Experiments in Visual Perspective: Size Experience

Brentyn J. Ramm

The Australian National University

Abstract

Phenomenal objectivism explains perceptual phenomenal character by reducing it to an awareness of mind-independent objects, properties, and relations. A challenge for this view is that there is a sense in which a distant tree looks smaller than a closer tree even when they are the same objective size (perceptual size variation). The dual content view is a popular objectivist account in which such experiences are explained by my objective spatial relation to the tree, in particular visual angle (perspectival size). I describe a series of first-person experiments for investigating size experience. I use a ruler as a first-person method for operationalising perspectival size (Experiment 1). I use the corridor illusion (Experiment 2), outlining one's head in the mirror (Experiment 3), and outlining the size of objects on glass (Experiment 4) to show a phenomenal difference in size for items in different depth contexts, despite being identical in visual angle. These finding demonstrate that visual angle cannot account for these spatial experiences. Psychological evidence provides further support for the thesis that subjects do not experience visual angle when depth information is present. Together this evidence supports the hypothesis that perceptual size variation cannot be accounted for by visual angle, hence undermining a plausible version of the dual content theory. This outcome, combined with problems raised by alternative objectivist accounts of size variation, provides support for a subjectivist account of size experience.

Keywords: Size Experience, Perspective, Perceptual Relativity, Subjectivism, Objectivism, Direct Realism, Strong Representationalism, Experimental Phenomenology.

1. Introduction

There is something it is like for me to smell a vanilla scented candle, and to see a red door. The experiences have a unique phenomenal character. The bugbear to physicalism is providing a plausible explanation of the phenomenal character of experience within a physicalist framework (Chalmers 1996; Foster 1982; Jackson 1982; Levine 1983; Nagel 1974; Strawson 1994). Phenomenal objectivists' master move in this regard is in promising to close the phenomenal-non-phenomenal gap by "kicking the phenomenal character downstairs, into the external world"

Argumenta 5, 2 (2020): 263-278

ISSN 2465-2334
DOI 10.14275/2465-2334/20200.ram

(Shoemaker 2003: 256). When I smell vanilla, the phenomenal property I am aware of *is* a property of molecules given off by the candle. When I look at a red door the phenomenal character of redness *is* my awareness of the door's redness and the phenomenal character of rectangularity *is* my awareness of the door's rectangularity.

Phenomenal objectivism is the thesis that the phenomenal character of experience just is an awareness of mind-independent objects, properties, and relations.[1] Phenomenal subjectivism is the denial of this thesis.[2] Phenomenal objectivism has an intuitive appeal in that it is consistent with ordinary experience that smells, colours, and shapes are apparently properties of physical objects, not apparently mind-dependent properties or objects in the mind. This "transparency of experience" (Harman 1990; Moore 1903; Tye 1995)[3] is the main the intuitive force behind the two main versions of phenomenal objectivism: for strong representationalists, phenomenal character is identical with represented mind-independent objects, properties, and relations (Dretske 1995; Lycan 1996, 2001; Tye 2000, 2014). For direct realists, phenomenal character is a non-representational relation between a subject and mind-independent objects, properties, and relations (Brewer 2008; Campbell in Campbell & Cassam 2014, chapters 1-4; Fish 2009; Kennedy 2009; Martin 2002; Smith 2002).

Of course, from the fact that I *seem* to experience mind-independent properties it does not follow that these properties *are* in fact mind-independent (Hatfield 2009: 328-29, 348-49). However, we can grant that the observation, if phenomenologically accurate, does at least provide a prima facie case for objectivism.[4] This

[1] "Mind-independent" can be roughly understood as anything that does not metaphysically depend for its existence upon a subject's awareness, beliefs, concepts, and linguistic practices (Miller 2016; Tahko & Lowe 2016).

[2] The terms "internalism" and "externalism" are often used to indicate that certain properties such as meaning and phenomenal properties are located in the head (internalism) or outside of the head (externalism). However, Descartes who was a paradigm internalist is not included in this category. Since Descartes held that the mind was an unextended substance with no spatial location, phenomenal properties were not literally located inside the head. Where phenomenal qualities are spatially located is orthogonal to the question of whether the properties presented in experience are mind-independent or not (see Farkas 2003). As I use the term, Descartes and Berkeley would count as subjectivists. Phenomenal subjectivists may also hold that experience is relational in that it is the subject's awareness of mind-dependent properties or objects (i.e., sense data). Both phenomenal subjectivism and phenomenal objectivism are compatible with the view that phenomenal character is a property of an experiential state or a subject (Chalmers 2010: 342). Phenomenal subjectivism as I understand it is also compatible with weak representationalism, the thesis that all experiences have representational content (Chalmers 2010: 344). Peacocke (1983) is a phenomenal subjectivist about some experiences who rejects weak representationalism.

[3] Perhaps the earliest statement of transparency comes from G.E. Moore (1903: 450): "the moment we try to fix our attention upon consciousness and to see what, distinctly, it is, it seems to vanish: it seems as if we had before us a mere emptiness. When we try to introspect the sensation of blue, all we can see is the blue: the other element is as if it were diaphanous. Yet it can be distinguished if we look attentively enough". This last sentence, from the historical source of transparency, is worth highlighting. That "consciousness" (which Moore uses interchangeably with "awareness") is distinguishable according to Moore, contradicts the contemporary usage of transparency to show that consciousness is totally inaccessible to introspection (Ramm 2019).

