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## Spatial Attention and Perception: Seeing without paint

A Tanesini

**Abstract:** Covert spatial attention alters the way things look. Objects situated at attended locations appear bigger, closer, if striped, stripier than qualitatively indiscernible counterparts whose locations are unattended. These results cannot be easily explained in terms of the number and kind of perceived properties of objects. Nor do they appear to be cases of visual illusions. Ned Block has argued that these results are best accounted for by invoking what he calls ‘mental paint’. In this paper I argue, instead, for an account of these phenomena in terms of the perception of action scaled affordances concerning saccadic eye movement. As part of the argument I draw connections with the empirical literature on the way in which performance efficiency alters visual appearance.

Attention alters the way things look. There is incontrovertible empirical evidence showing that objects situated at attended locations appear bigger, closer, if striped, stripier than qualitatively indiscernible counterparts whose locations are unattended. The colours of their surfaces look more saturated. In experimental conditions the onset of a dot in an attended portion of a screen seemed earlier than a simultaneous dot situated at a less attended location. Similarly the flicker rate of flickering objects seems faster when we attend to their locations.<sup>1</sup> At first sight these are not instances

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<sup>1</sup> For results concerning spatial frequency and gap size see (Gobell & Carrasco, 2005); for colour saturation (Fuller & Carrasco, 2006); for motion coherence (Liu, Fuller, & Carrasco, 2006); for flicker rate (Montagna & Carrasco, 2006); for speed (Turatto, Vescovi, & Valsecchi, 2007); and for size of a moving object (Anton-Erxleben, Henrich, & Treue, 2007).

where the deployment of selective attention merely facilitates the perception of a greater number of (more determinate) properties of the objects of perception.<sup>2</sup>

One can contrast these cases with other more familiar examples. For instance, an object might look red, however when we pay closer attention we might perceive it as being crimson or another specific hue of red. Examples such as this one can be explained by noting that selective attention allows us to experience both more determinate properties of objects (e.g., crimson rather than red) and a larger number of them (e.g., crimson and red rather than red only). However, the increased acuity that attention brings to perception could not, it would seem, explain why an object situated at an attended location looks bigger than another object of the same size whose location is not attended even though there is no change in illumination conditions or in distance to the perceiver. This phenomenon seems unsuitable for an explanation in terms of the number and kind of properties of objects which are perceived.

These observations might lead to the conclusion that perceptual illusions are surprisingly common. Although, strictly speaking, experiments in this area concern comparative experiences of objects, some whose locations are attended and others which are similar but whose locations are unattended, they warrant the counter-to-fact claim that objects appear bigger, and stripier if striped, when their locations are attended than those same objects would when placed at unattended locations. Consequently, it would seem that either attention systematically distorts perception, so that every time one attends to something, one misperceives it, or if the experience of objects at attended locations is not illusory, then it is experience when attention is directed elsewhere that is always illusory. Neither conclusion is, in my opinion, satisfactory. Whilst perceptual illusions are not rare, a position according to which the majority of experiences are at least in part illusory should, if at all possible, be avoided.

The challenge, therefore, is to explain how objects at attended locations could look bigger, closer, their colours more saturated than they would if their locations were unattended without claiming that either case involves some kind of perceptual

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<sup>2</sup> In this paper I use the term 'perception' to refer to the successful cases of detection of objects and properties by mean of the senses. I shall not presume that all perception is conscious. I shall reserve the term 'experience' to conscious states of sensory awareness. Thus, experiences include both conscious perceptions and illusions as well as hallucinations. This is not to say that there are experiences which are common to all of these cases.

illusion. A natural response, one that has been adopted by Ned Block in ‘Attention and Mental Paint’ (2010), is to account for this phenomenon by invoking features that pertain to the *manner* (or mode) in which objects are represented in experience rather than to those objects themselves or to the contents of perception. According to this view, experiences of the same object in the same conditions when attending to its location and when not so attending would share the same representational content, but would differ in the manner or mode in which things are experienced. It is this difference in manner or mode that Block, borrowing the expression from Gilbert Harman (1990), labels “mental paint”.

Block defends this view by arguing that the examples under discussion cannot, once it has been granted that we are not dealing with perceptual illusions, be explained either by direct realists or by representationists. Representationists who claim that the phenomenal character (the look) of a perception is determined by its representational content (what it represents) would not be able to explain the examples under discussion because in these cases the representational contents are the same but the characters of these experiences differ.<sup>3</sup> Direct realists would also fail because these are experiences of the same objects and properties but whose phenomenology nevertheless differs.<sup>4</sup> More specifically, Block claims that his opponents would have to be able to invoke properties which (A) are experienced in the one, but not in the other case *and* (B) would be of the kind to which there can be a corresponding phenomenal look capable of explaining the phenomena. However, Block argues, in these cases there are no such properties.

Block further shores up this conclusion by remarking that those changes in phenomenal character which are brought about by shifts in attention do not even look like changes in the world (Block, 2010, p. 53). This is why, in Block’s opinion, it is much more plausible to place the explanatory burden on the mental side and postulate the existence of qualities that do not pertain to the perceived objects or to what is

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<sup>3</sup> By ‘phenomenal character’ I mean what it is that we are aware of when we have the experience. Thus, I do not take phenomenal character to be a property of the experience itself. See Fish (2010, p. 17) for an explanation of these two distinct interpretations of this notion.

<sup>4</sup> In this paper I adopt both Block’s terminology and characterizations for these two families of views. Arguably, his presentation fails to do justice to some of their more sophisticated versions. The account offered here suggests that even the most hard-nosed reductivist versions of representationists have a response to Block’s objections.

represented in perception but to the manner or way in which these objects are represented.<sup>5</sup>

This paper aims to provide an account of the changes in phenomenal character brought about by shifts of covert spatial attention which makes no reference to modes of representation. Instead, as in ordinary cases of selective attention, differences in the phenomenology can be explained in terms of the properties which are represented in perception or which figure among the objects of experience. More specifically, I argue that when one attends to the location of an object, one experiences affordances or action properties that cannot be consciously perceived otherwise. Notable among these are those action-scaled affordances involving saccadic eye movements.

The paper consists of five sections. In the first I summarise two kinds of experimental results: one which shows that spatial attention alters the appearance of things; the other concerns the way in which visual appearance is altered by performance efficiency. In the second section I briefly reconstruct Block's argument for mental paint. In the third I explain the notion of an affordance. This notion is used in the fourth section to provide an explanation of the results concerning covert spatial attention discussed in section 1 which dispenses with any kind of mental paint. This is an explanation that could be adopted by direct realists or by representationists.<sup>6</sup> Further, this account reveals some similarities between the effects of covert attention and of performance efficiency on experience. In both kinds of case experience is altered because of changes in what the environment affords to the perceiver. In the final section I consider the possible objection that the kinds of look associated with affordances are of the wrong sort to explain the way in which attention alters experience, and show how this objection can be addressed. In this section I also explain how, despite differences in phenomenal character, both the attended and unattended cases are instances of perception.

