Desires, magnitudes, and orectic penetration

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Abstract: Dustin Stokes argues for the existence of orectic penetration, a phenomenon in which a desire-like state penetrates our perceptual experiences. His candidate for a case of orectic penetration is the most convincing candidate presented thus far. It is argued here that his candidate and his further arguments for the existence of orectic penetration do not support the claim that orectic penetration takes place. As a result, it is concluded that there are no convincing cases of desire-like states penetrating perceptual experiences.

Keywords: Orectic penetration; Cognitive penetration; Dustin Stokes; Magnitude perception;

1. Introduction

Cognitive penetration refers to the possibility that our cognitive state causes a change in the phenomenal character of *perceptual experiences* in a manner in which this change is not due to an additional mediating act (such as walking to another room or turning our gaze to something).[1] Candidates for the cases of cognitive penetration include the suggestions that (i) our experience of a pine tree changes once we recognize it as a pine tree (Siegel, 2005), (ii) our belief about the characteristic color of familiar objects, such as apples and hearts, may influence the color we perceive them to have (Macpherson, 2012), and (iii) ambiguous figures, such as the famous duck-rabbit drawing, may appear as one thing or the other depending on the concept under which we apprehend them (Churchland, 1988).

Philosophers have been reluctant to accept that the mentioned candidates are cases of cognitive penetration or that cognitive penetration occurs at all. This is possibly partly because of the fact that treating mind as modular has proven to afford rich explanatory power. Moreover, there is a long tradition of separating cognition and perception from each other. Accordingly, the consequences of possible cognitive penetration for traditional philosophical topics have been argued to be substantial, ranging from undermining the role that experiences have in justifying our beliefs (Siegel, 2011) to questioning the modularity of mind (Raftopoulos, 2001). Given these reasons, it appears that most philosophers are willing to accept a candidate as a case of cognitive penetration only if the difference in perceptual

[1] This paper focuses on Stokes' example and thus, following him, the causal notion of cognitive penetration is adopted. This notion is not univocally endorsed though. Fiona Macpherson (2012), for example, emphasizes the intelligible link (not the causal relation) between cognitive states and perceptual experiences. It is also worth noting that whereas philosophers' debate concerns cognitive states as possibly penetrating perceptual experiences, cognitive scientists, e.g., Zenon Pylyshyn (1999) whose definition of cognitive penetration otherwise resembles Macpherson's definition, focus on cognitive states as penetrating pre-experiential states.

experiences cannot be explained in some alternative way that has less serious consequences. Obviously, this leaves the possibility of the existence of cognitive penetration open, since it merely provides reasons to doubt or deny the cases as candidates for cognitive penetration. Nevertheless, for many, the burden of proof is on those who maintain that cognitive penetration occurs (e.g., Macpherson, 2012; Stokes, 2012, 2013).

Dustin Stokes (2012) adds to the list of phenomena that have been put forward as a candidate for cognitive penetration the suggestion that subjective values influence the apparent size of coins. This is based on the study by Jerome S. Bruner and Cecile C. Goodman (1947). Two things separate Stokes' candidate from the other candidates. First, if true, Stokes' candidate would be a case of *orectic penetration*, a special case of cognitive penetration in which the penetrating state is desire-like.[2] Second, as discussed below, other candidates have been disputed because alternative interpretations that are at least equally plausible than the cognitive penetration interpretation exist for them. However, thus far no such alternative interpretation has been presented for Stokes' candidate. Accordingly, it appears to be currently the best—or at minimum the least controversial[3]—candidate for cognitive penetration. Its importance is further emphasized by the fact that if Stokes' candidate turns out to be a case of cognitive penetration, one can justifiably reason that similar candidates are also cases of cognitive penetration. This means that an array of likely cases of cognitive penetration would increase because, as regards these candidates, the burden of proof would shift to those who claim that cognitive penetration does not occur.[4]

This paper is a critical exposition of Stokes' candidate and his arguments for why it is a case of orectic penetration. I will first provide a detailed introduction of the candidate Stokes uses, as well as the reasons why he thinks orectic penetration takes place in this case. Section three then presents an alternative interpretation for part of the results Stokes draws on and explicates why his candidate should be rejected as a case for orectic penetration.