[4] The claim that there is a property of "mind-independence" to visual experience has been challenged by Spener 2012. I agree with Spener that visual experience is silent on the

kind of argument does not provide an a priori argument for objectivism, rather it provides an empirical and hence defeasible motivation. If for example, we cannot identify plausible objective properties or relations to account for particular perceptual experiences, then this initial defeasible motivation for objectivism is undermined. My goal will be to show that this is the case for size perception.

A puzzle for objectivists is that the stars look smaller than the moon, even though according to scientists the stars are actually much vaster in size than the moon. A distant tree also looks smaller than a closer tree in some sense despite being the same objective size. These are examples of how the experience of size differs from the sizes that common sense and science says they actually have.[5]

Christopher Peacocke (1983) describes the visual experience of viewing an avenue of trees as follows:

> Taking your experience at face value you would judge that the trees are roughly the same physical size [...] Yet there is also some sense in which the nearer tree occupies more of your visual field than the more distant tree. This is as much a feature of your experience itself as its representing the trees as being the same height (Peacocke 1983: 12).

Such size experiences have also been described in terms of the portion things take up in the visual field by Irvin Rock (1975: 36-39). Earlier still, Douglas Harding observed that:

> As children, some of us used to play the game of guessing how large the moon is—how large, that is to say, in terms of a halfpenny held at various distances from the eye—but we gave up the game before we had learned its astonishing lesson. My objects are presented in what I call my field of view, and their 'size' is primarily the proportion which they fill of that field (Harding 1952/2011: 428).

Such "size variation" (as a contrast with "size constancy")[6] is ubiquitous in visual perception and hence on the face of it is a part of a normal and accurate visual perceptual experience. Hence size variation can be distinguished from inaccurate perceptual experiences such as the moon looking larger at the horizon (illusions) and seeming to be aware of a red door that is not there (hallucinations). The goal of the objectivist is hence to find objective properties or relations in the physical environment such that the experience counts as veridical rather than illusory or hallucinatory.

How do we account for such perceptual experiences? According to Peacocke (1983) the trees in the avenue look the same size in some sense, so objective

metaphysical nature of presented objects and properties, however, I do not pursue this topic here.

[5] Doubts about phenomenal objectivism, usually in the context of criticising a strong representationalist account, also arise for reductively explaining the phenomenology of attention (Block 2010), blurry vision (Boghossian & Velleman 1989; Pace 2007), double vision (Boghossian & Velleman 1989), afterimages (Block 1996), and perceptual grouping (Peacocke 1983).

[6] Size constancy is when things look to remain the same size despite variability in the area they take up in the visual field as the distance between the perceiver and the object changes. An example is when an approaching car looks to remain the same size as it approaches. For recent discussions of perceptual constancy, see Allen 2018, Cohen 2013, Hatfield 2009: chapter 6, Matthen 2010, Overgaard 2010, Siewert 2006.

properties show up in visual experience. However, there is also a sensation of size which accounts for the sense of different sizes between the trees. The property of largeness of the closer tree belongs to visual sensational space (as distinct from public physical space).[7] It is a non-representational property that is intrinsic to experience. He argues that size variation is non-representational because veridical experience cannot represent a tree as being both larger than another tree and the same size (Peacocke 1983: 12).

The main objectivist account of size variation is the dual content view which is a popular theory amongst contemporary philosophers (Brewer 2011; Jagnow 2012; Kelly 2008; Noë 2004; Tye 2000). The strategy of this account is to identify mind-independent properties or relations in the environment which can account for such experiences. Tye, for example, holds that "the nearer tree looks the same objective size as the tree further away while also looking larger from the given viewing position" (Tye 2000: 78). He agrees with Peacocke that the trees look to have the same size, there are perspective independent properties in the experience, but there is also an objective property of how large the nearer tree looks from here in the experience. He proposes that this viewpoint relative relation is the visual angle of the objects. Visual angle is an objective geometric relation in the environment. It can be pictured by imagining two strings stretching from the centre of the eye to the extremities of a distant object. The angle formed by the strings is the visual angle. According to Tye, the visual angle is represented in the visual system by the number of cells that are triggered on the retina by the object. The nearer tree takes up more of the visual array than the further tree which allows the visual system to represent (track) the different visual angles of the objects (ibid.: 78). Thus, size variation is also representational—it's not a sensational property. Alva Noë (2004: 166) refers to such objective viewpoint relative relations as "perspectival properties".

The dual content view answers Peacocke's challenge by positing that visual experience represents objective relations between the viewer and objects as well as objective size (for a defence of Peacocke, see Millar 2010). Peacocke's (1983) response was that properties and relations can only be represented if one possesses these concepts. As the average person does not have the concept of visual angle, they cannot represent it. An opponent however can plausibly deny this assumption (e.g., Tye 2000: 78-79). In fact, Peacocke himself not only changed his mind in favour of a non-conceptual account of perceptual content, but became a champion for this view (e.g., Peacocke 1992, 1998, 2001).

A more promising strategy for refuting the objectivist response is to show that visual angle cannot account for size variation (Hatfield 2003, 2009, 2012; Millar 2010). Gary Hatfield (2003, 2009, 2012) holds that the geometry of visual space contracts with distance.[8] This can be experienced by looking down a long corridor, path or road. The objectively parallel lines apparently converge. Hatfield

[7] Peacocke (1983: 52-53) points out that we need to sharply distinguish between public physical space and sensational space. This way we can avoid the confusions sense data theorists got into such as asking "'Are sense data surfaces of material objects?' and 'Do we perceive sense data?'" (ibid.: 53, Footnote 22). By restricting his talk to subjective properties, Peacocke also avoids the need to posit sense data.