## **1. Some empirical results**

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<sup>5</sup> I use 'object' here to refer to anything which can figure as an object of experience. Thus properties as well as things are included. Hereafter, it should be clear in context when I use 'object' with this sense.

<sup>6</sup> Or at least could be adopted given the considerations offered in this paper. There might however be other features of affordances that support arguments in favour of one of these two families of positions.

Work in psychology on the relation between perception and attention often focuses on enhanced sensitivity to features such as contrast or fineness of patterning<sup>7</sup>. Sensitivity is measured behaviourally often using Posner's cuing paradigm. In these experiments participants have to respond as quickly as possible by pressing a button (or similar) to a peripheral target whose onset follows a central cue (which is also symbolic such as an arrow) or a peripheral one (which is also non-symbolic such as the whole quadrant being briefly illuminated) (Cf. Carrasco, 2011, p. 1488; Styles, 2006, pp. 52-4). The cue has the effect of attracting attention to a portion of the visual field; and when the cue is valid, and thus correctly indicates the location of a subsequent target, participants were faster in locating the target compared to when the cue offered no indication of its location or when it was invalid. These results suggest that attention, which is drawn to a location by the cue, enhances sensitivity to the onset of a target as measured in terms of reaction times.

The sort of sensitivity with which these experiments are concerned has no direct connection with experience. The participants who react faster after being presented a valid cue are not aware of this fact; the difference is measured in milliseconds. More recently, however, there has been work on the relation between attention and perceptual appearance. This work, conducted by Marisa Carrasco and her lab, is concerned with the experience of contrast, colour saturation and flicker rate (see note 1 for references). In particular, Carrasco and her team developed a new paradigm to test subjective contrast in order to study the effect of spatial attention on perceptual appearance (Carrasco, Ling and Read, 2004). Block's argument in favour of mental paint is based on the effects discovered by Carrasco. In what follows I briefly present these experimental results before turning to Block's argument in the next section.

These results are concerned with subjective or perceived contrast.<sup>8</sup> The first set of experiments concerned involuntary (exogenous) covert spatial visual attention. This form of attention is spatial because it is directed at locations rather than objects or features (Carrasco, 2011, p. 1486). It is covert (as opposed to overt) because a shift in attention has been achieved without any movement of the eye (Styles, 2006, pp. 56-

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<sup>7</sup>Spatial resolution is the ability to detect fine patterns. Attention has been shown to enhance this ability. For an overview see Carrasco, 2011, p. 1500.

<sup>8</sup> Contrast is defined as the result of subtracting the lower luminance of the darker areas from the higher luminance of the lighter area divided by the average luminance. 'Perceived contrast' is intended to refer to what it is like to experience a given contrast.

7; Carrasco, 2011, pp. 1487). In this case, one looks one way but attends another. It is involuntary, transient or exogenous, rather than voluntary, endogenous, or sustained because attention has shifted involuntarily as a result of something capturing one's attention at the periphery of one's field (a phenomenon aptly known as 'Attentional Capture') (Styles, 2006, pp. 54-57; Carrasco, 2011, pp. 1487-89).

Participants were asked to fix their gaze onto one point; they were then either presented with a neutral cue (to establish a baseline) or a peripheral cue (that attracted their exogenous attention) followed after an interval by the onset of the stimuli consisting of a couple of Gabor patches with different orientations. A Gabor patch is a sinusoidal luminance pattern with a fixed contrast (see Figure 2). Participants were asked to press a button to indicate the pattern orientation of the patch that looked higher in contrast (See Figure 1). The results showed that exogenous covert spatial visual attention makes a statistically significant difference to perceived contrast so that when a patch is situated at the attended location its relative contrast is experienced to be higher than that of a comparable but unattended patch (Carrasco Ling and Read, 2004 and Carrasco 2011).<sup>9</sup> Another set of experiments showed similar effects could be found for endogenous (voluntary and sustained) covert spatial visual attention (Liu, Abrams and Carrasco, 2009).<sup>10</sup> Thus, both voluntary and involuntary covert attention have the effect of making the contrast between dark and light areas of the pattern of Gabor patches appear higher than it would otherwise.

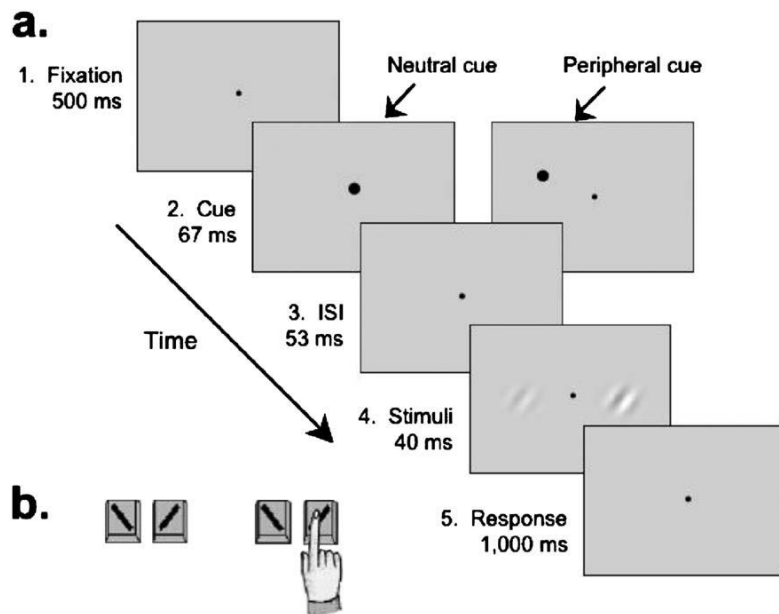
Fig. 1

From Carrasco, Ling and Read (2004). Reproduced with permission by the author

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<sup>9</sup> For ease of exposition, and following Carrasco's and Block's usage, I will sometimes use the expressions 'attended stimulus' or 'attended patch' as shorthand for 'attended location at which the stimulus (patch) is situated'. It is important to remember, however, that strictly speaking this paper is exclusively concerned with visual spatial attention; that is to say, visual attention directed at spatial locations.

<sup>10</sup> Subsequent experiments have shown the existence of similar effects of covert transient or exogenous attention for other properties such as colour saturation, gap size, flicker rate, speed, motion coherence and size of moving objects (see note 1 for references).



