Cognitive Penetration and the Nature of Experience

Abstract

The influence of perception on cognition is a rather uncontroversial issue in philosophy and psychology. We often come to form beliefs, or other cognitive states, on the basis of our experiences. For example, one’s perceptual experience of a red traffic light can bring about the belief that one must bring the car into a full stop. The influence of cognition on perception, on the other hand, is a far more controversial issue. MacPherson (2012) defends the view that perception is cognitively penetrable and proposes an indirect mechanism that purports to explain how cognitive penetration may occur. This paper accepts the first part of MacPherson’s argument – which involves a counterexample to the cognitive impenetrability thesis – but aims to show that the indirect mechanism she proposes is based on the flawed assumption that perception is passive (Spruit 2008). Two cases of blind subjects who regained their sight late in life are used to illustrate that perception arises from interactions between sensory inputs and prior knowledge. This view of perception provides a natural explanation for cognitive penetration, one that does not involve such an indirect mechanism.

1. Introduction

The influence of perception on cognition is a rather uncontroversial issue in philosophy and psychology. We often come to form beliefs, or other cognitive states, on the basis of our experiences. For example, one’s perceptual experience of a red traffic light can bring about the belief that one must bring the car into a full stop. The influence of cognition on perception, on the other hand, is a far more controversial issue. MacPherson (2012) defends the view that perception is cognitively penetrable and proposes an indirect mechanism that purports to explain how cognitive penetration may occur. This paper accepts the first part of MacPherson’s argument – which involves a counterexample to the cognitive impenetrability thesis – but aims to show that the indirect mechanism she proposes is based on the flawed assumption that perception is passive (Spruit 2008). Two cases of blind subjects who regained their sight late in life are used to illustrate that perception arises from interactions between sensory inputs and prior knowledge. This view of perception provides a natural explanation for cognitive penetration, one that does not involve such an indirect mechanism.

2. A counterexample to cognitive impenetrability thesis

In philosophy and psychology, perceptual experience is often thought as being cognitively impenetrable (27). MacPherson (2012) offers a counterexample to the cognitive impenetrability thesis (CIT), which states that differences in cognitive states cannot bring about differences in perceptual experiences. More specifically,

“perceptual experience is cognitively impenetrable if it is not possible for two subjects (or one subject at different times) to have two different
experiences on account of a difference in their cognitive systems which makes this difference intelligible when certain facts about the case are held fixed, namely, the nature of the proximal stimulus on the sensory organ, the state of the sensory organ, and the location of attentional focus of the subject.” (MacPherson 2012: 29)

Advocates of the CIT often cite the Müller-Lyer illusion to motivate their claim. When the arrows at the end of the line are turned inwards, the line appears shorter. When they are turned outwards, the line appears longer. The illusion

persists even when one’s cognitive state changes, that is, when one comes to believe that the lines have the same length.

Drawing a vertical line at the edges of the horizontal lines and changing their colour changes the visual experience – the lines now appear to have the same length. In this case, however, it is not one’s cognitive states that account for differences in one’s visual experience but rather changes in the proximal stimulus as well as changes of the location of attentional focus of the subject. The subject’s attentional focus is now on the red horizontal lines and their relation to the dotted vertical line. It follows that the Müller-Lyer illusion is not a case of cognitive penetrability, or so the argument goes.

MacPherson (2012) provides a counterexample to the CIT, which involves an experiment conducted by Delk and Fillenbaum (1965). Cutouts were constructed using the same reddish-orange paper. Some of these cutouts represented objects that are characteristically red such as a love-heart shape, a pair of lips, an apple, etc. Others represented objects that are not characteristically red such as geometrical shapes, a mushroom, etc. Each of the cutouts was placed in front of the subjects one at the time. Their task was to ask the experimenter to adjust the colour of the background the cutout was on in order to match it to the colour of the cutout. The study revealed that subjects systematically matched the cutouts that had characteristically red colours (e.g., a pair of lips) with a background colour that was more red than the background colour they matched the cutouts that did not have characteristically red colours (e.g., a circle).
MacPherson (2012) argues that this is a counterexample to the CIT. According to the CIT, cognitive states cannot affect perceptual experiences. It follows that the subjects’ cognitive states about the cutouts – that is, their beliefs about having or not having characteristically red colours – cannot affect their perceptual experiences. This study is, therefore, a counterexample to the CIT. For it shows that the subjects’ perceptual experiences were indeed affected by their cognitive states. The phenomenal character of the experiences subjects had when viewing the cutouts that were characteristically red were, in fact, different from the phenomenal character of the experiences these subjects had when viewing the cutouts that were not characteristically red.