[8] "Visual space" refers to the spatial structures visually experienced by a subject. This phenomenological notion is to be distinguished from the "physical space" as investigated by physicists. Visual space as so defined may or may not be identical to a portion of subject-independent physical space.

further holds that this contraction is not identical with visual angle as represented in a two-dimensional perspective picture. Rather, as the lines of the corridor converge in depth, the contraction is less steep than would be represented in a perspective picture. Hatfield and a colleague estimated the phenomenal convergence of a corridor to be between 80 and 85 degrees, while the angle in a perspective picture would be between 35 and 40 degrees (Hatfield 2012: 42). They also adjusted a calliper as an aid to making these judgements, so their observations could be counted as a kind of first-person experiment. Their judgements suggest that the convergence in visual space is intermediate between linear perspective and full constancy (parallel), though closer to constancy than linear perspective. The prediction of this account is that in the context of depth cues things in the distance will look larger than their angle subtended at the eye. This is exactly the situation that occurs in the Müller-Lyer illusion when the line intersecting with inward pointing arrows (a visual indication of spatial remoteness) appears longer than a line intersecting with outwards pointing arrows (a visual indication of spatial closeness) despite the fact that they take up the same visual angle.

In the spirit of the experiment reported by Hatfield, I propose that the objectivist account of size experience can be tested empirically by designing a first-person experiment in which the apparent size of a close object is contrasted with that of a distant object that takes up the same visual angle. This set up would hold fixed visual angle, while manipulating depth cues. If apparent size is determined solely by visual angle then the distant object should seem the same apparent size as the close object. This would support the objectivist account of size variation. If, on the other hand, due to the influence of depth cues the distant object appears larger, this would undermine this theory. This type of experiment would be a three-dimensional equivalent of the Müller-Lyer illusion. In viewing the Müller-Lyer diagram subjects do not need to estimate the apparent size of each line, but merely make a simple judgement about whether there is a phenomenal difference in size between them.

In section 2, I use first-person experiments to show that there is a phenomenal difference in size experience between items that are identical in visual angle, hence providing evidence that visual angle does not account for size variation. In section 3, I review psychological evidence which also supports the view that size variation does not reduce to visual angle. I outline some issues raised by alternative objectivist accounts of size variation in section 4, hence providing a motivation for subjectivism about size experience.

2. Experiments in the Perspective of Size

In this section I use first-person experiments to show that variation in size experience is not typically reducible to visual angle. Rather than "just looking", in first-person experiments a subject's experience is manipulated (often with the aid of apparatus) to hold fixed extraneous factors (Ramm 2018), typically with the goal to produce a salient phenomenal contrast (Siegel 2007). This assists one in isolating an experience of interest and reducing common introspective errors (Ramm 2018). The current methodology follows in the tradition of experimental phenomenology originating with Carl Stumpf (Albertazzi 2013; Ihde 2012; Ramm 2018; Verstegen 2005; Vicario 1993). The first experiment provides a means of measuring perspectival size properties. The second, third and fourth experiments provide evidence that variation in size experience is not the same as perspectival properties, in particular visual angle.

Is there a first-person means of operationalising perspectival size? Alva Noë defines the “perspectival size” of a thing as “the size of patch that one must fill in a given plane perpendicular to the line of sight in order to perfectly occlude an object from view” (Noë 2004: 82). My own suggestion is to use a ruler.

2.1 Experiment 1: Measuring Perspectival Size

Hold out a ruler at the same distance as your hand. I find that my hand measures 17 cm from the bottom of the palm to the top of the middle finger. Maintain the ruler at the same distance and align it with the appearance of your foot. I find that it measures 5 cm on the ruler (Figure 1).

Figure 1. Measuring Perspectival Size. Holding a ruler fixed at the same distance as my hand, my foot measured as a third of the perspectival size of my hand on the ruler.

If this procedure accurately measures visual area, then my hand currently takes up more than three times the visual area of my foot (I will be arguing that this method does not typically measure visual area). Why hold the ruler close to the hand rather than closer to the foot? Where you hold the ruler does not make an important difference because whilst the units will change the ratio remains constant. Perhaps my foot will be measured as 10 cm, while my hand will then be measured as 30 cm. My foot will continue to be measured as a third the size of my hand, where ever I hold the ruler, unless of course I change the distance between my hand and my foot, or the relative position of the ruler. This method abstracts away from depth and thus provides a first-person means of measuring perspectival size on the vertical and horizontal axes.

The same method can be used for measuring perspectival shape. For example, upon measuring the shape of an obliquely viewed plate I found that it took up less area on the vertical axis than the horizontal axis which is consistent with an ellipse. A plate viewed straight on however was measured as the same area on both axes consistent with a circle.[9]

[9] An objection is that using a ruler introduces another thing into the visual experience which may interfere with it. To test this, one can take a photo and measure the size of the images on the photo. I find that the ratio of the images is the same as measured by the

While perhaps a useful approximation of how things look, it turns out that in many circumstances apparent size and shape does not coincide with perspectival size and shape as measured by a ruler. The Müller-Lyer illusion in particular shows that perceptual size variation is not always identical with perspectival properties such as visual angle. The lines look different in size in the context of intersecting lines, despite the fact that they take up the same visual angle. As another example, the moon looks larger when it is close to the horizon than when it is at its zenith (the "moon illusion").

2.2 Experiment 2: The Corridor Illusion

That size variation cannot always be explained by visual angle is illustrated in figure 2. In A, block ii looks smaller than block i. There is a phenomenal difference in size between the blocks. However, block ii looks larger than block iii even though they are identical in visual angle. In B, block v looks larger than block iv, however they are in actual fact identical in visual angle.