In addition to results obtained by the Carrasco laboratory and discussed by Block, there is an apparently unrelated literature on the effects of performance efficacy on the phenomenology of visual experience. Players of ball games have often claimed that the ball looks bigger when they are in form. For instance, the legendary cricketer D. W. Grace has been reported as saying that when one is ‘in’ (that is, one has spent time at the crease) one sees the ball as big as a football (Porritt in Davie and Davie, 1987, p. 120). Similar remarks have been made by golfers and by baseball players. More recently, Jessica Witt and Dennis Proffitt have set to examine the veridicality of these anecdotal reports. In a series of experiments that involved asking participants to make judgements about the size of a baseball by matching it to one of eight black circles in a display, Witt and Proffitt found that there is a statistically significant correlation between high batting average and matching the ball to one of the bigger circles (Witt and Proffitt, 2005a). Other experiments show that when one holds a tool which one intends to use, and that makes a target object reachable, that object is judged to be closer than it would if one did not hold the tool or did not intend to use it (Witt and Proffitt, 2005b). Similarly, individuals wearing heavy rucksacks, when compared to unencumbered subjects, judge on the basis of visual experience slopes to be steeper (Bhalla and Proffitt, 1999) and target objects to be further away (Proffitt and al. 2003).

Strictly speaking, these findings concern participants’ verbal responses based on their visual experiences, but together with Witt, Proffitt and their colleagues I shall



assume here that these responses are explained by relevant changes in the visual experiences themselves.<sup>11</sup> Hence, I take these experiments to show that the opportunities for action offered by things in their layouts shape our visual experience of these things. More specifically, they show that subjects consciously perceive features of the environment, like egocentric distance, as affordances understood as a function of both objective features of the layout (e.g., actual extent) and effort (cf. Proffitt et al., 2003, pp. 111-12). In a nutshell, we experience the world at least in part in terms of ‘our abilities to act on it’ (Witt and Proffitt, 2008, p. 1479).

It might be thought that the work on how covert spatial attention alters phenomenal appearance bears no relation to the work on how performance efficiency or effort also alters the appearances of things. Thus, one might claim that a result showing that the perception of affordances shapes visual experiences does not shed any light on how attention alters the way things appear. This conclusion would be premature. The key connection between the two sets of experiments is the role that motor planning plays in both. First, there is strong evidence that we experience the world in terms of affordances because conscious perception is influenced by the outcome of planning for the movements of eye and limbs (Witt and Proffitt, 2008; Kirsch et al. 2012).<sup>12</sup> Second, recent work has shown that preparation for saccadic eye movement alters the perceived contrast of Gabor patches in ways that are very similar to the alteration caused by covert attention (Rolfs and Carrasco, 2012). Third, the existence of a close link between covert spatial attention with motor planning of saccadic eye movements is well-established. Some brain areas are involved both in the control of covert attention and in motor preparation of saccadic eye-movement (Moore and Fallah, 2001). It has even been suggested by supporters of the premotor theory of covert spatial attention that this kind of attention is functionally equivalent to motor preparation for goal directed activities. In their view covert attention to a location in space would be the phenomenal manifestation of preparation for planned movement (Rizzolatti et al., 1987).

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<sup>11</sup> This conclusion seems the best explanation of the experimental evidence. However, in this paper I shall not offer an argument in support of the claim that these properties are consciously perceived rather than inferred on the basis of perception. Instead I shall, to some extent, simply assume that they experienced. Arguments for a similar conclusion have been put forward by Nanay (2011 and 2012). It should be added, however, that the argument in sects. 4 and 5 below offers some considerations in favour of taking affordances to be among the objects of experience.

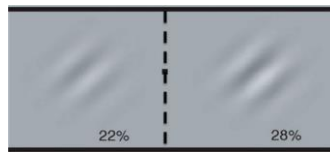
<sup>12</sup> I do not intended to suggest here or anywhere else in this paper that only affordances are perceived. Rather, affordances are among the objects of perception. These also include things and their properties.

I shall return to these issues, but for now I wish to put forward the following argument which I shall flesh out and defend in sect. 4 below. There is conclusive empirical evidence that motor planning influences conscious perception. More specifically, we do perceive the environment partly in terms of our ability to act on it. Further, this perception of affordances is manifested in experience. Thus, since behavioural studies have shown that motor preparation for saccadic eye movement enhances the appearance of contrast in ways that are comparable to alterations engendered by covert attention, and given the close connection between covert spatial attention and motor planning for saccades, it seems at least plausible that in this case also the character of experience can be explained in terms of the perception of affordances. It is one of the burdens of section 4 to make the case for this conclusion.

## **2. Block's Argument for Mental Paint**

Block argues that Carrasco's results offer strong evidence for the view that the phenomenal character of experience cannot be fully explained either in terms of direct awareness of objects (and perhaps their properties) as the direct realist would have it or in terms of the representation of these objects (and properties) as is advocated by some supporters of representationism. Instead, Block claims that these experiments show that any account of the phenomenology of experience must resort to invoking something else. This something else is what he dubs 'mental paint'. Given his commitment to physicalism, Block does not envisage this paint to be tantamount to a quale (a purely qualitative intrinsic feature of experience). Instead, he presumes that mental paint will turn out to be reducible to some neural features of perception (2010, n 2, p. 56). What matters for the purposes of his paper is not the exact nature of this extra dimension of the phenomenal character of experience. Instead, his main concern is to show that this extra dimension is required so that both direct realists and those representationists who wish either to identify phenomenal character with representational content or to reduce the former to the latter are shown to be mistaken. What follows is a reconstruction of what I take to be the structure of Block's argument.

Partially reproduced from Carrasco, Ling and Read (2004) with permission of the author



Call ‘E1’ the experience one of the participants in Carrasco’s experiment has of the leftmost Gabor patch in Fig. 2 when her attention is not drawn to that patch and call ‘E2’ the experience that she has of the same patch when her attention is drawn to it because of the onset of an earlier cue. It is assumed that all other relevant factors (distance, illumination conditions, etc) are invariant in the two cases.

- Premise 1: Experiences E1 and E2 have different phenomenal characters.
- Premise 2: The difference in phenomenal character is a genuine perceptual effect.
- Premise 3: Neither E1 nor E2 is an illusion.
- Premise 4a: There is no difference in the kind or number of objects (and properties) that one is directly aware of in E1 and E2

Alternatively,

- Premise 4b: There is no difference in the number or kind of properties represented in experience in E1 and E2.

Therefore,

Conclusion 5: Something other than the objects and properties one is aware of or represents in experience must account for the difference in phenomenal character between E1 and E2.

Conclusion 6: The best candidate for this something else is mental paint.

Block’s opponents must reject at least one of these premises. In this section I focus on Block’s arguments in favour of premise 4 whilst granting the truth of premise 1, 2 and 3. It is worth noting, however, that none of these is absolutely beyond question at least with regard to the effects found by Carrasco.<sup>13</sup> In section 4 I offer reasons to reject Block’s arguments.