2. Desire-like states as affecting perception

Stokes' suggestion that our values or desires influence our perception is based on a study by Bruner and Goodman (1947), which is one of the New Look psychological movement studies. Their subjects consisted of three groups of ten-year-old children: a control group, a poor group (children from poor families) and a rich group (children from well-to-do families). The children in the poor and rich groups were asked to estimate the sizes of coins from one cent to half a

[2] Given the possible worry concerning the notion of cognition here, Stokes (2012, p. 480) argues that "some desires are cognitive states". Assuming that the orectic states that relate to his candidate are also cognitive states, then if the orectic penetration interpretation of his candidate is true, then cognitive penetration is true too.

[3] The replication problems of the results on which Stokes grounds his candidate are well-known. However, these problems and Stokes' response to them have not been critically examined in relation to Stokes' argumentation and the issue of orectic penetration.

[4] Stokes argues that candidates in which food-deprivation influences our perception (Epstein, 1961) and the effect of desire-like states on spatial perception (Balcetis & Dunning, 2006, 2010; Stefanucci, Proffitt, Clore, & Parekh, 2008) can be explained without assuming orectic penetration. Given that both involve desire-like states, just as Stokes' candidate does, it is not unreasonable to think that all three instances are cases of orectic penetration despite the fact that two of them are open to plausible alternative interpretations.

dollar by adjusting the size of a patch of light. They were asked to do this first by relying on their memory of the coins, and then by having the coins (one at a time) in their palms to compare with the patch of light they were adjusting. The control group did only the latter task, and instead of having coins in their palms, they had cardboard discs of sizes identical to the coins.

The *first main finding* was that children in the poor and rich groups estimated the coins to be 15 to 35 percent larger than they actually were, and "the larger the value of the coin, the greater is the deviation of the *apparent* size from the *actual* size." (Bruner & Goodman, 1947, 38) Since no coin was estimated to be smaller than its actual size in this study, this means that the more valuable the coin, the more its size was overestimated. The control group estimated the size of the discs veridically, except that the disc of the size of a one-cent coin was estimated to be 5 percent smaller than it actually was. Accordingly, the researchers concluded that the social value of the coins influenced their judged size in the poor and rich groups. The *second main finding* was that the children in the poor group overestimated the sizes of the coins by 23 to 50 percent, whereas the rich children only overestimated the sizes by 10 to 23 percent. To explain the effect, Bruner and Goodman hypothesized that because the poor children had a greater subjective need or desire for money than the rich children, the poor children valued it more, and this influenced their perception of the coins. In other words, their idea was that the children had a desire for money, and the strength of this desire influenced "the size properties of the objects as experienced." (Stokes 2012, 488) If this explanation is true, this is a case of cognitive penetration in which a desire-like state influences our perceptual experiences.

Stokes discusses three alternative interpretations for the case he presents. The first one is *the memory interpretation*, according to which the cognitive states do not influence the initial perceptual experiences, but only how those experiences are later recalled. Stokes (2012) considers this to be one possible interpretation of Emily Balcetis and David Dunning's (2006) results. In their study, subjects' performance on a categorizing task involving ambiguous figures was found to be influenced by the reward that was promised for certain categorization results. Although the finding could be interpreted as a case of orectic penetration (subjects' desire for the reward influenced their perception), the memory interpretation can also account for it because the categorization was done based on the memory of the recently presented ambiguous figures. This objection does not apply to Stokes' case, however, because the subjects had ample time to inspect the coins while adjusting the light and some comparison took place so that the subject held the coins in their palms. Thus Stokes (2012, p. 488) concludes that "in no sense were the subjects making reports just based on memory."

The second alternative is the *judgment interpretation*. This alternative maintains too that our perceptual experiences remain the same, but this time it is our judgments and beliefs about our experiences that change as a function of our cognitive states. Fiona Macpherson (2012) argues that this accounts for Susanna Siegel's (2005) candidates in which possessing the concept of a pine tree supposedly affects our perceptual experiences of pines, and the perception of Cyrillic characters which changes once we learn to read them. In the Bruner and Goodman 1947 study, the target stimulus was present when the comparisons were made. Thus, as regards Stokes' candidate, this explanation would mean that subjects had not noticed that their judgment of the sizes do not correspond with their veridical experiences of the sizes of the coins even though they had unlimited time to do their comparisons. Stokes finds this

explanation of the results less plausible than the orectic penetration interpretation. He writes (2012, p. 489): "this interpretation must maintain that these subjects are continually ignoring, remaining unconscious of, or somehow otherwise failing to accurately report a current perceptual experience. This is less plausible than the interpretation it opposes, namely, that experience is penetrated by desire."