The phenomenal difference between ii and iii, and iv and v demonstrates that not all size variation is identical with such view-point relative properties. In the context of depth information there is a phenomenal difference between the experienced size of a thing and its visual angle. By contrast, we are relatively accurate in judging the size difference between block i and block iii, in particular in judging that block iii is one third the size of block i. In this case, when depth information is the same for both targets, we are sensitive to relative perspectival sizes.

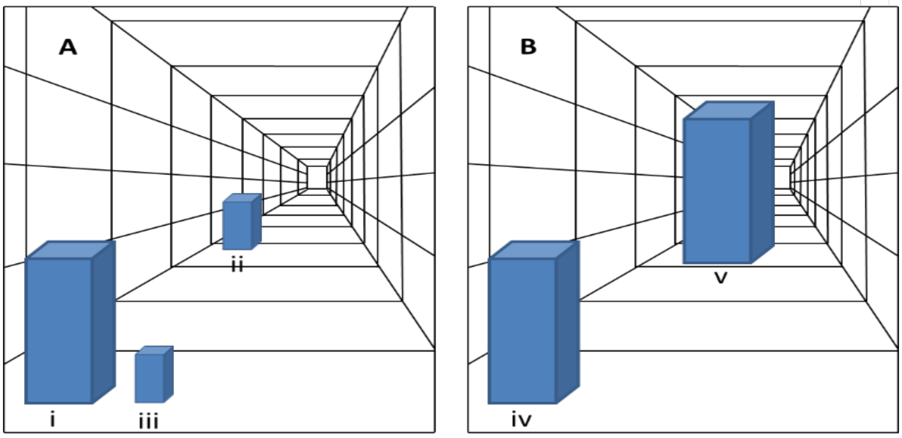

Figure 2. The Corridor Illusion. Adapted from Palmer 1999. There is a phenomenal difference in size between ii and iii and iv and v despite these items being identical in visual angle.

One criticism of this methodology is that it involves contradictory depth cues. The image is viewed from a distance, and the image itself also presents depth cues. Hence the example could be dismissed as involving a non-standard perceptual experience.

original ruler, and it remains the same both with and without the ruler, hence I conclude that there is no interference occurring in the experiment.

2.3 Experiment 3: How Large Does your Head Look in the Mirror?

Another experiment is looking at your head in the mirror and trying to judge how large it looks in comparison to the size of the image in the mirror. Gombrich (1960: 5) has pointed out that people are unaware that the image is half the objective size of their head as is seen by tracing its size on a steamed-up mirror. Below, I extend the experiment as reported by Gombrich.

The experiment is as follows: stand in front of a mirror and use a ruler to position your head 30 cm from the mirror. Now trace around the outline of your head in the mirror with a whiteboard marker. For me the image traced measured only 11 cm high and 8 cm in width. That the image was so small was a highly surprising result. Now step to one side, and use the ruler to again stand 30 cm from the mirror. Now compare the size your head looks with the outline. I find that my head looks significantly larger (perhaps a third larger) than the outline next to it. To be even more precise, next to this outline, you can also draw the objective size of your head on the mirror. Again, position your head 30 cm from the mirror. I find that the head in the mirror looks smaller than the outline of its objective size, but not as small as the image outline. That is, the experienced size is intermediate between the image and its objective size. This experiment shows that my head looks bigger than the outline on the glass (when the image and the marking are not lined up) despite the fact that they are the same visual angle. This again provides evidence contrary to the dual content theory.

Noë (2004: 165) briefly considers Gombrich's experiment as showing that we do not usually experience perspectival properties, but then dismisses it as being due to the "puzzling character of reflections" (ibid.: 166).[10] As with experiment 2, mirrors are examples of non-standard perceptual experience. It again has conflicting depth cues which may have been confounding the experiment. The mirror is at a distance from me and the image it reflects also has depth information (it seems to be projected beyond the glass). A means of overcoming this problem is to repeat the experiment with non-reflective glass. Leonardo da Vinci in fact traced scenes on glass as a technique for translating three-dimensions to two-dimensions. In the following experiment, I extended da Vinci's method by using it to distinguish between the visual angle of objects and their apparent size in the context of depth information.[11]

[10] One of the counter-intuitive properties of mirrors is that the image of your head is always half the objective size of your head independently of the distance you stand from the mirror. This is because the glass is always half of the distance between you and your virtual self in the mirror (Bertamini & Parks 2005: 86). I confirmed this startling effect by drawing the outline of my face on the mirror and walking backwards. I found that the image did indeed stay the same size as the outline.

[11] In his notebooks Leonardo da Vinci describes the method as follows: "In order to put into practice this perspective of the variation and loss or diminution of the essential character of colours, observe at every hundred braccia some objects standing in the landscape, such as trees, houses, men and particular places. Then in front of the first tree have a very steady plate of glass and keep your eye very steady, and then, on this plate of glass, draw a tree, tracing it over the form of that tree. Then move it on one side so far as that the real tree is close by the side of the tree you have drawn; then colour your drawing in such a way as that in colour and form the two may be alike, and both, if you close one eye, seem to be painted on the glass and at the same distance. Then, by the same method, represent a second tree, and a third, with a distance of a hundred braccia between each. And these will serve as a standard and guide whenever you work on your own pictures, wherever

2.4 Experiment 4: Tracing Objects on Glass

View the scene out of a window and choose an object in the distance. Use a whiteboard marker to outline the size of the image on the glass. I outlined the image of a window of a distant building, and again stepped to one side using a ruler to keep my head 30 cm from the glass. As with my head in the mirror, the distant window looked larger than the outline on the glass. This was only the case with binocular vision. With one eye closed both the window and the image on the glass looked the same size. The phenomenal difference between binocular and monocular vision can hence be experienced by opening and closing one eye.