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<sup>13</sup> Premise 1 could be challenged since Carrasco’s experiments involve forced choice snapshot judgements which might be guided by unconscious enhanced sensitivity to contrast in attended regions of space. Block’s defence of premise 2 is based exclusively on the claim that Carrasco’s effects are subject to visual adaptation. Thus, he is able to exclude the possibility that they are a result of cognitive

Premise 4a expresses the crux of Block's case against direct realism. The direct realist claims that the phenomenal character of a conscious perception is constituted by the objects, properties and layout of which one is directly aware. However, in Block's view there is no difference in this regard between E1 and E2 because there is no difference in the environment in the two cases. Further, the phenomenal difference in the two cases cannot be explained by claiming that there are determinate properties of which one is aware in the one case but not in the other because the change is not experienced as a move from generic to more specific, but as a difference in contrast (at the same level of specificity) (2010, p. 43).

Block considers two possible responses from the direct realist. The first would be to claim that one is directly aware of the focus of attention as it shifts. It is this awareness of the property of being-the focus of attention which is instantiated by the left hand patch in E2 but not in E1. Awareness of this property would explain the difference in phenomenology between the two perceptions. Block dismisses this response because, in his view, it is tantamount to conceding the existence of mental paint as being the focus of attention plausibly pertains to the way in which one is aware of things rather than to those things of which one is aware (2010, p. 43).

The second response, which in Block's opinion is an improvement on the first, treats attention as constituting, at least partly, the relation of direct awareness. Nevertheless, Block claims that this response is of no help. Although it could perhaps explain why an attended object looks more salient than it otherwise would, it cannot explain why it would look bigger or stripier or as having a higher contrast. And yet it is precisely these phenomena that need explaining (2010, p. 44).

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bias. But he cannot establish that they are due to the phenomenology of perception rather than to that of attention. As a matter of fact, some earlier studies on how attention alters appearance explicitly identify the phenomenon as one pertaining to the phenomenology of attention and thus concerning "attensity" (the phenomenal quality of attended objects) rather than to the phenomenology of perception (Prinzmetal et al, 1997). In defence of premise 3 Block contrasts the results of the Carrasco experiments with other cases where he acknowledges that attention gives rise to illusions (Cf., Tse, 2005). This is also not dissimilar from the distorting effect of pro-attitudes that make us, for instance, treat desired objects as if they were closer to us than they really are as revealed by both verbal reports and actions toward the objects (Balcetis and Dunning, 2010). Nevertheless, I am inclined to concede something akin to premise 3 because attention is not an all or nothing phenomenon. It is a matter of degrees. Thus, when we look we might pay attention to more than one point in space; we might attend to a whole area whilst attending more to some portions of it than to others (Cf. Carrasco, 2011, p. 1487). This shows that the boundaries of attention are vague; it might also be the case that the boundaries between illusion and perception are vague insofar as it might be true that there are borderline cases. However, the vagueness of the boundaries of attention present in most cases of perception would mean that almost every case is on borderline between illusion and perception.

Block raises similar issues in his attack against representationism whose crux I have expressed by means of 4b. Like her direct realist opponent, the representationist cannot invoke any features of the environment which because they are represented in the one case but not in the other explain the difference in phenomenal character between E1 and E2. In particular, also like the direct realist and for the same reason, the representationist cannot invoke a move from determinable to determinate properties since the difference in look between E1 and E2 is not a difference between a more generic and a more specific look. Thus, although a distinct look would correspondent to each of the represented properties, these are not looks that would explain the phenomena.

Obviously, since both E1 and E2 are said to be perceptions, the representationist cannot invoke the possibility of misrepresentation to explain the difference in phenomenal character between the two (Block, 2010, pp. 49-50). The representationist might resort to responses similar to those Block attributes to the direct realist, but in Block's view such an adoption would suffer from the same flaws mentioned above. There is, however, an extra string to the representationist's bow: she can invoke vague contents to explain the difference between E1 and E2. Block is sympathetic to this response as he thinks that the contents of E1 and E2 are indeed vague and that their vagueness explains how they can be different and yet both pertain to perceptions. Thus the content of E1 would include a range of contrasts and that of E2 a different higher range, as both of these would include 22%, both contents are true.

Despite his endorsement of vague contents, Block denies that they can explain the relevant difference in the phenomenal characters of E1 and E2. This is because the only *one* look that could correspond to a vague content is a fuzzy look, but neither E1 nor E2 are experienced as fuzzy (p. 52). Alternatively, one could say that what flows from vague contents is not a single look but a disjunction of looks one for each determinate contrast in the ranges. This move would not help since a disjunction of looks is not one way in which something could look (p. 52). So either the look corresponding to the vague content is not of the right sort to explain the phenomena or there is not a single look which is determined by the vague contents. Either way, Block concludes that representationism also fails.

### 3. Defining Affordances

Block's argument is predicated on the assumption that the range of properties and objects that can be represented in perception or figure among the objects of experience is rather limited. More specifically, Block has ignored the possibility that affordances or action properties are perceived and could contribute to the phenomenology of perceptual experience. In this section I clarify the notion of an affordance or action property before in the next arguing that the phenomenological effects highlighted in the two kinds of cases I have presented in the first section could be explained in terms of the perception of these properties.

We owe the notion of an affordance to James J. Gibson who first defined it as 'what [the environment] *offers* the animal... either for good or ill' (1986, p. 127).<sup>14</sup> Thus conceived affordances are relative to a subject or animal. Examples would include the climbability of a staircase by a biped or the graspability of a ball by a creature with an opposing thumb. Although the notion of an affordance was first developed in the context of ecological psychology, its current use does not imply a commitment to that approach. In this paper I am simply agnostic about this approach's utility or correctness.

There is no agreed upon view of the ontology of affordances.<sup>15</sup> I shall not attempt to settle this issue here. For my purposes it is sufficient to spell out those features of these properties which are needed to develop the argument in the next section that, if they are consciously perceived, their experience explains why, for example, objects at attended locations look to have higher contrast and also why, for instance, slopes look steeper to tired people than they do to those who are rested.

Affordances are something akin to possibilities for action. They are features of the environment which are relative to a given animal. Typically affordances can be characterised as follows: Object *o* in situation *s* affords  $\phi$ -ing for animal *a*. Thus, for instance, staircase *o* (with risers of a given height) in situation *s* (it is dry and well-lit) affords climbing for animal *a*. To say that the staircase in the given situation affords climbing for a given animal is to claim that animal *a* can climb the staircase in that

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<sup>14</sup> The view that I defend here differs from Gibson's in some respects. Importantly, I take objects and their properties to be perceivable as well as affordances. Gibson claimed that only the latter are perceived.