Stokes refers to the third alternative explanation as the *attention-shifting interpretation*. It admits the change in perceptual experiences, but attributes it to a non-cognitive factor, namely to a shift in attention. That is, even though our cognitive states influence where and what we attend to, and there are good reasons to think that attention alters phenomenology, this has not been regarded to be a case of cognitive penetration. The attention-shifting interpretation has been used to challenge Paul Churchland's candidate, which makes use of ambiguous images (e.g., Macpherson, 2012; Stokes, 2013). Stokes dismisses this interpretation for his candidate because there is no reason why the attentional shift between the stimulus and the adjustable light patch would have differed between the groups.

We can add to the list of alternative interpretations *the perceptual learning interpretation*, which appeals to relatively slow and long-lasting modifications to an organism's perceptual system involving functional and structural changes in sensory systems. Because it takes place under conditions that do not entail cognitive influences, perceptual learning does not imply cognitive penetrability (e.g., Arstila, 2015; Raftopoulos, 2001).[5] The perceptual learning interpretation cannot account for Stokes' candidate because the perception can be altered only if the learning has already taken place. Nevertheless, the "suitable" learning could not have occurred in the coin study because it would assume that the coins the children held before the experiment (when the learning supposedly took place) would have been of different sizes than the ones used in the experiment, and that these sizes would have differed between the poor and rich groups (otherwise the effects of possible perceptual learning between the groups would had been the same).

In short, Stokes' candidate appears immune to all alternative interpretations that have been used in arguments against cognitive penetration. As a result, his candidate might be a case in which desire-like states penetrate our perceptual experiences. Thus Stokes (2012, p. 490ff) concludes by stating that "[u]nless there is some [new] line of interpretation, [Bruner and Goodman's results and other New Look movement results] remain plausible cases of cognitive penetration generally and orectic penetration specifically". In what follows, I present an interpretation that is more plausible than the orectic penetration interpretation.

3. Magnitudes and errors

Bruner and Goodman reported two main findings. *First*, the more valuable the coin, the more its size was overestimated. *Second*, the children in the poor group overestimated the sizes of the coins to a greater degree than the children in the rich group. The alternative interpretation

[5] In the context of philosophical debate on cognitive penetration, perceptual learning was first deployed in arguments against Churchland's candidate concerning bistable figures by Raftopoulos (2001). Later, the perceptual learning interpretation was used to account for the last remaining candidate for the cognitive penetration—Macpherson's candidate (2012)—mentioned at the beginning (Arstila, 2015).

I want to put forward holds that the first finding is due to interaction in magnitude perception and that the results for the second finding are unreliable. It is further argued, contrary to claims by Stokes, that the similar studies by the New Look movement do not provide adequate support for the orectic penetration interpretation of Bruner and Goodman's results, nor for the more general claim that desire-like states penetrate perceptual experiences. If this is correct, the presented interpretation for Bruner and Goodman's results is more plausible than the orectic penetration interpretation.

Let me begin by noting that the first finding has been contested by Launor Carter and Kermit Schooler (1949). Contrary to Bruner and Goodman (1947), they reported that the size of the small coins is underestimated and the overestimation only occurs for more valuable coins. Subsequently, the average difference between the estimated size and real size of the stimuli was smaller than in the Bruner and Goodman's study. After reexamining the question how different experimental setups influence size estimation, Bruner, this time with John Rodrigues, responded by presenting a modified version of the first finding. According to this version, which they call *relative accentuation* (1953, p. 24), "as one increases the value (and size) of coins, the extent of overestimation increases significantly more markedly than is the case with metal discs or paper discs." Not only is relative accentuation supported by Bruner and his colleagues' findings (Bruner & Goodman, 1947; Bruner & Rodrigues, 1953), but Bruner and Rodrigues take it to be present also in (Carter & Schooler, 1949) because the extent of overestimation increases in this study too. Thus, despite the criticism towards the first finding, it seems justified to think that the modified version of it (the relative accentuation) is true—maybe the estimated sizes of coins do not deviate as much from the real sizes as Bruner and Goodman argued, but deviation does occur and the overestimation increases as a function of the value of the coin.[6]