This outcome confirmed the original finding without the possible confounds of using a reflective surface and without conflicting depth cues which was a potential problem with experiments 2 and 3. The size of the image on the glass and the distant door both take up the same visual angle. That they appear different sizes (with binocular vision) again demonstrates that size variation is not accounted for by visual angle. Rather size variation is partly determined by depth information.

Furthermore, recall that one means of operationalising perspectival size is the area that something would take up if it was projected upon a plane perpendicular to the line of sight. In viewing my head in the mirror and images on windows I am literally viewing a plane perpendicular to the line of sight. If size variation was explained by its perspectival size then it should look to take up the same size as the image on the glass. The fact that they diverge demonstrates a failure of perspectival size to explain size variation. That this effect is found in many different contexts as seen in experiments 2-4 suggests that it is a robust effect.

3. Psychological Evidence

In section 2, I presented phenomenological demonstrations that size variation is not explained by visual angle. In this section, I discuss how psychological studies also suggest that this generalises to typical cases of perceptual size variation.

In a classic study, Thouless (1931) presented subjects with two white discs of different sizes at varying distances. The distance of the smaller (closer) disc was varied until subjects reported when it looked the same size as the larger (further) disc. It was found that subjects did not adjust the closer disc such that it took up the same the size as the further the disc on the retina, but rather to a size intermediate between the retinal size and objective size. Thus,

> as the distance of an object changes, its phenomenal size changes, whether the object be far or near. It changes, however, less rapidly than does the size of the retinal image. The tendency to constancy is shown by the amount of change being a compromise between the changing size of the peripheral stimulus and the unchanging 'real' size of the object (Thouless 1931: 353).

Thouless (1931) also found that same for shape. Subjects tended to choose an ellipse for a tilted circle, but it was an ellipse that was in between that of the shape projected on the retina and its objective shape. Furthermore, many studies have shown that when subjects are asked to estimate the projective size of an item, or

they may apply, and will enable you to give due distance in those works" (da Vinci 1970: 158).

the amount it takes up in the visual field (ignoring depth), the results produce underconstancy, but the size selected is larger than retinal size (Carlson 1960; Gilinsky 1955; Singer 1952).[12]

Perdreau and Cavanagh (2011) have also presented evidence that artists are not better at judging the perspectival size of images in the context of depth information than non-artists. Artists, art students and non-artists were given images of cylinders in the context of depth cues (similar to the images in Figure 2) or in no context (with a grid as background). They were then asked to adjust a comparison cylinder such that it was the same objective size as the test cylinder (ignoring context). They were effectively being asked to adjust the comparison so that it took up the same visual angle. All groups' judgements significantly overestimated the size of the test cylinders when they were in the context of depth cues. There was no difference between groups in ignoring context therefore suggesting that artists do not have superior perceptual access to visual angle.

It is also noteworthy that one technique used by painters to produce a perspective picture is to hold up their brush against things. This recalls the ruler experiment, and suggests that even painters do not directly experience perspectival size—or at least not without the assistance of tools. The history of art also shows the use and development of sophisticated artist techniques for capturing perspective and the discovery and the use of geometric principles such as contraction to a vanishing point. Many of these techniques were only developed in the Renaissance (Edgerton 1978, 2009; Kemp 1990; Kubovy 1986). This again suggests that two-dimensional linear perspective is at best difficult to access in experience, if not an invention by artists in an effort to translate three-dimensional visual space to two dimensions (Schwitzgebel 2006). That is, visual experience is not the same as drawn in a perspective picture.

This being said, it is likely that in some situations when depth cues are minimal that perspectival size and apparent size coincide, such as when we see the moon at its zenith. Also, when the visible terrain is eliminated by viewing the moon through a tube the moon illusion is eliminated and the apparent size of the moon is the same as its retinal size (Rock & Kaufman 1962). Similarly, when depth cues are eliminated by viewing objects through a tube then apparent size reduces towards that of the size of the image on the retina (Holway and Boring 1941). Thouless (1931) found the same result when visual cues were eliminated. We can then be aware of the perspectival size, but only in contexts where depth information is minimized.

The evidence presented here backs up the phenomenological findings that the angle subtended at the eye only approximates the experience. The experience of the tree does not directly track these objective properties in the environment. If experience does represent objective perspective-dependent properties these are systematically misrepresented. Tye and Noë cannot reduce the experience to relations in the environment (except in restricted cases). Hence, they can at best treat most size experiences as on par with illusions, awareness of uninstantiated properties, rather than in terms of actual objective properties. Perhaps the objectivist can identify a different relation in the environment other than visual angle or retinal images which could plausibly account for visual area. It is difficult to

[12] For further discussion of how empirical results support a view in which size experience is intermediate between visual angle and full constancy see Hatfield (2009: 182-83) and Hill and Bennett (2008).

know what this could be. The burden here is on the objectivist to supply a plausible candidate relation or property.

4. Alternative Objectivist Accounts

The dual content theory is a popular account of perceptual size variation. In this paper, I argued that distant things looking smaller cannot be accounted for by their visual angle. In particular, I used first-person experiments to show that in the context of depth cues, distant objects are experienced as larger than their visual angle. Hence these perspectival properties cannot explain typical size experience. This paper hence shows that a plausible version of the dual content theory is false. I will conclude by outlining some issues raised by alternative objectivist accounts of size variation.

