Perceptual learning explains two candidates for cognitive penetration

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Abstract

The cognitive penetrability of perceptual experiences has been a long-standing topic of disagreement among philosophers and psychologists. Although the notion of cognitive penetrability itself has also been under dispute, the debate has mainly focused on the cases in which cognitive states allegedly penetrate perceptual experiences. This paper concerns the plausibility of two prominent cases. The first one originates from Susanna Siegel's claim that perceptual experiences can represent natural kind properties. If this is true, then the concepts we possess change the way things appear to us. The second candidate for cognitive penetration is Fiona Macpherson's claim that, in addition to concepts, our beliefs can penetrate perceptual experiences. It is argued that neither candidate is a case of cognitive penetration. In doing so, I provide an explanation to both that is based on perceptual learning, a non-cognitive phenomenon where relatively slow and long-lasting modifications to an organism's perceptual system bring about changes in perception. This explanation is theoretically more plausible and remains closer to the empirical data than the explanations based on cognitive penetration.

Keywords

Cognitive penetrability, perceptual learning, Susanna Siegel, Fiona Macpherson

1. Introduction

Roughly stated, the disagreement over cognitive penetration concerns the question whether our perceptual experiences can somehow be affected by our beliefs and hopes. Moreover, this effect should be direct in a sense that it is not mediated by separate acts. For example, our perceptual experiences will change if we walk to the kitchen because of our belief that we will find coffee there. Nevertheless, such changes are not attributed to cognitive penetration since the way in which our belief have an effect on perceptual experiences is mediated by the act of walking. The two issues of the debate concerning cognitive penetration are, rather unsurprisingly, how to define cognitive penetrability and whether the candidates for the case of cognitive penetration are successful.

Assuming that cognitive penetration takes place, the most crucial disagreement concerning the definition of cognitive penetrability relates to the purported relationship between perceptual experiences and cognitive states. Two alternatives have been put forward. According to the causal notion, the relationship between the two is a causal one—if cognitive penetration occurs, then our cognitive state causes a change in the phenomenal character of perceptual experiences. This notion is endorsed, for example, by Dustin Stokes (forthcoming) and Susanna Siegel (2005; 2012). Fiona Macpherson (2011), on the other hand, defines cognitive penetration through the idea of an intelligible link between cognitive states and perceptual experiences, meaning that the cognitive state and perceptual experience have more or less the same content. In this respect, her explanatory notion of cognitive penetrability is similar to Zenon Pylyshyn's semantic notion of cognitive penetration (1999), where such semantic coherence between the cognitive states and penetrated states is emphasized over the causal connection.[i]

Regardless of the correct definition of cognitive penetration, the consequences of cognitive penetration are considered significant. The first example of such consequence concerns the epistemic normativity of perception and belief formation. Our perceptual experiences are commonly considered independent from the beliefs for which the experiences provide epistemic justification. However, if our experiences are partly subject to our beliefs, belief formation becomes circular and the role that experiences have in justifying our beliefs becomes open to objection (Siegel 2012).

Another prominent consequence relates to the highly debated topic of mental architecture (e.g. Fodor 1984; Churchland 1988). One could say that, according to the received view in the philosophical debates, mind is largely modular and perceptual processes are functionally independent systems that are informationally encapsulated from higher-level systems such as cognition and language (see for example Raftopoulos, 2001; Stokes & Bergeron, manuscript). However, if cognitive penetration takes place, perceptual systems are not informationally encapsulated from cognitive information, and since the latter is one of the characteristics of a modular system, this view requires amendment. Accordingly, the way mental mechanisms are explained would change considerably.

The modularity thesis of mind and the cognitive penetrability of perceptual experiences relate to the possible theory-ladenness of observations too. The latter refers to the idea that observations and empirical data in science are affected by the prior theoretical conceptions. Thomas Kuhn (1996, 111ff) suggested that the effects can occur both on experiential level and on semantic level. The first possibility amounts to cognitive penetrability. Hence one who maintains that perceptual experiences are cognitively penetrable holds that observations are theory-laden too. Conversely, the issue whether observations are theory-laden in semantic level or not is neutral as regards the cognitive impenetrability of perceptual experiences.

The possible consequences of cognitive penetration highlight the importance of the question whether the suggested cases of cognitive penetration are sound: if cognitive penetration does not occur, the considerations referred above are merely speculative. It is worth noting that the question whether the cognitive penetration occurs or not can be approached without settling the aforementioned difference in the definitions of cognitive penetration. This is because, once unsuccessful candidates for cognitive penetration have been considered, different definitions of cognitive penetrability have been similarly amended and clarified. That is, the unsuccessful candidates have had a largely similar effect on different definitions of cognitive penetration. The purpose of the amended definitions proposed by various authors in the past is to provide criteria for the situation where non-cognitive influences to the experiences have been excluded. Thus, if two perceptual experiences differ in these situations where the causes specified in the amendments are absent, the differences would be due to cognitive penetration (assuming that no other, yet to be presented, plausible interpretation for the differences exist).

Philosophers debating on cognitive penetrability have agreed that the successful candidate for cognitive penetration must meet three criteria. *First*, it must be unequivocal that cognitive states penetrate perceptual experiences, not merely some prior or later processing states—that is, our perceptual experiences must be somehow different because of our cognitive states. In particular, it has been argued that situations in which one’s judgments about the experiences change but the experiences remain the same do not establish cognitive penetration (e.g. Macpherson 2011, Stokes 2012). *Second*, for cognitive penetration, the difference in two persons' experiences must not be due to attentional effects. In other words, even though the act of attending to something changes our perceptual experiences and attention is closely related to (if not part of) cognition, this is not considered a case of cognitive penetration. In a sense, attention is considered to be similar to separate acts (e.g. turning our head or gaze towards something) that mediate the effects of our cognitive states on our perceptual experiences. This criterion has been used to challenge the candidates of cognitive penetration that make use of ambiguous images (such as Paul Churchland's use of duck-rabbit in 1988; for objections, see Macpherson 2011, Stokes 2012). *Finally*, although it is already entailed by the first criterion, it is often made explicit that the difference in two persons' experiences should not be due to the stimuli they perceive or due to the state or difference of their sensory organs. Thus Pylyshyn (1999, 343), for example, maintains that the differences in perceptual experiences that are caused by the differences among sense organs "do not count as cognitive penetration because they do not alter the contents of perceptions in a way that is logically connected to the contents of beliefs, expectations, values, and so on."