The explanation that I endorse for the first finding appeals to the mechanism involved in magnitude perception. Magnitude perception refers to the perception of magnitude information included in stimuli, such as the size of the stimuli in Bruner and Goodman's study.[7] Other commonly studied magnitudes include, for example, duration, luminance, numerosity, and digits (number symbols). Importantly for the issues at hand, the perception of one magnitude has been shown to be influenced by the presence of another magnitude. For example, when two stimuli of equal duration are presented, the larger stimulus is perceived (or reported) to last longer than the smaller stimulus (Xuan, Zhang, He, & Chen, 2007). This reciprocal interference has also been shown to occur between size (both real and semantic), luminance, and the symbolic numbers (number words and digits from one to nine) as demonstrated by reaction times. For instance, with the written words "two" and "nine", it takes subjects longer to determine which of the two stimuli refers to a larger number when "nine" is written in smaller font than "two" (Cohen Kadosh, Henik, & Rubinsten, 2008). Likewise,

[6] Other studies for the first finding (Dukes & Bevan, 1952) or against it (Dorfman & Zajonc, 1963; Rosenthal, 1968) can be disputed on the grounds of possible memory effects because estimations were done in the absence of the stimuli. A study by Abraham Blum (1957) has been taken to concur with the first finding. This support can be disputed too, however, because the study used objects (but not coins) that varied considerably in their size, and it has been suggested that the size of the object influences the size of the overestimation (Carter & Schooler, 1949).

[7] Whether or not magnitude perception involves changes in perceptual experiences, see the last section.

subjects' performance on a task in which they judge the size of words referring to animals (e.g. ant, cat, elephant) is influenced by the known size of the animal, and vice versa (Rubinsten & Henik, 2002).

The degree of interference varies as a function of the distance between the stimuli within the interfering magnitude: The incongruity effect is small if, say, the numbers used for the luminance comparison are close to each other, and the effect is large if the numbers are further from each other. This has been interpreted to mean that the magnitudes "are processed in a refined way (i.e., placing the digits on a mental number line so that, say, "three" and "four" are closer to each other than "four" and "eight" are)" (Cohen Kadosh & Henik, 2006, p. 88). This concurs with results showing that when the perceived durations were compared, the larger the numerosity of a stimulus, the longer the stimulus was perceived and reproduced on a reproduction task to last. Thus, the stimuli with larger numerosity produce less accurate duration perception results (Hayashi et al., 2013). These robust results have been explained by proposing that there is an abstract and joint coding of different magnitudes. Because the different magnitudes are processed by a common mechanism, the processing of one is influenced by the processing of another.

The interaction between the perception of different magnitudes explains the finding that the size of the valuable coins is overestimated more than the size of the less valuable coins as follows: Since coins have different numerical values, they are processed as having numerical value largely in the same way as other stimuli that contain numbers. If this is the case, then the theory predicts that the values of the coins influence our perception of their sizes so that the more valuable the coin, the more its size is accentuated. Thus, rather than being a case of orectic penetration, this finding turns out to be a prime example of interaction in magnitude perception.[8] Indeed, one could say that the results showing that the perceived size of a stimulus can be influenced by the numerosity of the stimulus was one of the reasons why the common mechanism behind the perception of magnitudes was postulated in the first place (e.g., Piazza, Pinel, Le Bihan, & Dehaene, 2007; Walsh, 2003).

In short, the first finding (or more precisely a modified version of it, relative accentuation) appears to be true and it can be accounted for in two different ways. Hence the crucial question regarding it is which explanation is more plausible in general, that of orectic penetration or that of interaction in magnitude perception? Since this question concerns how to *interpret* the finding, not whether the results are correct or not, and both theories explain the first finding, the mentioned studies that replicated it cannot settle this issue. Accordingly, one must look further at the evidence for the general plausibility of either side.

It might be needless to mention, but the plausibility of the interaction in magnitude perception interpretation is hardly in doubt. First, as evidenced by the references above, the existence of magnitude perception mechanisms is based on robust findings and appears to be

[8] The described perceptual effect is due to the real value of the coins and not our desires or subjective values. After all, the magnitudes in question are not subjective in a sense that values and desires are—for example, everyone agrees that 8 is a larger number than 2, or that an elephant is larger than a sheep. Accordingly, the effect is unlikely to be compatible with orectic penetration. Moreover, unlike orectic penetration requires, it is under dispute to what extend the interaction in magnitude perception influences perceptual experiences rather than judgements and reports about the experiences.

well-established. Second, some of these findings concern exactly the kinds of situations faced by Bruner and Goodman's subjects. That is, the situations in which subjects make size comparisons based on stimuli that differ as regards their numerosity (Cohen Kadosh et al., 2005; Pinel, Piazza, Le Bihan, & Dehaene, 2004).