MacPherson argues that cognitive penetrability is the best explanation for the subjects’ experiences. Since the differences between the colour experiences of the cutouts that were characteristically red and those that were not cannot be attributed to changes in the nature of the proximal stimulus, the state of the sensory organ, or the location of attentional focus of the subject, they must be attributed to differences in their cognitive states. It follows that the CIT is false. I agree with MacPherson. This case, along with many others as it shall be shown, is a counterexample to the CIT. In what follows, I take issue with the mechanism she proposes to explain the phenomenon of cognitive penetrability.

3. An indirect mechanism: explaining cognitive penetrability

MacPherson proposes an indirect mechanism that purports to explain cases of cognitive penetrability such as the colour case discussed above. It involves two steps. The first step involves “our cognitive states causing some non-perceptual state with phenomenal character to come into existence or to alter the phenomenal character of some existing non-perceptual state that has phenomenal character” (50). Imagination, dreams, and hallucinations are cited as examples of non-perceptual states whose content or phenomenal character is “often generated, affected by, and dependent on our beliefs and desires” or other cognitive states (51). The second step involves “the phenomenal character of these non-perceptual states interacting with and affecting the phenomenal character and content of perceptual experiences” (51). Cognitive penetration can occur, on this view, but only indirectly.

Let us apply this view to the colour case above. Recall that subjects were shown reddish-orange cutouts of objects that had characteristically red colours. When asked to adjust the colour of the background the cutout was on in order to match it with the colour of the cutout, subjects matched the cutouts that had characteristically red colours with a background colour that was more red than the background colour they matched the cutouts that did not have characteristically red colours. One might attempt to dismiss the study, but not without “attributing a gross form of misjudgment to the subject” (MacPherson 2012: 41). For, as MacPherson aptly notes, dismissing the results would not only require attributing to subjects “a mere miscategorisation of which colour a shade is” but also “a large and brute error of judgment despite their experience. [Yet we] have no explanation of why the subjects make such an error – or why they make such errors in the systematic way the experiment shows they do” (MacPherson 2012: 41). Moreover, given that “there is no independent evidence that the subjects’ experiences of the cutout and the background it is on are
different” (MacPherson 2012: 41), one cannot claim that the subjects did not experience the cutout as having the same colour as the background it is on. A more plausible explanation, according to MacPherson, involves the two-step mechanism she proposes: “the subjects [first] imagine the cutout shape being red and [then] the phenomenal character of this imaginative state interacts with the phenomenal states of their visual experience” (51). Subjects are only aware of one phenomenal character because “the contribution of the imagination and the contribution of the vision combine” to produce one phenomenal state (51).

One might object that this process cannot occur without subjects being aware of the imagining state whose phenomenal character affects the phenomenal character and content of their perceptual experience. However, I agree with MacPherson that this objection is empirically unmotivated. We are, after all, unaware of most of the mechanical processes occurring in our brains. Eye movement is one example of lack of such awareness. Even though vision involves “a stream of time-varying images” attributed to constant eye movement, the scene in front of us appears constant and uniform (Frisby and Stone 2010: 12). The appearance of high resolution all around us is another such example. “We are diluted into thinking we are seeing all around us clearly” even though “high resolution is limited to a small region of central vision, the fovea. The visual field is constructed from brief snapshots at each pause of the eye’s continual movements” even though we experience an uniform scene (Gregory 2009: 67).