The challenge therefore is to present a convincing case that meets these criteria and subsequently is immune to the plausible alternative interpretations. Three such cases have been put forward. What separates these three from the other suggestions is that their resistance to the alternative interpretations has been explicitly argued for.[ii] Stimulatingly, all three also describe different kinds of phenomena in which cognitive penetration might be involved. To begin with, it could be that the cognitive penetration is brought about by the concepts we possess. By far the most solid argument to this end has been provided by Siegel (2005). Her claim that recognitional concepts penetrate perceptual experiences relates to the issue of theory-ladenness of observations in experiential level. Second, it is also not uncommon to read that our beliefs penetrate our perceptual experiences, yet only Macpherson (2011) has defended and developed this claim in detail. Briefly, she maintains that our beliefs of the typical color of objects influence the perceived color of objects. Finally, Stokes (2012) has argued that there are cases where our perceptual experiences are penetrated by our values and desires. For example, a more valuable coin appears relatively larger than a less valuable coin.

Although these three are the most promising candidates for the case of cognitive penetration, it will be argued that the first two are not successful. This is for the reason that the most plausible explanation of these candidates concerns perceptual learning, not cognitive penetration (the third one, which requires different explanation, is discussed in a separate article, see Author submitted). Perceptual learning as a sensory mechanism that does not imply cognitive penetration has been examined in the philosophical context by Athannassios Raftopoulos (2001). Despite his argumentation, the relevance of the phenomenon for the issues of cognitive penetration, and the fact that the much cited paper by Pylyshyn (1999) also comments on the topic, perceptual learning has been ignored by other philosophers. The following extends Raftopoulos' discussion by presenting a more explicated view of the phenomenon (section 2) and how it relates to Siegel and Macpherson's arguments for the cognitive penetrability of perceptual experiences (sections 3 and 4).

2. Perceptual learning as a non-cognitive mechanism

Perceptual learning refers to *relatively* slow and long-lasting modifications to an organism's perceptual system involving functional and structural changes in sensory systems. Visual perceptual learning, for example, changes how certain visual stimuli are processed in the early visual areas. This change is possibly guided by top-down influence from higher visual areas. These effects take typically a few hours and hundreds of trials to occur (although they can also result from few encounters), and they are "persistent and can last for many months or years" (Roelfsema, van Ooyen, and Watanabe 2010, 64). The effects result from repeated exposure to particular stimuli and comprise three different types of mechanisms. These are imprinting, differentiation, and unitization. Robert Goldstone (1998, 585) summarizes them as follows:

> By imprinting, receptors are developed that are specialized for stimuli or parts of stimuli. By differentiation, stimuli that were once indistinguishable become psychologically separated. By unitization, tasks that originally required detection of several parts are accomplished by detecting a single constructed unit representing a complex configuration.

These mechanisms have an effect on perception as otherwise the learning would not be perceptual but, for example, declarative or procedural learning. Perceptual learning hence concerns the altered perceptual experience. Since such experience was the first criterion that any candidate that is to be considered as a case of cognitive penetration must fulfil, perceptual learning is in the position of possibly accounting for these candidates.[iii] Consequently, the crucial questions are whether perceptual learning should be understood as belonging to the domain of cognition or not and whether it can indeed account for some of the candidates. The first question will be discussed below while the latter question will be explored in the following sections.

Let me begin by noting that a conclusive answer to the question whether perceptual learning is cognitive or not cannot be given already for the reason that there is no established definition of cognition. For example, in a call for papers for a special issue of the journal *Behavioral Sciences* on “What is Cognition?” in 2012, Charles Abramson mentions that he identified fifteen different definitions of cognition in psychology textbooks.[iv] Accordingly, rather than trying to argue that perceptual learning is not cognitive under any definition of the term, my aim is to show why perceptual learning should not be considered as a part of cognition in the context of philosophical debates over cognitive penetration.

Philosophers have not provided any clear definition of cognition and cognitive states either. Instead, the debate has been guided by examples and references to states that are potential cognitive penetrators. For Siegel (2012, 201) these include “moods, beliefs, hypotheses, knowledge, desires, and traits”. She also counts affective states as a part of cognition. For Stokes (forthcoming) cognitive states are states like what we “know, believe, intend, and so on”. Stokes, on the other hand, does not appear to regard all affective states as a part of cognition, but only that some affective states have cognitive “aspects”. Corresponding with Siegel and Stokes’s views, Macpherson (2011, 4) regards cognitive states as “states such as thoughts, beliefs, desires, and other propositional attitudes”. Moreover, in a footnote she introduces two additional types of cognitive states both of which are related to concepts we possess.[v] In short, the philosophers’ conception of cognition and cognitive states emphasizes (what can be considered) traditional cognitive states, states of which we can be conscious, rather than, say, any kind of information processing. This is also exemplified by the fact that the suggested candidates for cases of cognitive penetration are states that are explicitly stored and can be recalled when needed (e.g. beliefs that apples are red, knowing what a word in a foreign language means, and possessing recognition concepts). Moreover, if any information processing, including that which takes place for example in sensory receptors, would count as cognitive, the issue of cognitive penetrability of perceptual experiences would be trivial.

The above does not mean that we need to be conscious of a state in order for it to be considered cognitive or that unconscious states could not be the states responsible for cognitive penetration. Quite the contrary, one regularly encounters the claim that we have unconscious beliefs and wishes, and I take these states to count as potential cognitive penetrators too. What separates them from processes taking place in sensory receptors is that the former are similar to the states that we are conscious of and they are states that we can be conscious of in principle. According to the notion of cognition that will be presumed in this paper, these similarities make some unconscious states cognitive under the philosophers' notion of cognition too.

Given that cognitive states are states that we can be conscious of in principle, learning can be seen as a part of cognition when it leads to such states or, in a less restricted view, when it at least is guided by cognitive states. Neither of these alternatives applies to perceptual learning. To begin with, as Manfred Fahle (2002, x) puts it, perceptual learning is

> not of the declarative type of learning, since it does not consist of consciously memorized facts or events. Quite to the contrary, most observers will be unable to formulate what exactly they do differently *after* compared to *before* the learning process. So perceptual learning is a form of implicit learning…

Consequently, "[p]erceptual learning leads to implicit memory" (Fahle 2002, ix) where the presentation of a stimulus of which the subject has no explicit memory affects how a similar stimulus is processed in the future. Arguably, this means that the functional modifications in the early sensory systems are not (easily) accessible by usual cognitive processes such as short-term memory and problem-solving (the outcomes of perceptual processes that perceptual learning influences are of course). In accordance with this conclusion, Raftopoulos (2001, 444) writes that perceptual learning, which he also calls slow learning because the process often takes some time, "is independent of recognition and semantic memory".