The plausibility of the orectic penetration interpretation is less clear however. To begin with, as mentioned above, Bruner and Goodman's study is a part of the New Look movement and Stokes implies that some of the other studies by the movement support Goodman and Bruner's results. Nonetheless, several results of the New Look movement studies and their interpretations of their results have faced serious criticism. This is because of problems replicating some of the results and because sometimes the results do not appear to be due to the factors that the New Look movement claimed them to be. Accordingly, the status of the claims made by the members of the New Look movement in general remains controversial. Since other examples will be discussed below, let me mention just one pertinent example at this point: In Bruner's next study, conducted together with Leo Postman (1948), the researchers used dollar signs and swastikas as symbolic values instead of coins. The neutral stimulus was a disc with diagonals, rather than a disc with uniform color. Again, the results supported the idea that subjective values and needs influence the perceived (or reported) size of stimuli. However, when the study was replicated, no such effect was found (Klein, Schlesinger, & Meister, 1951). Given the inconsistent results, Klein et al. suggested that the results should be attributed to the method used rather than the value of the stimuli.

Stokes is aware of the criticism against the results presented by the New Look movement, including Klein et al.'s criticism against Bruner and Postman's 1948 study. He responds to such criticism by maintaining that even if the values of stimuli do not influence the perceptual experiences in some studies, it does not mean that this could not happen in other studies. While this is correct in principle, his brief rebuttal of the criticism overlooks one crucial fact, however: the subjects of the studies he cites as supporting the orectic penetration interpretation misperceived the size of neutral stimuli too.

One of them is Bruner and Postman's 1948 study. All stimuli used in this study included a neutral, negative or positive symbol. The average distortion of the stimuli was 11.6 percent (calculated based on Table 1) and hence it is understandable that one might take the study to support the orectic penetration interpretation. This would be mistaken, however, because Bruner and Postman's analysis included the neutral stimuli too. When the distortion of the neutral stimuli is taken into account, the distortion of the affective value on size perception averaged only 2.8 percent. Whether this distortion (i.e., the overestimation of size of negative and positive stimuli versus neutral stimuli) is statistically significant was not analyzed. Accordingly, the support the Bruner and Postman's 1948 study lends for Stokes' claims is absent even if we ignore the problems with replicating the results.

The same applies to a more recent study on the matter (Van Ulzen, Semin, Oudejans, & Beek, 2008) that Stokes (2012, p. 490) takes to provide "good evidence" for the orectic penetration interpretation. In this study, which aimed to avoid the methodological shortcomings of the previous studies, subjects estimated the size of disc that was either blank or included positive, negative or neutral sign. The results showed that the estimated size of the disc with a sign differed from the estimate size of the blank disc. However, the estimated size

of discs with positive and neutral sign did not differ.[9] This lack of the influence of positive valence contradicts the interpretation of Bruner and Goodman's first finding in which the increased value of coins correlates with the increased positive valence and in which the latter correlates with the increased overestimation of the size of the coins. Van Ulzen et al. also reported that the largest distortion in size perception was caused by the fact that the discs were optically structured (had some sign) rather than being uniform in color. This finding could partly explain why the size of all coins was overestimated in Bruner and Goodman's (1947) study without assuming orectic penetration because coins are optically structured while the control task used uniform discs. Such an explanation would be only partial though, as it would not explain the relative accentuation.

Consequently, rather than providing support for the orectic penetration interpretation of Bruner and Goodman's 1947 results, as Stokes claims they do, the detailed results of these studies either challenge or do not provide convincing support for the idea that the first finding is due to orectic penetration. Thus, while the orectic interpretation can explain the first finding, it is based on an idea—that valence influences the perceived size of objects—which lacks support. The magnitude perception, on the other hand, is well supported by evidence that is independent of the first finding. Moreover, the discussed studies related to the New Look movement do not exclude the possibility that Bruner and Goodman's first finding is partly due to interaction in magnitude perception. On the one hand, because Bruner and Postman (1948) and van Ulzen et al. (2008) used stimuli that did not include (objective) values, these studies can neither support nor refute the magnitude perception interpretation. Since the relevant magnitudes were missing, this also means that the magnitude perception interpretation cannot account for these results. On the other hand, the results of these studies have no bearing on the relative accentuation. For example, although van Ulzen et al. (2008) reported that the largest distortion in size perception was caused by the optical structure of the stimuli—something that would also explain Bruner and Postman's (1948) later results—this does not yet account for the relative accentuation since all the coins are optically structured. Accordingly, the relative accentuation must be accounted for by some other means. One possible explanation is that based on the magnitude perception. In the light of these studies then, the interaction in magnitude perception is more likely to contribute towards the first finding than orectic penetration.