<sup>15</sup> Heft has argued that they are properties of the environment understood as resources for the organism (1989). Turvey has argued that they are dispositional properties (1992). Chemero (2003) has claimed that they are relations between features of situations and abilities of organisms.

given situation. I shall not spell out the nature of the modality involved in affordances; but, intuitively, the thought I am trying to express is that if animal *a* attempted to climb the staircase in that situation or relevantly similar ones, then it would succeed in a large number of cases.<sup>16</sup>

Even from this brief characterisation a few distinguishing features of the notion of affordance adopted here should be clear. First, the affordances I am interested in are possibilities; they are not, as Merleau-Ponty (1995) suggested, demands that the environment makes on the animal. Second, they are not relative to the animal's needs or interests. Thus, I am not considering cases where one perceives an object as an obstacle, or another as food. Instead, my discussion is only concerned with affordance as opportunities for actions offered by objects in given situations which are exclusively relative to the animal's motor abilities (which are in part determined by its anatomy and biomechanical limitations). So conceived, and as Gibson himself held, affordances can exist unperceived either because no animal is present or because the animal fails to perceive them.

Something more needs to be said about the notion of an activity which is crucial to my definition of affordance. An activity is a doing; it is something that an animal performs as opposed to something which is done to it by another thing or organism. It is, in other words, a self-directed movement. In addition, it is something of which it makes sense to say the animal tried (perhaps unconsciously) to do it and failed or succeeded. So activities have success conditions.

They do not, however, need to have a specific goal or telos which once achieved brings the activity to its completion, although they might. For instance, the activities of climbing the stairs or catching a ball have goals. For the first, the goal is to get to the top of the stairs and the activity terminates when this goal is achieved; for the second the goal is to catch the ball and the activity terminates when its goal is accomplished. Of course, these activities can also end in failure if the steps prove too high to climb or the ball too far to catch. By way of contrast, the activity of walking can be atelic in character at least in this sense: one can walk for the sake of walking without any particular further goal in mind. Here, the activity itself is its own goal and this why there is no goal which terminates the activity once achieved. Activities of

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<sup>16</sup> For a similar characterisation see Nanay (2012, p. 431)

this atelic kind also have success conditions. For instance, an animal can try to walk over a boulder field and fail because of the unevenness of the terrain.<sup>17</sup>

Further, these activities do not need to be consciously initiated or controlled as a result of a specific intention. Thus, the activities that can figure in affordances include those doings which are classified by Mark Rowlands as deeds. These are what he calls 'pre-intentional acts' because they are doings whose direct causes are not themselves intentional states and such that the general antecedent intention is not sufficient to individuate the deed (2006, p. 104). An example of such activities are a slip catch of a cricket ball when the ball is arriving at one's midriff, so that one has to 'choose' whether to point one's fingers down or up when attempting to catch. The general intention guiding the activity in this example is to catch the ball but the intention does not specify the orientation of one's fingers. Further, there is no time to form a conscious intention on this matter if one is to succeed in catching the ball. Another example is the skilful movement of the fingers of an expert pianist whilst playing a difficult piece.

Saccadic eye movements are a further example of a deed or pre-intentional acts. They are deployed, for instance, to explore visually a picture or to keep track of the ball in sports such as cricket or baseball. Like other pre-intentional acts these are not merely bodily movement such as, for instance, a spontaneous movement of a tongue done for no reason whatsoever.<sup>18</sup> Although subjects will not have formed any specific intention about where to move their eyes, the eye-movement is part of an overall activity which is intentional and either telic or atelic in the sense defined above. Thus, one might be visually exploring a picture, walking for pleasure, playing a piece of music on the piano, or trying to hit a ball with a bat. All of these activities are composed of sub-activities, several of which will fall under Rowlands' definition of a pre-intentional act. These acts are executed because of the subject's overall plan or intention, although there is no specific intention to move one's eyes exactly so, or one's foot, or fingers. These deeds have success conditions since they can fail in their contribution to the overall activity. Whilst exploring the picture one might mistakenly saccade onto the location of a fly on the adjacent wall, when descending a staircase

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<sup>17</sup> For the distinction between these two kinds of activity see Crowther (2009) who deploys it to explain the idea of perception itself being an activity.

<sup>18</sup> O'Shaughnessy refers to such movements as deeds or subintentional acts (1980, p. 60). He also argues that these acts are the result of non intentional tryings (1980, p. 96). I follow Rowlands' choice here of reserving 'deeds' for pre-intentional acts (2006, p. 99) and in rejecting the view that sub-intentional acts constitute genuine tryings (2006, p. 102).



one might stumble on a step because one's motion was calibrated for a shallower step, or one might lose track of the ball before one can even try to hit it. In all of these instances we have doings which have success conditions; all of these deeds and actions are included among the activities that can be afforded to an animal by the environment.

I should add that, although I develop my argument in terms of the notion of an affordance, the same or at least similar points could be made using Bence Nanay's notion of a Q-able property of an object, where Q is a goal-directed action (2011 and 2012). He defines these as relational properties of objects such as being edible or climbable.<sup>19</sup> In his view these properties are represented in perceptual states which he calls 'action-oriented' and which are deployed in perceptually guided action (2012). He thus restricts his account to properties concerning only intentional telic activities. I think that these restrictions are unwarranted and, perhaps, a result of the mistaken assumption that only intentional actions with a goal can have success conditions.<sup>20</sup>

#### 4. Experiencing Affordances

This section aims to accomplish four things. First, it provides an account of the phenomena highlighted by Block as examples of experiences of affordances. According to this account the deployment of covert spatial attention alters the appearance of contrast, colour saturation and flicker rate because it allows new affordances concerning saccades to be experienced. Second, it offers some evidence for the plausibility of this account. Third, it shows how the account is a rebuttal of Block's argument in so far as it points to the existence of (A) a property which is experienced when the object's location is covertly attended, but not experienced when the object's location is unattended and (B) of a kind to which there can be a corresponding phenomenal look capable of explaining the phenomena. Fourth, it addresses the obvious objection that the property invoked in the account defended here is not a genuine property but rather a mode or manner of representing things. If

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<sup>19</sup> It should be noted that insofar as being edible is relative to the interests and needs of an animal I would not consider it as an affordance proper. That said, I see no particular reason why these properties also should not figure in perception.

<sup>20</sup> It is also possible that Nanay might think of walking for walking-sake as a goal-directed activity whose goal is the activity itself.

this objection were correct, this account would also invoke mental paint in all but name.