Secondly, although perceptual learning often takes some time and requires repeated exposure to objects, once perceptual learning has occurred, it imposes its effects on perception very fast. Familiar objects, for example, influence figure/ground segmentation and have bearing on object classification already within 100ms after stimuli is shown (e.g. Kirchner & Thorpe 2006; Liu, Agam, Madsen & Kreiman 2009). Significantly, these effects that perceptual learning accounts for are real and happen too fast for semantic information to intervene. Thus the effects of perceptual learning are independent of the (on-line) top-down modulation of cognitive states such as beliefs and semantic knowledge, rather, the effects happen so fast that they are thought to occur in the feedforward sweep (i.e., cortical processing that proceeds from early visual areas to higher visual areas and to cortical areas that process semantic information). In addition of being supported by the timing studies concerning perception, this conclusion is also in accordance with the results showing that the involved brain areas include early visual areas (up to V4), and probably posterior inferior temporal lobe and lateral occipital complex too (Grill-Spector & Kushnir 1998; Kirchner & Thorpe 2006).[vi]

Finally, there is no evidence that the process of perceptually learning something is affected by anything other than perceptual processes. As Raftopoulos (2001, 444) expresses it, perceptual learning does not imply cognitive penetrability because perceptual learning "takes place under specific retinal input and task-dependent conditions. These factors do not involve cognitive influences, and therefore, do not imply the cognitive penetrability of perception." This conclusion is also in agreement with the view of Goldstone, Braithwaite and Byrge (forthcoming), according to which perceptual learning results in "task-relevant representations created directly by perceptual processes" (i.e., by non-cognitive factors) and the changes in the early sensory areas are "due to environmental inputs" rather than penetration by cognitive states.

It is worth noting that the previous does not mean that the process of perceptual learning could not be guided by top-down processes however. This is because, following Victor Lamme (e.g. 2006), one must separate two types of recurrent processing (i.e., cortical processing that proceeds to the opposite direction than the feedforward sweep, namely from the higher processing areas towards the early visual cortex): the localized recurrent processing, which takes place within a sensory modality, and the widespread recurrent processing, which involves for example also frontoparietal areas. While the latter probably would imply cognitive influence on perceptual learning, the top-down influence in visual perceptual learning has been suggested to have its origin within visual areas (Ahissar & Hochstein 2004) and hence be due to localized recurrent processes. That is, although the effects themselves take place in feedforward sweep, the learning process is likely to be guided partly by localized recurrent processes. Thus, if the effects of perceptual learning result from top-down processes, and these top-down processes originate from visual areas, this guidance is not cognitive in the sense philosophers use the term.

Related to previous discussion, it is worth noting that the distinction between perception and cognition has come under pressure recently—which is unsurprising already for the reason that the notion of cognition remains unclear—and that it has been argued that one should talk about the bottom-up effects versus top-down effects instead. Accordingly, Nicholas Shea (2014) has suggested that the cognitive penetration debate should be reconceived under this latter distinction. This suggestion overlooks, however, the fact that some of the top-down effects originate from the perceptual areas while some originate from the higher processing areas. Since the processing in the first case takes place within a sensory modality, and is thus perceptual, the distinction between bottom-up effects and top-down effects do not track the same distinction as the distinction between perception and cognition is supposed to do.

To summarize, perceptual learning refers to relatively slow and long-lasting modifications to an organism's perceptual system that bring about changes in perception. Even though it is a form of learning, it is not part of cognition in the sense philosophers (or most psychologists) use the term. To begin with, perceptual learning does not lead to states that philosophers consider to be cognitive—the modifications of early sensory states that perceptual learning brings about are not something of which we are and can be conscious. Second, the phenomena that perceptual learning explains (e.g. how the familiarity of objects influence object recognition) occur so fast that they cannot be explained by on-line intervention and guidance of cognitive states. Finally, such cognitive states do not play a role in guiding perceptual learning either. Instead, perceptual learning follows from repeated exposure to suitable input and task-dependent conditions, neither of which involves cognitive influences. Note that it does not follow from this that we could not have both implicit and explicit memory about something (such as that hearts are red), or that we could not learn perceptually and cognitively that two things occur together. It does mean, however, that if perceptual learning is not part of cognition and it can account for a candidate for cognitive penetration, then cognitive penetration is not established.[vii]

3. Perceptual learning and concepts as cognitive penetrators

Siegel's Thesis K states that, in addition to the properties that our perceptual experiences are typically considered to represent, they can represent natural kind properties (K-properties) and other similar higher-level properties too. For example, visual experiences represent "low-level" properties such as color, form, and motion, but they can also represent properties such as being a pine tree. Siegel's argumentation for the truth of Thesis K makes it relevant for the topic at hand since she claims that perceptual experiences representing K-properties are brought about by our cognitive states.

In more detail, Siegel maintains that learning a new recognitional concept results in a phenomenological difference between the experiences we had before we learnt the recognitional concept (E_1) and the experiences we have after we have learnt it (E_2). Moreover, Siegel argues that this phenomenological difference can be explained only if E_1 and E_2 differ with respect to represented K-properties (only E_2 represents them).[viii] Siegel's argument for Thesis K therefore rests on three claims:

(i) Perceptual experiences E_1 and E_2 differ.
(ii) The difference between E_1 and E_2 is caused by the concepts we possess.
(iii) The difference between E_1 and E_2 amounts to the represented K-properties.

Given that cognitive penetration involves some change in perceptual experiences, the first claim establishes the possibility that cognitive penetration might occur in E_2. The second claim in turn states that cognitive penetration indeed takes place. Finally, (iii) is the claim that concerns the Thesis K.

Each of these three claims can be reasonably challenged, however. To begin with, one can argue against (i) that there is no difference between E_1 and E_2. Siegel's defense for this claim (and her Thesis K in general) rests on intuitions arising from two cases, in both of which "the cognitive system seem[s] to bring about phenomenal changes" because we come to possess and slowly master new recognitional concepts. The first example concerns the experiences of a person who is learning to read Cyrillic text. Siegel argues that the reader focuses on each letter at the beginning. Once reading becomes more efficient, the reader grasps the shape of the words effortlessly and it takes special effort to attend to letters separately. As a result, how the page with Cyrillic text looks to the reader changes. The second example is about learning to recognize things too, but in this case one learns to distinguish pine trees from other trees. Again, it may be initially difficult for one to distinguish pine trees but after a while the task becomes easier:

> Some weeks pass, and your disposition to distinguish the pine trees from the others improves. Eventually, you can spot the pine trees immediately: they become visually salient to you. Like the recognitional disposition you gain, the salience of the trees emerges gradually. Gaining this recognition disposition is reflected in a

> phenomenological difference between the visual experiences had before and after the recognitional disposition was fully developed. (Siegel 2005, 491)

Siegel readily admits that neither of these cases proves that (i) is true. Quite the contrary, they are supposed to generate an intuition that (i) could be true—something that one must accept as the foundation for the argument for Thesis K. Macpherson (2011), for one, does not appear to share Siegel's intuition and suggests that the difference is only in the judgments we make about our experiences. If Macpherson's suggestion is correct, this would not be a case of cognitive penetration since it would violate the first of the three criteria of cognitive penetration.