The second finding reported was that the children in the poor group overestimated the sizes of the coins to a greater degree than the children in the rich group. The problem with this finding is that efforts to replicate it have not been successful. Indeed, other studies have either found that the size perception of coins between the two groups does not differ as a function of the value of coins (Carter & Schooler, 1949; Dorfman & Zajonc, 1963) or that it is the rich group, not the poor group, that overestimates the size of the coins (Rosenthal, 1968). It is worth noting that although the latter study is directly in conflict with the results presented by Bruner and Goodman (1947), Carter and Schooler (1949) also conflicts when one looks at the details: they reported that, for the poor group, the error in size perception was larger when based on

[9] The negative valence influenced the reported size of stimuli but even in this case the influence is very small. Curiously, the study does not report the actual percentage of error and it cannot be determined from the information given in the article.

memory than when based on perception. This finding is the opposite of what Bruner and Goodman (1947) reported, and is important because the difference between the groups in Bruner and Goodman's study is largely based on the difference in the memory-based task. In more detail, the average difference between the overestimations of the two groups during the task in which the coins were in the subject's palm was 5.5 percent, whereas the average difference in the memory-based task was 19.7 percent. The 5.5 percent difference does not support the conclusion that the value of the coins influenced poor children's performance more than rich children's performance either because poor children overestimate the size of all objects (not only coins) more than rich children (Dorfman & Zajonc, 1963). These studies thus suggest that Bruner and Goodman's results are not reliable enough to support their second finding.

Unfortunately, Stokes has not addressed this problem although he is aware of at least the study by Carter and Schooler (1949). His earlier response to the criticism against the New Look movement does not help here either. To remind, Stokes claimed that even if the values of stimuli do not influence perceptual experiences in some studies, it does not mean that this could not happen in other studies. Such response does not address the criticism against the second finding because two out of the three mentioned studies reported results that conflicted with the second finding. Thus, this is not a simple matter of null-result or failure to replicate some findings—even though three failed attempts to replicate a study is also rather telling. Consequently, without further elaboration on his side, in light of these three studies and contrary to Stokes' response, one cannot justifiably hold that the second finding is correct.

Overall, the previous argumentation suggests that the Bruner and Goodman's 1947 study is not a convincing candidate for orectic penetration. Yet, since a critical examination of the literature has only put in doubt the results of the case Stokes focuses upon, one might think that the studies cited in relation to the first finding still provide some support for the idea that orectic penetration occurs. After all, Van Ulzen et al (2008) reported size distortion for negative stimulus versus neutral stimuli. Likewise, Bruner and Postman (1948) reported the 2.8 percent influence of affective value on size perception and one might find this supporting the orectic penetration interpretation even if it is not clear whether this influence is statistically significant. Granting for the sake of an argument that all these results are statistically significant, this support is hardly convincing though, because the reported effects are small and can easily be explained with both the attention interpretation and the judgment interpretation.

To remind, Stokes rejected the attention interpretation since there is no reason why attention would have differed between the poor group and the rich group. While reasonable as regards the second finding, this response does not apply to many of the New Look movement studies because they concern the used stimuli and not subject groups. Moreover, as regards Bruner and Postman's 1948 study for example, it is plausible to assume that the amount of attention would differ between the neutral stimulus (diagonals) and the stimuli with valence (dollar signs or swastikas). Accordingly, it might very well be that the less than three percentage points difference between the neutral stimulus and the stimulus with valence is due to attentional effects. Of course, this interpretation assumes that attention generally has an effect on spatial tasks, which is indeed the case (Yeshurun & Carrasco, 1998, 1999).

The judgment interpretation proposes that subjects' perceptual experiences are accurate and that their reported judgments are inaccurate. Stokes (2012, p. 489) claimed that it was

implausible because the children "were able to make well-considered adjustments, comparing the two visual stimuli at the same time in the same visual field." If the discrepancies between our experiences and judgments about them are considerable (the average overestimation was 22.8 percent in Bruner and Goodman's 1947 study), then indeed it would be implausible to assume that we do not notice the discrepancies, especially when we have all the time we need to complete the task. However, even in those cases in which valence could be thought to influence the reported size of stimuli, the judged size distortion has been very small. E.g., it was less than three percentage points in Bruner and Postman's 1948 study, whereas in Van Ulzen et al's (2008) study the size distortion of neutral and positive discs was not significant and the distortion caused by negative stimulus versus neutral stimuli was small. Given that the discrepancy between the experiences and judgments about the experiences is that small in these studies, which Stokes takes to support the orectic penetration interpretation, explaining the error in size perception by means of the judgment interpretation is hardly implausible. In fact, it concurs with Nisbett and Wilson's (1977) famous study in which subjects touched stockings that, unbeknownst to them, were identical. Despite this, the subjects described the tactile feeling of the stockings differently, and firmly believed their own reports.

