mono-minimalism says the colours range over at least one standard perceiver in at least one standard condition.

I now want to outline how the three papers combine to produce a harmonious and pleasing vision of the nature of colour and colour experience. This vision emerges from combining realist error theories with mono-minimalism and SD bifurcation theory. I shall outline a dialectic that produces this vision.

We are first motivated to adopt mono-minimalism: a subject-dependent theory of colour which successfully classes colour experiences involved in perceptual variation as involving veridical attribution of colour, and successfully classes colour experiences involving erroneous attribution of colour as erroneous. We find mono-minimalism persuasive, but we find it compelling to think that colours are visually represented as subject-independent. We also find it compelling that colours are represented as intrinsic, but we think that science does not posit any intrinsic properties which are good candidates for being the colours. We therefore simultaneously adopt a subject-dependent realist error theory and a scientific realist error theory. The subject-dependent realist error theory says that colours are subject-dependent mono-minimal properties, but they are erroneously represented as subject-independent. The scientific realist error theory says that colours are mono-minimal properties which are consistent with the scientific image, but colours are erroneously represented as intrinsic. These realist error theories are consistent with each other, and consistent with mono-minimalism.

We then adopt SD bifurcation theory alongside mono-minimalism, the subject-dependent realist error theory, and the scientific realist error theory. We argue that the difference between steady and perceiver-light-unsteady colours is cashed out in terms of them having different manifestation conditions which are consistent with them being determinates of the (mono-minimal) colours. This view is motivated by the thought that the representation of steady colours persists through more changes in lighting conditions and perceiver spatial positions than the representation of perceiver-light unsteady colours. Since we are already motivated to hold a subject-dependent realist error theory and scientific realist error theory, we contend that steady and perceiver-light unsteady colours are *erroneously* represented as subject-independent and intrinsic. The three papers therefore provide us with novel

understandings of colour experience and colour which combine to form a much broader theoretical framework in the area.

Finally, I want to outline what I take to be an important area for future research. This thesis has focused on the possibilities regarding how objects and colours are represented, and has situated these possibilities in contemporary debates to demonstrate their promise. And throughout this thesis, I have made assumptions about the representations involved in colour experience.

First, all realist error theories assume that objects and colours are represented in certain ways. They all assume that objects are represented as coloured, and, depending upon which realist error theory we adopt, we assume that colours are represented as possessing some aspect(s) and/or represented as being in locations. It is therefore a central question whether objects are represented as coloured, whether colours are represented as having aspects, and whether colours are represented as being in locations. After all, if we do not know which representations are involved in colour experience, then we cannot hope to know whether a realist error theory is true.

Second, understanding the nature of perceptual variation involves understanding the representations involved in colour experience, since perceptual variation involves differing colour experiences which are (in some sense) in conflict. For example, whether perceptual variation involves identity, location, parthood-instantiation, or qualitative properties, depends on how colour experience represents objects, parts of objects, and colours. Indeed, whether both-ism (and therefore mono-minimalism) is a viable option in response to perceptual variation depends upon the nature of perceptual variation, which in turn depends upon how colour experience represents the world.

Third, understanding the nature of steady colours and perceiver-light-unsteady colours depends (in part) upon understanding how steady and perceiver-light unsteady colours are represented. If, for example, steady colours are represented as subject-independent, whereas perceiver-light unsteady colours are represented as subject-dependent, then this may tell in favour of a bifurcation whereby steady colours are subject-independent, but perceiver-light unsteady colours are subject-dependent. Or, if someone were compelled to think that all colours were subject-dependent despite the representation of steady colours to the contrary, then they would have a view whereby some colour experiences involved erroneous attribution of aspect. Thus, understanding how steady and perceiver-light unsteady colours are represented is important for understanding the nature of these properties and the nature of colour experience.

One way in which we could attempt to determine the contents of colour experience would be to pinpoint phenomenal contrasts and explain these contrasts with a given hypothesis about how the world is represented. One issue for this approach, however, is that there will be competing representational explanations of the phenomenal contrast, as we saw in the case of perceptual variation. I therefore doubt that considering phenomenal contrast alone will lead us to a complete understanding of the representations involved in colour experience. A promising approach, I suggest, is to also prioritise (1) the simplicity of the hypothesised contents, and (2) how many phenomenal contrasts the hypothesised contents can explain. If a particular hypothesised content is simpler than others and can explain more phenomenal contrasts than others, then this may tell in favour of this content being involved in colour experience. However, challenges here include deciphering what it is for a content to be simple, and exploring whether some phenomenal contrasts are more important than others. Challenges abound, as always, but nobody said it would be easy.