Let us grant, however, for the sake of argument that the claim (i) is true and turn to consider a more interesting claim (ii). Assuming that there is a phenomenological difference between E_1 and E_2, this difference must be accounted for somehow. Cognitive penetration, the fact that we learn the concept "pine tree" and how to read Cyrillic letters, would do the task.

Nonetheless, perceptual learning provides a more plausible explanation, or at least an empirically more justified explanation, for Siegel's examples. This is because what Siegel is describing in her examples is the process of becoming an expert in recognizing something (e.g. pine trees and words) and such learning is a prime example of perceptual learning. For instance, the expertise of radiologists to detect abnormalities in X-ray pictures is linked to their perceptual learning (Snowden, Davies & Roling 2000)[ix] and gaining such expertise is considered one of the most central aspects of perceptual learning (e.g. Goldstone 1998). The idea that Siegel is describing phenomena related to perceptual learning is also supported by the fact that the effects she describes occur slowly and hence in a fashion similar to that in which perceptual learning often occurs.

In more detail, Siegel's examples illustrate two different mechanisms of perceptual learning. The first mechanism is unitization, where parts of the stimuli that used to be detected separately are integrated into a single detectable functional unit. One source of evidence for such mechanism comes from word perception studies, where researchers have suggested that skilled readers detect words as single units (Goldstone 1998) or as a series of familiar letter-cluster units (McClelland & Johnston 1977). Given that such a phenomenon is exactly what Siegel describes in her example involving Cyrillic text, her example is a first-rate illustration of the perceptual learning mechanism.

The second mechanism is differentiation. Owing to this mechanism, perceptual sensitivity to critical differences between categories becomes enhanced and stimuli that are initially difficult to distinguish (like the needles of pines and spruces) "become increasingly differentiated from each other" (Goldstone 1998, 596). Given that percepts related to separate categories become more distinguishable by the means of differentiation, it is not surprising that differentiation has been used to explain the ability of bird (and dog) experts to separate subspecies from each other. Presumably differentiation also explains Siegel's example involving an increased ability to distinguish pine tree from other trees.

The above discussion therefore provides empirically well-established reasons to maintain that perceptual learning mechanisms are involved in gaining expertise in the type of perceptual tasks that Siegel described. Since perceptual learning involves changes in our perception, the previous discussion also provides support for Siegel's claim (i), which postulates phenomenological difference between E_1 and E_2.[x] Presumably this also leads to the improved recognitional abilities, as our experiences are changed in a way that makes it easier to distinguish different stimuli (words, trees) in the later post-perceptual processing stages. Given how very likely it is that perceptual learning takes place in Siegel's examples, and that perceptual learning accounts for the changes in our perceptual experiences, there is no reason to maintain that concept we possess penetrate our perceptual experiences—the concepts would not play any role in explaining the phenomenological difference between E_1 and E_2. While this does not mean that cognitive penetration could not occur in the described cases, it means that Siegel's argumentation does not provide any reason to think that it does.

Siegel's argumentation proceeds in steps (claims i-iii) and hence the previous conclusion has the consequence that also the claim concerning the Thesis K (claim iii) is unfounded. It is nevertheless worth considering Siegel's argument for the Thesis K separately too because the mere truth of cognitive penetrability (claim ii) would not make the thesis true. Thus, Siegel provided additional justification for the Thesis K and this justification, in turn, might lend separate support for the claim (ii). In another words, contrary to Siegel's original line of argumentation, one might try to justify the claim (ii) by the means of establishing the plausibility of the claim (iii).

Siegel's argument for Thesis K does not provide support for this plan however. To see this, let us grant again that there is a phenomenological difference between E_1 and E_2. One explanation for this difference is that Thesis K is true—the difference amounts to the represented K-properties. The only alternative explanation that Siegel considers is the one where the experiences differ as regards gestalt-type of properties represented. For example, experiences E_1 and E_2 of a pine tree might be otherwise the same but only the latter would represent something like pine-tree-shape-gestalt property. Even though Siegel (2005, 499) admits that she does not have "a knock-down argument against it", such an objection would be unsuccessful, however, because it is not "generally available".

Siegel's response might well be a correct one. Nevertheless, this does not establish the truth of Thesis K because Siegel overlooks the most obvious source of phenomenological difference in E_1 and E_2: low-level properties that are typically thought to be represented in experiences. Instead of addressing this possible source of difference, Siegel's claim relies on an implicit assumption that these low-level properties remain the same between E_1 and E_2. She then proceeds by arguing that because there are no pine-tree-shape-gestalt properties, what separates E_1 and E_2 must be the represented K-properties. Nonetheless, in the light of the previous discussion concerning perceptual learning, it is only to be expected that E_1 and E_2 differ as regards low-level properties represented in them. For example, if the needles of pines and spruces become differentiated from each other, then one would expect that their size, shape or contours be accentuated differently in E_1 and E_2.

Furthermore, even Siegel's own examples do not warrant the assumption her argument is based on. When she writes about Cyrillic letters, for instance, she mentions paying attention to words instead of letters. As discussed before, attention changes the phenomenology, say, by making certain features more salient, improving the spatial perception, and enhancing borders and other low-level properties. Hence paying attention to words instead of letters de facto changes perceptual experiences—there is a phenomenological difference between E_1 and E_2—but this does not mean that the represented properties would differ in kind.[xi] Likewise, Siegel maintains that pine trees become visually more salient to one who learns the recognitional concept "pine". Similarly to the example involving Cyrillic text, this could simply be a consequence of enhancing the category-specific properties. That is, if Siegel is correct, the phenomenological difference between E_1 and E_2 would be due to attention (although this does not exclude the possibility that perceptual learning affects too). Since it is well-established fact that attention changes how low level properties appear, the claim (iii) is unwarranted.

The problem with Siegel's claim (iii), according to which the phenomenological difference between E_1 and E_2 is with respect to represented K-properties, is therefore the following. Siegel contends that there is a phenomenological difference between perceptual experiences E_1 and E_2 by relying on the intuitions raised by two examples. Both of her examples, however, only suggest the difference in saliency (e.g., the borders of letters could be emphasized so that they stand out more in E_2 than in E_1). As argued above, this in turn only entails the difference in the low-level, simple properties represented in the visual experiences. Accordingly, even if one grants that E_1 and E_2 differ (and they might even differ due to concepts we possess if the above objection against the claim (ii) would be unsuccessful), Siegel has not provided any argument why the natural kind of the represented properties in experiences does not remain the same. Without an argument to that end, there is no reason to hold that Thesis K is true.