In what follows I first discuss those experiments that are concerned with the phenomenology of contrast before considering similar experiments about gap size, colour saturation and flicker rate. In this context it is significant to note at the outset that, with the exception of one study on contrast appearance (Liu et al, 2009), all of Carrasco's experiments concern exogenous or involuntary covert spatial attention. This point is of significance because the premotor theory of covert attention, which I have already mentioned in section 1 above, has received substantial empirical confirmation as an account of this kind of attention.<sup>21</sup>

Carrasco thinks of perceived contrast (with which she is concerned) as tantamount to salience (Carrasco, Ling, and Read, 2004, p. 308).<sup>22</sup> This interpretation of the notion of contrast, which undoubtedly encourages explanations invoking mental paint, helps to understand the kind of phenomenology Carrasco is concerned with. When she claims that a Gabor patch looks as having higher contrast when its location is attended to, she takes that claim to mean something which could also be described by saying that the patch is experienced as more salient. What she has in mind, then, cannot be the technical notion of contrast (see note 8), but something closer to the thought that a Gabor patch stands out more against its background when its location is attended to than it would if its location were unattended. Thus, there is no doubt that some of Carrasco's explanations of her results might encourage the line of thought preferred by Block. However, his approach is not compulsory, and the phenomenon can be explained differently.

If you, like me, tend to see Gabor patches as if they were folds in a carpet with the darker parts as if in the shadow and the lighter parts as if they were brightly illuminated ridges, then those patches that look to have the higher contrast are those which stand out in this sense: the edges look higher whilst the valleys deeper. There is

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<sup>21</sup> Carrasco and her team are not supporters of this theory of attention. Instead, Carrasco appears to favour the biased competition model (Carrasco, 2011, p. 1486-7). Nevertheless, the premotor theory of attention is not ruled out as incorrect by Rolfs and Carrasco in their 2012 which advances evidence that supports the dissociation of covert attention and saccadic preparation based on the timings of effects of saccadic preparation which were faster than those of either kind of covert attention (2012, p. 13751). The behavioural results discussed here, however, do not offer direct support for any specific theory of the computational or neurological mechanisms underpinning attention. Instead, they highlight some conscious phenomena concerning attention which any theory of attention would need to be able to explain.

<sup>22</sup> Recall that 'perceived' in this context is used as broadly equivalent to 'consciously perceived' or 'experienced'.

no separate and distinct experience, at least for me, that the darker parts also look even darker when the location of the patch is attended to. Instead, the whole patch simply jumps out more against its background. I take it that this is the phenomenology of the participants in Carrasco's experiments too when they have to judge in a split second the orientation of the patch that looks to have the higher contrast.

This idea of a Gabor patch standing out more or less against its background can be fleshed out quite naturally using the language of affordances. We can capture this sense of standing out in terms of the ease with which we can shift our eyes so that we look straight at the patch.<sup>23</sup> The patch, then, would be experienced as affording moving one's eyes (that is, saccading either intentionally or pre-intentionally) to its location. I am not aware of any commonly adopted term to describe this affordance. For the purpose of this paper, I coin the admittedly inelegant expression 'gaze-ability' for cases where an object *o* in situation *s* affords being gazed for animal *a*.

Gaze-ability like many other affordances is not categorical. Thus, for example, although it is true that a ball is either catchable or it is not, it is also true that it can be more or less easy to catch. In the same manner it might be easier or harder to fixate one's eyes on a given location. The level of ease (or difficulty) must be a function of at least two features: effort of moving one's eyes to the location and objective features of the target of the movement which might make it easier or harder to spot against its background. Hence, Gabors that are objectively more contrasty than others appear easier to direct one's gaze upon as their locations will be easier to spot. Similarly, Gabors whose locations are attended to will be easier to fixate on because the effort required to move one's eyes toward them is less than the effort of directing one's gaze elsewhere.<sup>24</sup>

The basis for this latter claim is purely empirical. There is good evidence that intentional (or voluntary) saccades to a target cannot take place unless covert spatial attention has first been directed to that location (Hoffman and Subramaniam, 1995). So those objects whose location is already the focus of covert attention either endogenous or exogenous are easier to direct one's gaze toward because no further preparation in form of a shift of covert spatial attention to their location is required for voluntary eye movement to take place. Hence, everything else being equal, objects

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<sup>23</sup> We also experience it as, in some sense, demanding that we direct our eyes toward it. The object captures our attention and we are inclined to move our eyes so that we can take a look at it.

<sup>24</sup> With exception of course of the location on which one's eyes are currently fixated.

whose locations are covertly attended are more gazeable than other objects among those on which our eyes are not already fixated because it is less effortful to saccade intentionally to their locations. It is less effortful because in all other cases one must first covertly attend to the given location, and to do so requires some effort.

However, not all saccadic eye movements are intentional; some are pre-intentional. In these latter cases we do not form a specific intention to move our eyes to a given location. Rather, the saccade is part of an overall pattern of activity which is initiated and controlled by intentions. In these cases also the direction of covert attention to a location makes it less effortful to move one's eyes in that direction. There is strong evidence that motor preparation is both necessary and sufficient for exogenous or transient covert attention to be deployed (Smith and Schenk, 2012, sect 3 and 4). In these cases then the direction of covert attention to a location is always accompanied by motor preparation for moving one's eyes to the location. Hence, when the eyes do move, less effort is required to execute the movement. Indeed, effort might be required to inhibit eye movement from taking place. The empirical evidence, however, also indicates that motor preparation is sufficient but not necessary for the deployment of voluntary covert spatial attention (Smith and Schenk, 2012, sect 4). Hence, voluntary covert attention could be deployed without any motor preparation taking place. However, attention is necessary for motor preparation of saccadic eye movement in the sense that if the saccades are prepared, attention is subsequently deployed. In other words, if one were to try pre-intentionally to saccade one would succeed only if attention were deployed to the relevant location. Hence, attention makes the execution of movement less effortful, since for the movement to succeed attention would first have to be engaged. Of particular relevance in this context is also the finding by Rolfs and Carrasco (2012) that motor preparation for saccadic eye movement alone also alters the appearance of contrast in the same way in which it is altered by the deployment of covert attention.<sup>25</sup>

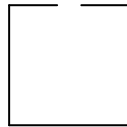
This account can be extended to explain Carrasco's other results concerning gap size (Gobell and Carrasco, 2005), colour saturation (Fuller and Carrasco, 2006) and flicker rate (Montagna and Carrasco, 2006). Experiments indicate that subjects experience the size of gap in the contour of a geometrical shape to be bigger when its

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<sup>25</sup> It must be added that the ability to move one's eyes is essential to covert spatial attention. Patients suffering from paralysis of the eye (opthalmoplegia) suffer from deficits of exogenous attention (Smith and Schenk, 2012, p. 6).

location is attended to (see Fig. 3). They also perceive colours to be more vivid at attended locations. Whilst the flicker rate of Gabor patches which oscillate right-left (rather than on-off) appears faster when covert attention is captured to their locations.