A major objectivist alternative is to treat size variation as illusory, in particular to explain it as an awareness of uninstantiated mind-independent properties. As an example, representationalism can account for the experience of a red afterimage by the visual system misrepresenting the presence of a red square with size, colour and shape properties. These properties do not need to be instantiated, just as I can mistakenly believe that there is a dragon outside without there being any actual dragon. The case of size variation can hence be treated as on par with illusions such as afterimages. But what are these uninstantiated properties of which I am aware? As I cannot be aware of non-existent properties, a common account is that they are platonic universals (Dretske 2003; Forrest 2005; Johnston 2004; Tye 2000). There are independent reasons for thinking that universals do in fact exist (Armstrong 1989), so if they can be put to work in explaining illusions and hallucinations this is a theoretical virtue. Furthermore, as universals (purportedly) exist independently of my awareness of them, they are objective properties.

Despite these appeals, this theory has some counter-intuitive consequences. Particularly, the phenomenal character of these ordinary spatial experiences would no longer be kicked downstairs into the external world (as quipped by Shoemaker 2003: 256), but out of the world entirely. When the moon looks larger near the horizon than at its zenith, I certainly do not seem to be aware of something abstract like universals which exist outside of space and time. The moon's size is apparently equally instantiated in both cases in the same visual space. Conversely, then, this provides a prima facie case for subjectivism which holds that variant size properties (and all sizes, shapes and colours) are all equally instantiated in my visual field (a mind-dependent field of visible properties).

The objectivist account also raises thorny metaphysical issues about whether uninstantiated properties can account for phenomenal character (Pautz 2007: 517; Thompson 2008). For example, it is not clear how I can be sensorially aware of universals given their lack of spatial and temporal properties, any more than I can sensorially experience unextended spacetime points or abstract objects (Pautz 2007: 517). Thompson (2008: 398) points out, that if my doctor told me that I do not need pain killers for my phantom limb pain because it is illusory, I would be justifiably irate. This is because the phenomenal character of painfulness self-evidently exists and is instantiated in the here and now. Another problem is mental causation. Given that universals lack causal powers, how can phantom limb pain cause me to wince if it is grounded in universals? (ibid.: 404). These questions may well have solutions. My point here is not that these questions do not have possible solutions (see Thompson 2008, for a discussion), but that these alternative accounts of size experience lose the phenomenological appeal and explanatory simplicity of the original objectivist motivations.

Another objectivist response is to accept that visual angle *alone* does not determine visual area, but rather visual experience represents a combination of visual angle and depth information (e.g., depth cues and binocular information). Since visual angle and depth information are objective properties, any inference to subjectivism would be blocked.[13] The important question to ask here is: how is this property of visual angle + depth information instantiated in the environment? It is also not clear what this holistic combined property is. One possibility is that in some contexts the visual system represents objects as having a visual angle with a non-veridical depth. This is of course possible and if successful would neatly explain the experience of size variation. In fact, there are infinite mathematically definable spatial geometries that could be represented by the visual system. The main problem is that very few of these geometries are actually present in the physical world. By contrast, standard (veridical) visual angle is both precisely mathematically definable *and* instantiated in the environment. In particular, it is the angle that light strikes the eye from the extremities of a distant object. This angle is a property of the stream of light from the object to the eye, and hence a property of a concrete system that has causal effects. This is why visual angle would be an ideal explanation of size variation for the objectivist. On the other hand, it is not clear that conjunctive properties or alternative visual geometries are concretely instantiated in the external environment, let alone how they are causally relevant. Hence, the objectivist would need to make the case that these proposals do not collapse into the abstract uninstantiated property account with its attendant puzzles.

In the absence of plausible instantiated or uninstantiated mind-independent properties for explaining apparent size, the objectivist is forced into less desirable positions such it being a mere cognitive illusion—hence denying that perceptual size variation is an aspect of sensory experience at all (Brewer 2008; Fish 2009: 172-77). This is certainly a defensible position, but it is surely at odds with visual experience. A penny that is held out so that it takes up the same portion of the visual field as the moon, *visually* looks the same size (in some sense). To deny this arguably fails to acknowledge the sensory experience we were trying to explain in the first place (see Millar 2015).

The main goal of this paper was to show that a popular version of the dual content theory is inadequate for accounting for size variation. The objectivist may still appeal to a theory of misrepresentation to account for size experience. However, the arguments presented here, when combined with criticisms of objectivist theories of illusion and hallucination (Millar 2015; Pautz 2007; Thompson 2008), provide reasons for rejecting these accounts, and consequently favour a subjectivist account of size experience.[14]

[13] Thank you to David Hilbert (2016) and an anonymous reviewer for raising this objection. John Campbell (Campbell and Cassam 2014: 88-90) makes a similar proposal for explaining visual illusions.

[14] This paper was presented at the 2016 American Philosophical Association Central Meeting. Thanks to David Hilbert for his insightful commentary and helpful comments by participants. Thanks to David Chalmers, Frank Jackson, Boyd Millar, Eric Schwitzgebel, Declan Smithies and Daniel Stoljar for helpful comments on the manuscript.

References

Albertazzi, L. 2013, *Handbook of Experimental Phenomenology: Visual Perception of Shape, Space and Appearance*, Chichester: John Wiley & Sons.

Allen, K. 2018, "Perceptual Constancy and Apparent Properties", in Dorsch, F., Macpherson, F., and Nida-Rumelin, M. (eds.), *Phenomenal Presence*, Oxford: Oxford University Press.