From the previous it follows that Siegel's argument does not provide new reasons to hold that the claim (ii) would be true either. This conclusion is also supported by the fact that concepts affect the phenomenology only through attention in the described cases. Since Siegel (2012) agrees that attention is not a source of cognitive penetration, the (assumed) phenomenological difference between E_1 and E_2 does not establish that cognitive penetration would take place.

Siegel's argumentation for the role of concepts in perceptual experiences is thus not particularly persuasive. However, the concepts we possess are central in the debate concerning the cognitive penetration of perceptual experiences. Hence even if Siegel's suggestion could not establish cognitive penetrability, it is important to say a word about a case that Macpherson (2011, footnote 3) briefly mentions: the situation where the color terms of a language have been found to influence the performance in color discrimination tasks (Winawer et al. 2007). For example, whereas color blue can be qualified with "light" and "dark" in English, there are altogether separate words for light blue and dark blue colors in Russian. This difference is reflected in perceptual tasks: while native Russian speakers discriminate light blue colors from dark blue colors faster than two colors from the same category (e.g. when both stimuli belong to the light blue category), the performance of English speakers remains the same across both conditions. This means that the learnt color terms "can affect performance of basic perceptual color discrimination tasks" (Winawer et al. 2007, 7783). Furthermore, the authors conclude that their results do not support an interpretation based on perceptual learning. Accordingly, Winawer et al. (2007, 7784) conclude that two explanatory options remain open. In effect these are that the cognitive penetration interpretation (linguistic system directly influences the perceptual system) or the judgment interpretation (results are due to processes that take place after perceptual system and are responsible for our judgments). In other words, based on the study that Macpherson cites, cognitive penetration is a plausible explanation of the discussed phenomenon. However, although these results from Winaver and colleagues did not settle the issue between these two options, another study with similar methodology by the same authors suggests that the effects are due to processes that take place after perceptual systems. As they conclude, the results of this other study are not consistent with the conclusion that “different language groups actually perceive colors differently” but instead, “it seems more likely that [the effect of language on performance] happens at a decision stage rather late in the processing stream [i.e., post-perceptual stage responsible for our judgments]” (Witthoft et al. 2003, 1252).

4. Perceptual learning and beliefs as cognitive penetrators

4.1. Candidate for the case of cognitive penetration

Macpherson puts forward a candidate for cognitive penetration in which the subject’s past experience influences the perceived color of an object. She cites John L. Delk and Samuel Fillenbaum in whose study (in 1965) subjects were shown figures cut from red-orange cardboard on a colorful background. The figures were placed behind waxed paper “to reduce visual acuity and to obtain a better blend of figure and ground” (Delk & Fillenbaum 1965, 291). One figure at a time, the subjects’ task was to change the background color until they could no longer distinguish the figure from the background. The results showed that the background needed to be redder for the figures that are stereotypically red—for these Delk and Fillenbaum used cutouts in the shapes of an apple, a love-heart, and lips—than for other figures. This was interpreted to mean that the “red-associated” figures appeared redder than other figures despite the fact that all the figures were cut from the same cardboard. In other words, our past experiences of apples, love-hearts, and lips make them look redder than their surface properties would afford.

Macpherson explains this phenomenon, which is sometimes referred to as “the memory color effect”, in terms of the subjects’ beliefs:

> one might think that what is happening is that the subjects’ beliefs, that certain of the cutout shapes were shapes of objects that were characteristically red, penetrated their perceptual experience of those cutout shapes thereby altering the content and phenomenal character of those experiences. (Macpherson 2011, 16)

Obviously, should this be the correct explanation, it would make the phenomenon a case of cognitive penetrability. This is especially so because the alternative ways to interpret possible candidates for cognitive penetration do not apply here. For example, this is unlikely to be a case where spatial attention influences color perception. Likewise, while classifying the stimulus as an apple, a love-heart or lips is necessary for the phenomenon to occur, it is not merely a case where we see the stimulus as an apple, a love-heart or lips. Rather, the effect is that our past experiences influence the perceived color.

In more detail, Macpherson suggests that the effect is due to a two-step mechanism. In the first step, cognitive state (belief) either brings about a non-perceptual state with phenomenal character (presumably, a state of mental imagery) or alters the existing phenomenal non-perceptual state. In the second step, this phenomenal non-perceptual state interacts with the phenomenal character of perceptual experiences. For instance, once the stimulus has been classified as an apple, this causes a non-perceptual state with phenomenal character (red, probably). Then the phenomenal character of this non-perceptual state affects our perception of the stimulus by making it look redder than it would appear if the stimulus had not been classified as an apple and if we did not believe apples to be red.

4.2. Problems with Macpherson's account

Macpherson's explanation can be questioned on several grounds. Let me briefly begin by noting that the two-step mechanism she describes lacks anecdotal evidence from the color imagery studies. When we are imagining an apple, a zucchini, or any other object, these experiences are largely dependent on our conceptions of the characteristic color of these objects. In fact, standard tests for color imagery are based on such conceptions. This means that if our color imagery is normal, then our cognitive system related to colors (including color memory, beliefs, and color naming) is functioning normally as well. Interestingly, our ability for color imagery is subserved by mechanisms that are independent of color perception; one can have celebral achromatopsia (loss of color vision due to cortical lesion) with preserved color imagery and vice versa (e.g. Shuren, Brott, Schefft & Houston 1996). The preserved color imagery means that the patients with celebral achromatopsia can satisfy all the requirements for the first step in Macpherson's explanation to occur: patients' shape perception, color imagery and color memory (i.e. beliefs about the characteristic colors of an object) are intact. Moreover, as the intact color imagery illustrates, these subjects can still have phenomenological color experiences. Thus should Macpherson's account of the mechanisms be true, one would suppose that in those cases of celebral achromatopsia where the color imagery is preserved, the beliefs would still exercise their influence on the first step and the related mechanism would bring about a non-perceptual state with phenomenal character when patients see, say, an apple. Nevertheless, instead of describing the world as gray with some color phenomenology related to familiar objects, these patients describe the world as being simply gray.

Even if Macpherson's suggestion to explain the particular mechanisms behind the memory color effect does not match with the reports of patients with celebral achromatopsia, it does not follow that her main claim would be incorrect. A more significant objection to her account arises however from the results of those psychologists who have studied the memory color effect, both before and after Delk and Fillenbaum.