Fig 3.



With regard to gap size, Gobell and Carrasco write that ‘attention increases the perceived distance between the ends of the two line stimuli—it makes the gap bigger, thereby easier to localize’ (2005, p. 650). Without taking issues with this construal of what is occurring, the results highlighted by Witt and Proffitt with regard to perceived size of a baseball, suggest an adjustment to this description.

Participants experience as bigger the gap which stands out the most for them; the one which they find easier to locate. Subjects, in other words, experience as being larger the gap which is easier to direct one’s gaze toward when the difference in size between the two gaps is either quite small or non-existent.<sup>26</sup> I do not, however, wish to deny that the attended gap looks bigger. Rather, my contention is that looking bigger is precisely what a gap which looks easier to view looks like. In the same way, I wish to claim that baseball players whose batting average is high judge the ball to be bigger because, looking bigger is what a ball that looks easy to hit looks like. Of course, these claims need further clarification as well as more argumentation in support. It is the burden of the final section of this paper to provide both of these. For now, I wish to turn to Carrasco’s results with regard to colour saturation and flicker rate. About the first, Carrasco’s findings indicate that the colours of coloured patches appear more vivid when their locations are attended to. Thus red patches appear redder and green ones greener. This result also can be explained along similar lines. The red patch looks redder because it stands out more; and redder is what a red patch looks like when it looks easier to gaze at.

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<sup>26</sup> I do not mean my comments here to be read as claiming that Carrasco’s results are due to cue bias which she ruled out in a control experiment. In other words, participants do not select the gap that is attended merely because it is attended. What I suggest is that they select the gap that affords gazing more easily.

The last of Carrasco's results which I wish to consider is different as it concerns a temporal dimension of perception. Gabor patches that flicker horizontally appear to flicker faster when their location is attended to. My account offers some explanation for this surprising finding.

Since this result concerns transient or exogenous covert attention, motor preparation for saccading to the target location will accompany attentional capture. As the Gabor patch is flickering, it is perceived as vibrating horizontally. Thus, it is experienced as affording fixation only with difficulty. It is gaze-able, but as its position seems to keep changing, it is hard to move one's eyes so as to fixate them to its location. What I would like to suggest here is that this difficulty in directing one's eyes toward and keeping track of the object is experienced as a difference in the rate of movement of the patch. Seeming to flicker faster or move around quicker then, would be what being harder to keep one's eyes fixed on an object's location as it moves around looks like.

The account offered here then points to the existence of properties which (A) are perceived when the object is at the attended location, but not otherwise, and (B) are of a kind to which there is corresponding phenomenal look capable of explaining Carrasco's results. These properties are affordances. Their existence gives to both representationists and direct realists an opportunity to rebut Block's argument. Strictly speaking, in order to block the argument, it would be sufficient to show that there is a property that could be invoked to show that premise 4 of the argument in either of its guises is false. In this section I have aimed to go further and show that there are good reasons to believe that the phenomena under discussion are best explained by counting affordances among the objects of experience.<sup>27</sup>

It may be objected to the account developed so far that it invokes mental paint in all but name. Gaze-ability, it may be said, pertains to the *manner* of experiencing things or to the *mode* of representing them in conscious perception rather than to what is so experienced. After all, it might be added, what makes a given object gazeable or a hill climbable is never just a matter of the object's location or of the incline of the slope but also a matter of the subject's ability to move her eyes or of her level of fitness. In response, whilst it should be granted that action-scaled affordances,

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<sup>27</sup> Or perhaps, more weakly, my argument shows that if we admit affordances among the possible objects of experience, their inclusion makes available a plausible explanation of the phenomena under discussion.

understood as comprising a measure of the effort that would be required to carry out the action, are not determined by retinal input, it should be retorted that affordances are genuine relational properties of things within a given situation.<sup>28</sup> The experience of a hill as being very steep, even if the perceived steepness depends both on actual incline and effort given one's level of fitness, is not a matter of a mode or manner of representing things. It is, instead, the experience of a relational property of the hill, which it retains when no one is experiencing it. In this way affordances differ from modes of representing objects such as experiencing things as fuzzy when one is very short-sighted and is not wearing corrective lenses.

It is true that Carrasco sometimes describes the phenomenology uncovered by her experiments as concerning increased salience; it is equally true that salience is a mode of experiencing rather than something which is experienced. But as I have argued above the vocabulary of salience is best re-interpreted in terms of a specific affordance that concerns saccadic eye movement; this re-interpretation makes it explicit that what is experienced is a property of things to afford moving one's eyes to their location so that one can look straight at them.

It might at this point be worth recalling Block's additional consideration in support of explaining Carrasco's findings in term of mental paint. This is his claim that the changes in phenomenology he is discussing do not even look like changes in the world (Block, 2010, p. 53). The account developed here can make sense of this intuition. Because affordances do not depend solely on the objective properties of things in their layout but also on the motor abilities of perceivers, their perceptual detection cannot depend exclusively on retinal input; either stored information about the subject's motor ability or information derived by the subject's actual movement in its environment is also required.<sup>29</sup> The change is not perceived as a change in the world because it does not concern the world's intrinsic properties. Whatever change there is concerns only some of its relational features which are not determined by retinal input alone.

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<sup>28</sup> Gibson also thought that the information required to specify an affordance was to be found both in the optic flow and in the subject so that this form of exteroception includes a proprioceptive component.

<sup>29</sup> For empirical evidence that in some cases the information is gathered 'on the fly' on the basis of the perceiver's actual movements see Fink et al., (2009).

## 5. What looking easier to look at looks like

In this section I argue that the phenomenal looks associated with affordances are of the right sort to explain the phenomena highlighted by Block. That is, I defend the view that looking to have higher contrast, more colour saturation, to be a bigger gap is what being easier to gaze looks like. In the course of developing an argument for this conclusion, I shall explore further the question as to whether these cases are best understood as illusions or as perceptions.

This argument is particularly pressing because Block's argument against representationism rests on the claim that there is no property which is represented in perception *and* is also of the right sort to determine the character of the given experience. In Block's original example the property in questions needs to be of the sort that explains why the look of the patch changes in the dimension of contrast. Since the account developed here might seem not to supply a property of the right kind, it would appear vulnerable to the same objection. The difference that needs explaining, Block may add, is one of experienced contrast and not that of experience gaze-ability.

The issues raised by this objection cannot be settled one way or another by means of introspection alone (Cf., Schwitzgebel, 2008). Current debates about how to account for colour or shape constancy effects suffice to teach us this lesson. For instance, the disagreement between those who claim that a tilted coin looks elliptical and those who claim that it looks like a tilted round coin cannot be solved simply by focusing introspectively on the character of the given experience. Instead, one must also consider how the attributed look fits into an account which is consistent with the empirical evidence and has considerable explanatory power. In order to defend the claim that the phenomenology of affording moving one's eyes so as to fixating them on the object is what is being described when one says that a patch looks to have higher contrast or its colour looks to be more more saturated, I want to consider first the phenomenal character of the visual experiences of walkers who, while wearing a heavy backpack, judge a hill to be steeper than it is thought to be by their unencumbered counterparts.