Armstrong, D. 1989, *Universals: An Opinionated Introduction*, Boulder: Westview Press.

Bertamini, M. and Parks, T.E. 2005, "On What People Know about Images on Mirrors", *Cognition*, 98, 1, 85-104.

Block, N. 1996, "Mental Paint and Mental Latex", *Philosophical Issues*, 7, 19-49.

Block, N. 2010, "Attention and mental Paint", *Philosophical Issues*, 20, 1, 23-63.

Boghossian, P.A. and Velleman, J.D. 1989, "Colour as a Secondary Quality", *Mind*, 98, 389, 81-103.

Brewer, B. 2008, "How to Account for Illusion", in Haddock, A. and Macpherson, F. (eds.), *Disjunctivism: Perception, Action, Knowledge*, Oxford: Oxford University Press, 168-80.

Brewer, B. 2011, *Perception and its Objects*, Oxford: Oxford University Press.

Campbell, J. and Cassam, Q. 2014, *Berkeley's Puzzle: What Does Experience Teach Us?*, Oxford: Oxford University Press.

Carlson, V. 1960, "Overestimation in Size-Constancy Judgments", *The American Journal of Psychology*, 73, 2, 199-213.

Chalmers, D.J. 1996, *The Conscious Mind: In Search of a Fundamental Theory*, Oxford: Oxford University Press.

Chalmers, D.J. 2010, *The Character of Consciousness*, Oxford: Oxford University Press.

Cohen, J. 2015, "Perceptual Constancy", in Matthen, M. (ed.), *Oxford Handbook of Philosophy of Perception*, Oxford: Oxford University Press, 621-39.

Da Vinci, L. 1970, *The Notebooks of Leonardo da Vinci*, Vol. I, Richter, J.P. (ed.), New York: Dover Publications.

Dretske, F. 1995, *Naturalizing the Mind*, Cambridge, MA: The MIT Press.

Dretske, F. 2003, "Experience as Representation", *Philosophical Issues*, 13, 1, 67-82.

Edgerton, S.Y. 1978, "The Renaissance Rediscovery of Linear Perspective", *Journal of Aesthetics and Art Criticism*, 36, 3, 377-78.

Edgerton, S.Y. 2009, *The Mirror, the Window, and the Telescope: How Renaissance Linear Perspective Changed our Vision of the Universe*, Ithaca: Cornell University Press.

Farkas, K. 2003, "What is Externalism?", *Philosophical Studies*, 112, 3, 187-208.

Fish, W. 2009, *Perception, Hallucination and Illusion*, Oxford: Oxford University Press.

Forrest, P. 2005, "Universals as Sense Data", *Philosophy and Phenomenological Research*, 71, 3, 622-31.

Foster, J. 1982, *The Case for Idealism*, London: Routledge & Kegan Paul.

Gilinsky, A.S. 1955, "The Effect of Attitude upon the Perception of Size", *The American Journal of Psychology*, 68, 2, 173-92.

Gombrich, E.H. 1960, *Art and Illusion*, Oxford: Phaidon Press.

Harding, D.E. 1952/2011, *The Hierarchy of Heaven and Earth: A New Diagram of Man in the Universe*, Digital edition, Crowquill: The Sholland Trust. Abridged version first published by Faber and Faber in 1952.

Harman, G. 1990, "The Intrinsic Quality of Experience", in Tomberlin, J. (ed.), *Action Theory and Philosophy of Mind*, *Philosophical Perspectives*, 4, Atascadero: Ridgewell, 31-52.

Hatfield, G. 2003, "Representation and Constraints: The Inverse Problem and the Structure of Visual Space", *Acta psychologica*, 114, 3, 355-78.

Hatfield, G. 2009, *Perception and Cognition: Essays in the Philosophy of Psychology*, Oxford: Clarendon Press.

Hatfield, G. 2012, "Phenomenal and Cognitive Factors in Spatial Perception", in Hatfield, G., and Allred, S. (eds.), *Visual Experience: Sensation, Cognition, and Constancy*, Oxford: Oxford University Press, 35-62.

Hilbert, D. 2016, "Comments on Brentyn Ramm, 'Phenomenal Size'", *American Philosophical Association Central Meeting*, Chicago, March 2-5.

Hill, C.S. and Bennett, D.J. 2008, "The Perception of Size and Shape", *Philosophical Issues*, 18, 1, 294-315.

Holway, A.H. and Boring, E.G. 1941, "Determinants of Apparent Visual Size with Distance Variant", *The American Journal of Psychology*, 54, 1, 21-37.

Ihde, D. 2012, *Experimental Phenomenology: Multistabilities*, Albany: SUNY Press.

Jackson, F. 1982, "Epiphenomenal Qualia", *Philosophical Quarterly*, 32, 127, 127-36.

Jagnow, R. 2012, "Representationalism and the Perspectival Character of Perceptual Experience", *Philosophical Studies*, 157, 2, 227-49.

Johnston, M. 2004, "The Obscure Object of Hallucination", *Philosophical Studies*, 120, 1, 113-83.

Kelly, S.D. 2008, "Content and Constancy: Phenomenology, Psychology, and the Content of Perception", *Philosophy and Phenomenological Research*, 76, 3, 682-90.

Kemp, M. 1990, *The Science of Art: Optical Themes in Western Art from Brunelleschi to Seurat*, New Haven: Yale University Press.

Kennedy, M. 2009, "Heirs of Nothing: The Implications of Transparency", *Philosophy and Phenomenological Research*, 79, 3, 574-604.

Kubovy, M. 1986, *The Psychology of Perspective and Renaissance Art*, Cambridge: Cambridge University Press.