The results of the studies conducted before Delk and Fillenbaum were inconclusive—it could not be said whether the subject's past experience of the objects influences their color experience or not. This suggests that there were some crucial differences in the studies. However, the used objects were the same in most studies (e.g. apple, love-heart), the participants in all experiments had a long time to look at the pictures (thus they arguably recognized the figures), and the instructions for the subjects did not influence the results. Accordingly, Delk and Fillenbaum suggest that the previous studies were otherwise flawed. In particular, they maintain that perhaps the results of Fisher, Hull, and Holtz (1956) were inconclusive too because of the technique used to mount the figures had the result that "the figures used by Fisher may not have been identical in color" (Delk & Fillenbaum 1965, 290).

Although such criticism may be valid for some studies, it is peculiar as regards Fisher et al.'s study since they mention explicitly how all the figures were cut from the same paper (as they were in Delk and Fillenbaum's study too) and that the problems concerning uneven illumination relating to mounting (that had hindered previous studies) had been resolved. If the same paper were used for the cutouts and they were illuminated evenly, it is unclear why the stimuli would not have been identical in color. Given that Delk and Fillenbaum did not provide any justification for their claim, there is no basis for maintaining that the uneven color explains the differences in the results. In fact, the only demonstrable difference in the setup between these studies concerns the size of the stimuli. It is most probable, however, that the belief that apples are red remains the same regardless of the size of the cutout. That is, the only demonstrable difference between the setups does not influence the beliefs and yet the same results are not obtained with all cutouts of apples (or love-hearts, for that matter). Consequently, it cannot be the beliefs about the characteristic color of an apple that explain the results in these different studies. Therefore, Macpherson's belief-based account is incorrect. This conclusion is consistent with Fisher and colleagues' (1956, 559) results, as their subjects' color matching performance "did not predict their beliefs (if any) regarding the relative redness of the stimuli, and vice versa".

It is worth emphasizing that the previous conclusion also concurs with the original study by Delk and Fillenbaum, as they do not discuss beliefs influencing the perceived color, but how "*past association* of color and form does in some way influence perceived color" (1965, 293, my italics). Given that not all associations are explicit and cognitive, Delk and Fillenbaum's interpretation of their own results does not make this necessarily a case where beliefs or any other higher-order mental processes influence the perceived color.[xii]

Macpherson might defend her view by arguing, and rightfully so, that the experiments conducted in the 1950s and 1960s were not controlled properly and hence they did not provide reliable evidence for whether the color memory effect is real or not. Thus one should look into the more recent studies conducted by Karl Gegenfurtner's research group (Hansen, Olkkonen, Walter & Gegenfurtner 2006; Olkkonen, Hansen & Gegenfurtner 2008; Witzel, Valkova, Hansen & Gegenfurtner 2011). Although the experimental design differs in the old and new studies, the researchers consider their work to be a continuation of the previous studies.[xiii] These studies demonstrate convincingly that past experiences can have an effect on our later color experiences and that this holds for various different kinds of stimuli: two-dimensional pictures (e.g. a Smurf, the Milka confectionery logo, a traffic sign for a walk-and-cycle path), fruits and vegetables, three-dimensional pictures (e.g. pictures of a yellow mailbox, a ping-pong table, a brown chair and a Nivea moisturizer tin).

The details of the results provide a more interesting picture of the phenomenon. For instance, the effect was strongest for objects whose typical colors are close to the yellow-blue color axis (yellow, blue, violet) and "extremely low" for typically red or orange objects. Accordingly, the effect was close to zero for a fire extinguisher, whereas for the love-heart the effect was in the opposite direction to what one would assume based on the memory of the color of a love-heart. Likewise, for the logo of Coca-Cola the effect was small and not in the direction of the color the subject remembered the logo to have, but towards yellow.

In order to be a plausible explanation of the color memory effect, Macpherson's view must be able to explain these details. Without further elaboration on her part, it is however difficult to see how an account based on our beliefs would succeed on this. For example, a fire extinguisher and a German mailbox are both man-made three-dimensional objects, and in most cases they have their typical colors. Thus prima facie the only difference between our beliefs about their colors is that the former is mostly red and the latter is mostly yellow. Nevertheless, the memory color effect only occurs for the perception of a mailbox. One can also ask why the direction of the effect varies depending on the object in question. Again, there appears to be little difference between our beliefs about the color of a walk-and-cycle sign and a love-heart, both of which are two-dimensional objects. Furthermore, the memory color effect holds for both of them. Nevertheless, while the effect for the former is in the direction one would assume (it makes the sign appear more blue), the effect for the latter is not (it makes the figure appear less red). Given that our beliefs do not explain the details of the memory color effect without further arguments on Macpherson's side, her account of the phenomenon is clearly inadequate.

Finally, one can also challenge Macpherson's account on the basis of the neurophysiology related to color perception. To begin with, as James Tanaka, Daniel Weiskopf and Pepper Williams conclude in their review paper on color and high-level vision, "the neural areas activated by the retrieval of object color knowledge are separable from those areas activated by color perception" (2001, 213). Moreover, although the images used in Gegenfurtner et al's study were of unnatural color (slightly saturated images, which subjects tried to adjust to appear grey) and although such images activate different brain areas than the images of naturally colored object (Zeki & Marini 1999), the unnaturally colored images do not activate the areas related to the memory or "retrieval of object color" either (Tanaka, Weiskopf & Williams 2001, 214). In other words, the color appearance of an object is independent of our knowledge of the typical color of the object. Hence, Macpherson's account of the memory color effect based on cognitive penetration is incorrect.

4.3. Perceptual learning and the color of familiar objects

Instead of holding the memory color effect to be a case of cognitive penetration, Gegenfurtner and colleagues regard it as one of the mechanisms of color constancy (Hansen et al. 2006; Olkkonen, Hansen & Gegenfurtner 2008; Witzel et al. 2011). Color constancy refers to the fact that the color appearances of objects remain largely the same despite considerable differences in their viewing conditions. The most significant difference concerns lighting conditions, but even large differences in the lighting conditions do not usually change the color appearances much—our blue jeans, for example, appear blue whether we are indoors or outdoors. One particularly significant variation in the lighting concerns daylight. While the morning light is warm, the proportion of shortwave length light (bluish light) increases considerably during the day, only to decrease again before sunset. This means that obtaining color constancy for blue and yellow things (because yellow is processed in the same opponent-processes as blue) is a more difficult challenge for our color perception than obtaining color constancy for red and green things.

Several different mechanisms make color constancy possible and Gegenfurtner and colleagues maintain that the memory color effect is one of them. Moreover, they claim that the memory color effect is tuned to the daylight axis because obtaining color constancy is particularly challenging for colors that are along this axis. This means that the memory color effect would be particularly strong for yellow and blue, and much weaker or non-existent for orthogonal colors such as red and green. Clearly, this claim matches the results. Rather than merely providing an explanation for the known results, their hypothesis has also received independent support from their other experiments. For example, replacing uniformly colored discs with objects had the biggest impact on color constancy when the colors were along the daylight axis.