Bhalla and Profitt note that human subjects in general overestimate the steepness of a hill when asked to report it verbally in units of degrees or visually by adjusting the moving part of a disk that represents the cross section of the hill in terms



of an angle. Normally, a hill whose slant is  $5^\circ$  is reported as being about  $20^\circ$ , and one which is approximately  $10^\circ$  is thought to be roughly  $30^\circ$  (Bhalla and Proffitt, 1999, p. 1076). Subjects who are tired or are wearing a backpack are prone to even worse overestimates. In the backpack experiment subjects overestimated a  $5^\circ$  slant verbally by a further 19% and visually by an added 27% (p.1082). From these observations Bhalla and Proffitt conclude that experience of slant is on the whole illusory because it is 'highly exaggerated' (p. 1092). The experience of the backpackers then would be even more illusory since it is even further off from the reality.<sup>30</sup>

But Bhalla's and Proffitt's work also supports a different interpretation of these experiences. This is an interpretation that Proffitt himself adopts in a later discussion without taking it to be in tension with the claim about exaggerated experience (2003, p. 106). Human subjects do not experience (or at least not solely) geographical slant, such as the steepness of a hill, in units of degrees; instead, they experience it in units of the effort (or physiological potential) it would take to walk up it. Effort so conceived is a function of the objective steepness of the incline and the subject's motor abilities as determined by generic facts about human biomechanics and specific facts about individuals such as their level of fitness, whether they are rested, whether they carry a load, and so forth. However, if subjects visually experience slant in terms of effort, it seems plausible to conclude that these experiences are veridical. All subjects accurately perceive visually how hard it would be for them to walk up the hill. It is harder for those wearing a backpack. That is why, they experience the hill to be steeper than subjects who are not being weighted down by a load.<sup>31</sup>

These considerations support seeing the erroneous verbal and visual reports as resulting from false beliefs generated in the attempt to translate accurate visual experience in terms of efforts into representations of the same slant expressed in degrees. The supposition that visual experiences of slant are veridical, despite leading to the formation of false beliefs, is corroborated a few of considerations.

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<sup>30</sup> Yet, as Bhalla and Proffitt also notice, subjects do not stumble over when they attempt to climb hills. This fact is taken by Bhalla and Proffitt as evidence of the existence of a dual visual system. One system controls visually guided activities such as the fine calibration of the angle of the foot when walking uphill; the other conscious system guides the planning of motor behaviours such as gait selection (Bhalla and Proffitt, 1999, pp. 1076-7). For the classic statement of the dual system theory see Milner and Goodale (2006). It should be noted that attention is thought to play a crucial role in how the two systems interact.

<sup>31</sup> I am not aware of any results connecting the heaviness of the load to the perception of steepness. Be that as it may, there need not be a precise transformation between the two.

First, the presumption that subjects experience slant in terms of how easily it affords walking up or down makes sense of a range of findings. Generally 30° is roughly the steepest slant humans can walk up (as opposed to scramble), although this slant is already too steep to walk down safely (Proffitt et al. 1995, p. 409). So we would expect hills to look steeper when we look down at the slope from the top. This is what Proffitt has found (Proffitt et al. 1995, p. 426). Further, hills are harder to walk up if one is tired, one is unfit or wears a heavy load; these are precisely the conditions in which subjects perceive hills to be even steeper than other subjects do (Bhalla and Proffitt, 1999). Second, given the role of visual experience in the planning of action, sensitivity to the level of effort it would take to walk up a hill makes evolutionary sense. There is an advantage in being able to gauge whether we are able to walk to the top of a hill, jump over a torrent, squeeze through a gap (Reed, 1996, ch. 2). Empirical evidence suggests that this sensitivity is perceptual in character because it is insensitive to belief since knowing about the effects revealed by Proffitt makes no difference to the perception of slant. Third, Bhalla and Proffitt have found that subjects are much less sensitive to changes in steepness of inclines that are not within the walkable range.

The lesson to be learned from these cases is that the phenomenal character of visual experiences is shaped by affordances so that when we say that a hill looks very steep what we describe is the phenomenology of affording walking up only with difficulty. Similarly, when the in-form baseball player describes his perception of the ball as being as big as a melon, he is trying to express in words the phenomenology of affording hitting with ease.<sup>32</sup> This lesson can now be applied to the results of Carrasco's experiments.

In this context it is worth recalling that there is empirical evidence that saccadic eye preparation alters appearance of contrast as does covert attention (Rolfs and Carrasco, 2012). The defence of the account proposed here does not, however, need to rest solely on this result. Instead, it gains also support from its ability to explain Block's observation that the experience of a change in contrast is not experienced as a change in the world. Paradoxically the subject experiences the contrast of the patch as having both changed (because it looks different) and not

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<sup>32</sup> Or at least this is the conclusion that one should draw given the analogy with the perceived steepness of slopes. So contrary to initial intuitions, the in-form player sees the ball bigger because he is in-form, his form is not caused by seeing the ball to be bigger.

changed.<sup>33</sup> Yet the paradox disappears if we note that perceived contrast is a function of both objective contrast (defined as the result of subtracting the lower luminance from the higher luminance and dividing by the average luminance) and amount of effort required to move one's eyes to the location of the object. When we covertly attend to the location of a patch, the contrast of the patch appears higher than it would otherwise, because the patch is easier to gaze straight at. The experience of diminished effort is the experience of the patch as standing out more clearly. However, the patch is also experienced as not having changed in contrast because its objective contrast has not changed. The situation is thus analogous to that of a subject who visually experiences the steepness of a hill before wearing a heavy backpack and then whilst carrying the load. On the one hand, she will experience the hill as being steeper, but on the other hand as not having changed. What has changed is the effort it would take to walk up it and this is the change which is reflected in the phenomenology.

We have learnt from the literature on performance efficacy that things look bigger when they are easier to hit; they look steeper when they are harder to walk up. This lesson can be applied to the results concerning covert attention. Covertly attended gaps are easier to gaze which is why they look bigger; covertly attended Gabors are also easier to gaze which is why they look to have higher contrast. In sum, bigger, more contrasty, more saturated is what looking easier to look at looks like.<sup>34</sup>

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<sup>33</sup> This phenomenon is thus difference from constancy effects concerning shape or colour where one experiences something as having changed such as the relative position of the object or the illumination conditions.

<sup>34</sup> Acknowledgments

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