4. Concluding remarks

To summarize, Bruner and Goodman (1947) reported that (i) the size of valuable coins is overestimated more than the size of less valuable ones, and (ii) the children in the poor group overestimated the sizes of the coins more than the children in the rich group. These two findings suggest that subjective value (or generally, a desire-like state) influences the size of objects as experienced, and thus Stokes (2012) argues that the finding illustrates how desire-like states can penetrate our perceptual experiences. His claim for the existence of orectic penetration is particularly noteworthy because other similar claims have been rejected due to the existence of alternative explanations.

Against Stokes' claim, it was argued here that the (new version of the) first finding, while real, can also be explained by appealing to the interaction in magnitude perception. It was further argued that the second finding is erroneous because of problems replicating it and the conflicting results provided by these replication attempts.

Given the problems with the second finding, the plausibility of Stokes' claim depends on the question of whether the orectic penetration interpretation is a more plausible explanation of the first finding than the interpretation based on the interaction in magnitude perception. Since both interpretations can account for the first finding, addressing this issue required considering the plausibility of the magnitude perception occurring in general, as well as assessing those studies similar to Bruner and Goodman's (1947) study that have been taken to support the orectic penetration interpretation. It was first concluded that the interaction in magnitude perception has plausibility independent of the first finding—it is a well-established phenomenon—and that it is known to occur in the kinds of situations the subjects faced. Hence, this interpretation of the first finding is well supported. Then again, the studies in which valence possibly influenced the estimated size of stimuli report much smaller effects than the first finding. Moreover, even if the effects reported were true, they were so small that the attention interpretation and the judgment interpretation are both plausible explanations for them.

Accordingly, it was concluded that neither Bruner and Goodman's study nor these other studies by the New Look movement provide sound reasons to believe that desire-like states can penetrate our perceptual experiences. If Stokes is right in stating that alternative interpretations can account for the other candidates of orectic penetration, we can further conclude that there is no convincing case in which desire-like states penetrate perceptual experiences.

Let me end with a comment on the question whether or not the interaction in magnitude perception is a form of cognitive penetration—a question one might reasonably wonder in the light of the previous discussion. After all, many examples of the magnitude perception appeared to involve cognition, and arguably this is also the case with the explanation for the relative accentuation (the first finding)—it is only through some cognitive mechanisms that we learn that 5 is a larger number than 1, and thus that a five cent coin is more valuable than a one cent coin. (At least it is not something that can be perceived "directly" based on the shape of Arabic numerals.) Thus, although not all interaction in magnitude perception necessitates the involvement of cognition (e.g., when the size of stimuli influences the reported luminance of the stimuli), it might be argued that one cannot explain the relative accentuation without the involvement of cognition.[10]

As discussed and defined in the introduction, however, cognitive penetration requires that (i) magnitude perception involves cognition and that (ii) the related cognitive states cause a change in the phenomenal character of perceptual experiences.[11] While the first requirement is presumably met based on the previous considerations, whether or not magnitude perception meets the second requirement is more debatable. Moreover, merely establishing the possibility that magnitude perception changes the phenomenal character of perceptual experiences is not enough, given that for many philosophers the burden of proof is on those who maintain that cognitive penetration occurs (as discussed in the introduction).[12] Instead, such a possibility should at least be as likely and plausible as the alternative, according to which magnitude perception influences only the reports concerning perceptual experiences. This latter alternative would make the magnitude perception interpretation a special case of the judgment

[10] Moreover, one could also argue that the magnitude perception experiments almost always involve comparisons, just like Bruner and Goodman's (1947) study also did, and that such tasks are cognitive by nature.