It is interesting to note that the previous concurs with the above-mentioned claim that the memory color effect appears to disappear with acquired cerebral achromatopsia: If memory color effect is a consequence of color constancy processing, the effect follows from the processing related to color perception. Therefore, the effect should disappear together with color perception (but not with explicit color memory), just like it does. Thus the objection based on cerebral achromatopsia that was raised against Macpherson’s specific proposal of the mechanism of cognitive penetration can be addressed.

If the memory color effect does indeed relate to color constancy, it can be understood as one of the manifestations of perceptual learning. After all, assuming that the effect results from color constancy mechanisms, the effect is perceptual in nature. It involves learning too because if we had never been presented with bananas and Nivea tins, our color perception could not learn to “correct” our perception of them. Moreover, this learning is modulated by environmental stimuli and task-demands, as all perceptual learning does. Finally, the fact that both perceptual learning and color constancy processing are considered to take place in visual areas (especially V4; see Zeki & Marini 1999), rather than taking place in separate cortical areas, concurs with the idea that memory color effect is one manifestation of perceptual learning. Given these considerations, it is unsurprising that when Goldstone (1998) discusses the separation of perceptual learning and higher-level, cognitive learning, he gives the memory color effect as one of the examples of perceptual processes.

The previous interpretation of the memory color effect necessitates that early visual processing can categorize visual stimuli finely enough to separate, say, broccoli from cauliflower, and to exert its influence without cognition. Even though Macpherson is willing to admit that this could happen in the cases of love-hearts and lips, she dismisses this explanation for the phenomenon in general because she does not think it can happen as regards the perception of an apple. “[W]hile the visual system can respond to shape, it surely can’t classify an object as an apple, as it is not sensitive to the features that are required to do so. It is surely only the cognitive system that is capable of doing such classificatory work.” (Macpherson 2011, 24-25)

Macpherson makes two related claims in this passage, but she does not provide any empirical justification for them. In fact the claims appear to be based on her consideration of the situation (and consideration of the perception of apples in general, not the stimuli used in the experiment) rather than on a scientifically sound position. For example, the claim that apples cannot be distinguished from other fruits by their overall shape alone does not receive support from the Delk and Fillenbaum study that Macpherson cites. This is for the reason that the only information their subjects were likely to have was the overall shape because the figures were otherwise similar. E.g. all the figures were two-dimensional, had the same color and were presented behind waxed paper at the expense of visual acuity. The second claim, according to which only cognitive system “is capable of doing such classificatory work”, is likewise doubtful in the light of the previous discussion concerning both perceptual learning (§2) and its relationship on expertise (§3).[xiv] There are, furthermore, other empirical reasons, independent of the issue of perceptual learning, to challenge Macpherson’s claim.

One such reasoning is based on Galit Naor-Raz, Michael Tarr and Daniel Kersten’s (2003) study in which the question whether color is an intrinsic property of the visual representation of objects was investigated by means of various Stroop-like experiments. The results showed that this is indeed the case: the color-shape association of everyday objects (e.g. banana and pumpkin) is an inherent part of the object representation at the visual perception. This means that the shape of an everyday object is associated with a specific color in a sense that whenever the shape is processed, the associated color becomes processed too regardless of whether it facilitates or interferes with the processing of the color of a stimulus. For example, whenever we perceive a raw (i.e. green) banana, the color associated with the shape of bananas (yellow) becomes activated even if this interferes with the processing. Moreover, since the pictures shown to subjects did not prime words, the authors took their results to show that the visual representations of objects are separable from the semantic representations of objects.

The Naor-Raz, Tarr, and Kersten's finding that color and shape of an everyday object are associated already at the perceptual level, and that such association is independent of color-shape associations occurring at other levels of representation (e.g., in our semantic knowledge), is significant for two reasons. First, contrary to Macpherson's claim, the results show that our visual perception is able to distinguish the shape of everyday objects without cognitive processes. Second, the results are in accordance with the perceptual learning interpretation of the memory color effect because this classificatory work results in color-shape association at the stage of visual perception. Accordingly, in the light of this study, the results of Delk and Fillenbaum would not be due to our beliefs or other states deserving to be called cognitive but to mechanisms restricted to visual processing.

5. Consequences of perceptual learning

To summarize, the main claims that have been made are the following. First, even if the stimuli, sensory organs and spatial attention of two subjects are fixed, a possible difference in their phenomenal experiences might be due to perceptual learning and not due to cognitive penetration. Second, the candidates for the cases of cognitive penetration that Siegel provided appear to be prime examples of perceptual learning. Hence, they do not provide reasons to think that cognitive penetration occurs. Third, even though our past experiences can influence our color perception, most probably this does not amount to cognitive penetration either. While Macpherson's belief-based explanation provides an inadequate account of the details of the phenomenon and is contradicted by neurophysiology of color perception, the alternative explanation based on perceptual learning is theoretically sound, appeals to an empirically well-established phenomenon, and can explain all the details. Accordingly, this alternative explanation is more likely to be true than Macpherson's explanation.

Presuming that the previous argumentation is sound, we are led to the conclusion that, in the light of these examples, there is no need to reject the idea that mind is modular and to change our view on the role of experiences in justifying beliefs. Moreover, there is no reason to think that K-properties are represented in our experiences.

Let me end, however, with a reflection on the epistemic normativity of perceptual beliefs, assuming that the discussed examples were cases of cognitive penetration. (The other two consequences will be overlooked because, under this assumption, the threat to the modularity of mind would be demonstrably true, whereas Thesis K, as elaborated above, would still require additional arguments from Siegel's side in order to be a plausible consequence of cognitive penetration.) What I want to propose is that although the described consequences for epistemology are true in principle, in the light of the discussed examples they are less significant in practice.

Let us first focus on beliefs as cognitive penetrators. If beliefs can have an effect on perceptual experiences, then there would be circularity in how beliefs are formed. Subsequently, the received view of the experiences providing independent justification for beliefs is contested. Yet, in the light of Macpherson's example and the fact that it constituted the most convincing case of where beliefs influence perceptual experiences, this worry is less extensive than it first appears to be.

First, even if Macpherson is correct (i.e., if cognitive penetration takes place on the memory color effect), the worry about the role of experiences in justifying our beliefs would be warranted only as regards the particular situation where we perceive a color of an object and we have a prior belief about the typical color of the object. It does not follow from Macpherson's argumentation that color perception of other objects would be affected or that our perceptual experiences related to other properties (e.g. form, motion, and texture) would be cognitively penetrable. In fact, given how complex phenomenon color perception is and that it can be lost independently of, say, visual motion perception, it is not unreasonable to think that our perceptual experiences of other visual qualities—not to mention other sensory modalities altogether—are cognitively impenetrable.