Levine, J. 1983, "Materialism and Qualia: The Explanatory Gap", *Pacific Philosophical Quarterly*, 64, 354-61.

Lycan, W.G. 199, *Consciousness and Experience*, Cambridge, MA: The MIT Press.

Lycan, W.G. 2001, "The Case for Phenomenal Externalism", *Noûs*, 35, 15, 17-35.

Martin, M.G.F. 2002, "The Transparency of Experience", *Mind and Language*, 17, 4, 376-425.

Matthen, M. 2010, "How Things Look (and What Things Look that Way)", in Nanay, B. (ed.), *Perceiving the World*, New York: Oxford University Press, 226-53.

Millar, B. 2010, "Peacocke's Trees", *Synthese*, 174, 3, 445-61.

Millar, B. 2015, "Naïve realism and Illusion", *Ergo*, 2, 607-25, http://dx.doi.org/10.3998/ergo.12405314.0002.024

Miller, A. 2016, "Realism", in Zalta, E.N. (ed.), *The Stanford Encyclopedia of Philosophy*, https://plato.stanford.edu/archives/win2016/entries/realism.

Moore, G.E. 1903, "The Refutation of Idealism", *Mind*, 12, 433-53.

Nagel, T. 1974, "What Is it Like to Be a Bat?", *The Philosophical Review*, 83, 4, 435-50.

Noë, A. 2004, *Action in Perception*, Cambridge, MA: The MIT Press.

Overgaard, S. 2010, "On the Looks of Things", *Pacific Philosophical Quarterly*, 91, 2, 260-84.

Pace, M. 2007, "Blurred Vision and the Transparency of Experience", *Pacific Philosophical Quarterly*, 88, 3, 328-54.

Palmer, S.E. 1999, *Vision Science: Photons to Phenomenology*, Vol. 1, Cambridge, MA: The MIT Press.

Pautz, A. 2007, "Intentionalism and Perceptual Presence", *Philosophical Perspectives*, 21, 1, 495-541.

Peacocke, C. 1983, *Sense and Content: Experience, Thought, and their Relations*, Oxford: Clarendon Press.

Peacocke, C. 1992, *A Study of Concepts*, Cambridge, MA: The MIT Press.

Peacocke, C. 1998, "Nonconceptual Content Defended", *Philosophy and Phenomenological Research*, 58, 381-88.

Peacocke, C. 2001, "Does Perception Have a Nonconceptual Content?", *Journal of Philosophy*, 98, 239-64.

Perdreau, F. and Cavanagh, P. 2011, "Do Artists See their Retinas?", *Frontiers in Human Neuroscience*, 5, 171, doi: 10.3389/fnhum.2011.00171.

Ramm, B.J. 2018, "First-Person Experiments: A Characterisation and Defence", *Review of Philosophy and Psychology*, 9, 3, 449-67.

Ramm, B.J. 2019, "Pure Awareness Experience", *Inquiry*, doi: 10.1080/0020174X. 2019.1592704.

Rock, I. 1975, *Introduction to Perception*, New York: Macmillan.

Rock, I. and Kaufman, L. 1962, "The Moon Illusion, ii: The Moon's Apparent Size is a Function of the Presence or Absence of Terrain", *Science*, 136, 3521, 1023-31.

Schwitzgebel, E. 2006, "Do Things Look Flat?", *Philosophy and Phenomenological Research*, 72, 3, 589-99.

Shoemaker, S. 2003, "Content, Color, and Character", *Philosophical Issues*, 13, 1, 253-78.

Siegel, S. 2007, "How Can We Discover the Contents of Experience?", *The Southern Journal of Philosophy*, 45, S1, 127-42.

Siewert, C. 2006, "Is the Appearance of Shape Protean?", *Psyche*, 12, 3, 1-16.

Singer, J.L. 1952, "Personal and Environmental Determinants of Perception in a Size Constancy Experiment", *Journal of Experimental Psychology*, 43, 6, 420-27.

Smith, A.D. 2002, *The Problem of Perception*, Cambridge, MA: Harvard University Press.

Spener, M. 2012, "Mind-Independence and Visual Phenomenology", in Smithies, D. and Stoljar, D. (eds.), *Introspection and Consciousness*, Oxford: Oxford University Press, 381-403.

Strawson, G. 1994, *Mental Reality*, 2nd ed., Cambridge, MA: The MIT Press.

Tahko, T.E. and Lowe, E.J. 2016, "Ontological dependence", in Zalta, E.N. (ed.), *The Stanford Encyclopedia of Philosophy*, https://plato.stanford.edu/archives/win2016/entries/dependence-ontological.

Thompson, B. 2008, “Representationalism and the Argument from Hallucination”, *Pacific Philosophical Quarterly*, 89, 3, 384-412.

Thouless, R.H. 1931, “Phenomenal Regression to the Real Object. I”, *British Journal of Psychology*, 21, 339-59.

Tye, M. 1995, *Ten Problems of Consciousness*, Cambridge, MA: The MIT Press.

Tye, M. 2000, *Consciousness, Color, and Content*, Cambridge, MA: The MIT Press.

Tye, M. 2014, “Transparency, Qualia Realism and Representationalism”, *Philosophical Studies*, 170, 1, 39-57.

Verstegen, I. 2005, “Mona Lisa’s Smile: The Place of Experimental Phenomenology within Gestalt Theory”, *Gestalt Theory*, 27, 2, 91-106.

Vicario, G.B. 1993, “On Experimental Phenomenology”, *Advances in Psychology*, 99, 197-219.