[11] If magnitude perception is a form of cognitive penetration, it would differ from the previous candidates for the cognitive penetration in two respects. First, whereas other candidates refer to general mechanisms, such as recognition capacities and declarative (explicit) memory, the magnitude perception concerns a specialized system within those mechanisms; some interaction in magnitude perception requires that one has formed beliefs about and recognizes symbols for, say, numbers. Yet, the interaction only concerns magnitudes and no other features of the stimuli (e.g., shape and color of number symbols). Second, whereas the link between cognitive state and the influence that it bears on perceptual experiences is considered to be direct—Macpherson, for instance, argued that our belief about the characteristic color of apples influences our color perception of an apple—this would not be the case with magnitude perception. Instead, here our belief or knowledge about X would often influence our experience of something else (Y). For example, our belief that 5 is larger than 1 would make Arabic numerals appear to be of different luminance and physical size.

[12] One should not place too much importance on the fact that the phenomenon in question is called magnitude *perception*. Scientists write about judged magnitudes and almost never mention the term 'experience' in the cited articles. Then again, one should not take this as an argument against the possibility of cognitive penetration either, because the used terms could merely be a consequence of the fact that scientists have only reports (based on judgments) at their disposal.

interpretation.

Settling between these two alternatives—whether magnitude perception influences perceptual experiences or merely judgments of perceptual experiences—is difficult because it is (nearly) impossible to know what a person experiences without the person reporting it. Since reporting on one's experiences requires one to make a judgment of one's experiences, the report does not distinguish between the two alternatives. Therefore, the issue needs to be approached indirectly.

One way to do so is exemplified by Stokes' argument against the judgment interpretation of Bruner and Goodman's (1947) results. It is important to remember that Stokes did this not by referring to the judgments of experiences themselves, but by referring to the implausibility of a considerable discrepancy existing between perceptual experiences (which were assumed to be veridical) and judgments about the experiences. Thus the plausibility of this argument depends on the amount of discrepancy between the judged size of objects and the real size of objects rather than merely on the judgments themselves.

The same line of reasoning could be used to argue that magnitude perception is a form of cognitive penetration. However, this argument would suffer from the same objection as Stokes' argument: As regards the cases that were relevant for his argument, the discrepancy between the judged and real size of objects was concluded to be small and the judgment interpretation remained a plausible alternative. Given that that the influence of magnitude perception is confined to a few percentage points (see e.g., Cohen Kadosh & Henik, 2006; Hayashi et al., 2013; Pinel et al., 2004), the effect, while true, is so small that the influence does not provide justified reason to regard magnitude perception as a form of cognitive penetration rather than a special case of error in judgment.

The second line of reasoning makes use of brain-imaging results, in particular the results that show how the interaction of magnitude perception occurs in two different cortical areas, the inferior frontal gyrus and the intraparietal cortex (e.g., Cohen Kadosh et al., 2005; Hayashi et al., 2013; Piazza et al., 2007; Walsh, 2003). A noteworthy fact as regards these areas is that neither of them is located in the ventral pathway of the visual cortex, i.e., in the parts of the visual cortex where the activation correlates with the phenomenal character of experiences (see Kravitz, Saleem, Baker, Ungerleider, & Mishkin, 2013 for a recent review). Instead, the inferior frontal gyrus is located in the frontal lobe and known to be involved only in non-visual tasks such as categorical decisions (e.g., Cromer, Roy, & Miller, 2010). The intraparietal cortex, in turn, is located in latter part of the dorsal pathway. While the functions of this pathway include processing information for visually guided action (e.g., grasping and manipulating hand movements) among other functions such as spatial comparisons and guiding spatial attention, the activation in the intraparietal cortex is not considered to correlate with the phenomenology of perceptual experiences. Hence, the brain-imaging results suggest, if anything, that the mechanisms of magnitude perception are not related to perceptual *experiences* per se.

To conclude, at least some forms of interaction in magnitude perception involve cognitive processes. This does not however mean that magnitude perception should be considered as a special case of cognitive penetration. One must further make a convincing case for the claim that the interaction in magnitude perception changes perceptual experiences. Two ways in which this could be done were considered and neither of them supported the claim. It

is important to note, however, that this argumentation does not disprove the possibility that magnitude perception is a form of cognitive penetration. First, since the argument related to discrepancy between the real and judged magnitude of objects only demonstrates that the results can be interpreted without assuming cognitive penetration, it did not show that the results could not be due to cognitive penetration. Second, although the brain-imaging results show that the interaction in magnitude perception is due to (comparison) processes taking place in cortical areas not linked to perceptual experiences, the results do not conclusively exclude the possibility that the results of such comparisons would not subsequently influence processes that correlate with perceptual experiences. Accordingly, there remains the possibility that magnitude perception is a form of cognitive penetration.

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