Second, it is plausible to assume that our beliefs about the typical color of objects are more often correct than not (at least in our usual surroundings). Hence, when we perceive objects that have some typical color, the perceived objects indeed have that color. Accordingly, often our beliefs would not change our color perception of objects with typical color. When they do change it, these are likely to be the cases with difficult viewing conditions (e.g. challenging lighting) and beliefs would push the color perception towards the correct one. Our beliefs would only make our perception erroneous when the object we perceive is of a different color than its typical color, and arguably we perceive objects with atypical color more rarely than objects with typical color. That is, even if our beliefs were to penetrate our perceptual experiences, in the larger scale this could improve the veridicality of our perception. Hence we end up in a peculiar situation. While Macpherson's example necessitates a reconsideration of the epistemic role of perceptual experiences on cases involving color perception, it also provides us with reasons to maintain that our experiences are veridical. In fact, they are more veridical than the experiences we would have without beliefs about the typical color of objects.

A similar argument applies also to Siegel-inspired cases where the recognitional concepts we possess (supposedly) influence our perceptual experiences. In order for the recognitional concepts to affect our perceptual experiences in a way that would put the epistemic role of experiences in doubt, the kind of gradual learning that Siegel describes must take place. Then again, we are in a position to learn to distinguish two stimuli from each other, say pine trees from spruces, only if we are in the situation where there is some difference in the first place—if there were no difference between two stimuli, our recognitional concepts would not develop. In other words, if Siegel is correct and recognitional concepts make pine trees visually salient, such effect is a consequence of enhancing some real difference between pine trees and other trees.[xv]

As before, the previous argumentation does not mean that the epistemic role of perceptual experiences would not be compromised. In practice, however, the situation is less worrisome than one might expect: the real differences in the world are emphasized and our ability to distinguish pines from other trees is improved.

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[i] Pylyshyn does not appear to discard the causal notion altogether however. Rather, although he explicates mainly the notion of semantic coherence, he can also be understood to as maintaining that, if cognitive penetration takes place, such coherence is a consequence of cognitive states causally influencing the penetrates states (e.g. Pylyshyn 1999, 343, 405).

[ii] Indeed, it appears as if most of the time cognitive penetration is simply assumed and philosophers are more interested in addressing the consequences of cognitive penetration than providing convincing argument that it actually takes place. This is peculiar, however, since even if cognitive penetration does occur in some form, the details of these cases determine what their consequences are (see §5).

[iii] The processing in the early visual areas does not determine the perceptual experiences, but it is plausible to assume that the altered processing in the early visual areas affects the latter processing states too, which in turn would change perceptual experiences in some respect.

[iv] For what it's worth, it appears that perceptual learning is not considered to be part of cognitive processes in the psychology textbooks on cognition (e.g. Matlin 2008; Reisberg 2012). Likewise, although "declarative learning" was regarded as a cognitive term in a recent study (Whissell, Abramson & Barber 2013) analyzing the prevalence of cognitive terms in psychology journals, "learning" per se and "perceptual learning" were not. This concurs with the fact that even though Pylyshyn accepted that perceptual learning occurs, he did not regard it as cognitive penetration of early visual areas either. Then again, on the broadest definition, *any information processing* appears to qualify as cognition. Thus, for instance, snails' brains in vitro that are observed to learn to distinguish odors are said to possess micro-cognition

(Watanabe, Kirino & Gelperin 2008). In short, perceptual learning appears to be a part of cognition at least under some of the definitions (even if it is not explicitly discussed in them) and not under others.

[v] The first type is the possession of concept: the concepts we possess determine in part our cognitive states and hence the concepts we possess belong to cognition too. The second example Macpherson (2011, 4) gives is that of "the cognitive system being primed so that certain concepts are likely to be triggered or activated".

[vi] The object information is most likely to be stored as configurations and fragments of properties of objects, not as holistic figures and shapes (Grill-Spector & Kushnir 1998; Ullman, Vidal-Naquet & Sali 2002).

[vii] Contrary to this conclusion, Ariel Sebastianos Cecchi (2014) has argued that cognitive penetration occurs because of perceptual learning. The disagreement between our conclusions is only apparent though, because our conception of cognitive penetration differs. In more detail, Cecchi argues that perceptual learning influences the allocation of attention that in turn affects the early stages of the visual processing. Thus he maintains that the differences between perceptual experiences before and after perceptual learning are due to attentional mechanisms. However, as mentioned in the introduction, philosophers (including Macpherson whose candidate for a case of cognitive penetration is under scrutiny in this paper) usually do not think that the differences caused by attentional mechanism constitute a case of cognitive penetration. Hence, in the current framework, Cecchi does not establish that perceptual learning leads to cognitive penetration either.

[viii] The argument assumes that experiences have contents and that the difference in content is reflected in phenomenological difference. Since these assumptions are not central for the point that Siegel tries to make—and are often assumed in the debate related to cognitive penetrability (e.g. Macpherson 2012)—they are not discussed here.

[ix] This does not exclude the likely possibility that expertise also improves one's skills to verbalize the contents of experiences and make correct judgments based on them.

[x] For example, by enhancing the difference of the percepts of physically similar stimuli, differentiation enhances the salience of distinguishing dimensions too. It is worth noting that the described effects and mechanisms are compatible with possible additional attentional effects, and Goldstone (1998) in fact argues that attentional weighting aids to sensitize perceptual processes related to the category-relevant dimensions (especially those that are at the category boundary).

[xi] Moreover, the idea that that the increased saliency results from the concepts we possess somehow yet not through attentional effects (even though Siegel writes about attention) does not help Siegel. After all, this would still not demonstrate Thesis K, because the difference between E_1 and E_2 could be in the represented low-level properties.

[xii] For this reason, it is odd that Macpherson (2011, 23, my emphasis) writes *inaccurately* that "Delk and Fillenbaum explicitly say that they tried to ensure that the only relevant difference between the cases where the subjects were presented with cutout shapes of characteristically red objects and non-characteristically red objects was the *subject's beliefs*".

[xiii] The main modifications in the more recent studies include the following: (i) the intersubjective differences in color perception are taken into account, (ii) the experiment is conducted on a computer screen, (iii) the task of the subject is to adjust the color of a stimulus to match with the gray background, (iv) the perception of figures is not reduced by placing them behind waxed paper, and (v) more stimuli and more varied stimuli are used.

[xiv] In addition to considering the possibility of low-level recognition of the apple, Macpherson also elaborated on similar phenomena as regards the color of faces of members of different races. However, empirical evidence does not concur with Macpherson's consideration here either because it has been shown that race categorization can occur very

early in visual processing.

[xv] See Lyons (2011) for a similar claim according to which cognitive penetration can increase the reliability of perception.