MacPherson defends her proposal by bringing “forward evidence, independent of the phenomenon of cognitive penetration, that shows that each step can occur” (2012: 49). However, the fact that these processes can occur independently is insufficient to show that they are causally related in the way proposed. I agree that imagination frequently involves being in a state with a phenomenal character which is often generated, affected by, and dependent on cognitive states. But why think that the experience’s phenomenal character and content of experience can only be affected by a subject’s cognitive states indirectly? Why does the process have to be indirect in the way proposed? MacPherson provides the following reason for thinking that cognitive penetration involves the indirect process she proposes:

If the imagination would have produced a state with the phenomenal character of an experience had when imagining a red object if no contribution from the visual state had been present, and if the visual system would have produced a state with the phenomenal character of a visual experience had when veridically seeing an orange object if no contribution from the imaginative state had been present, then the resulting phenomenal character of the combination of vision and imagination would plausibly be the phenomenal character of an experience had when veridically seeing a reddish-orange object. This would explain why the subjects matched a more red colour to cutouts of an orange shape with a characteristically red colour compared to those that weren’t characteristically red. (2012: 52)

The argument is that the phenomenal character of the experience of the cutout that is characteristically red must be affected by an imaginative state (or, more
generally, a non-perceptual state). For if it were not, its phenomenal character would be identical to the phenomenal character an experience would have when veridically seeing a reddish-orange object.

This explanation is based on the assumption that perception involves the passive reception of information supplied by our senses. Spuit (2008: 204) shows that this view is associated with ancient and atomistic theories of perception. In psychology, this view of perception is often described as involving a "bottom-down" mechanism (whereas imagination and other such non-perceptual states are described as involving a "top-down" mechanism) (Palmer 1999, Spuit 2008). The view of perception as a passive reception of information gives rise to the idea that perceptual experience represents objects or properties as they are when the experience is veridical, but fails to represent objects or properties as they are when the experience is illusory.¹ In what follows, I shall argue that this passive view of perception is false and that perception arises through an interaction between sensory input and prior knowledge. This view of perception provides a natural explanation to phenomena involving cognitive penetration, one that does not require the indirect mechanism proposed by MacPherson.

4. An active model of perception: learning from the blind

Philosophers tend to assume that perception is passive (in the way described above), rather than active.² Vision is often likened to a camera.³ The ease with which the visual system informs us about the world around us is the reason that it “is tempting to suppose that the scene we are looking at is immediately given” by a photographic type of representation. But the truth is exactly the opposite. Arriving at a scene description as good as that provided by the visual system is an immensely complicated process requiring a great deal of interpretation of the often limited information” (Frisby and Stone 2010: 12).

Frith and Dolan (1997: 1221) argue that for “perception to occur incoming sensations must be imbued with meaning based on past experience and prior knowledge.” The visual system is not passively receiving the information from external objects. It actively imbues meaning to them on the basis of prior knowledge. Frith and Dolan attempt to explain where in the brain these interactions between sensory input and prior knowledge take place and argue that they require at least two brain areas: “the ‘site’ where analysis of afferent signals occurs and the ‘source’ which applies the relevant prior knowledge”

¹ This relates to the “innocuous” assumption MacPherson makes, namely that there can be no changes to the phenomenal character of experience without changes to its content, and vice versa (2012: 27).
² I am not suggesting that MacPherson accepts this assumption since her aim is to convince those would be far less interested in a direct mechanism.
³ Traditional digital video cameras “snap 24 frames a second to capture the varying intensities of light that make up the different parts of a visual scene are surprisingly inefficient. Each pixel, or discrete picture element in an image, records the average intensity over the past 40 milliseconds, the time it takes a fast-hit tennis ball to move about 1.5 meters.” As a result, they are very inefficient. Researchers at the Institute of Neuroinformatics at the University of Zurich developed a camera that mimics the way parts of the retina encode images for our brain (see Scientific American 307(4) Oct. 2012).
Gregory (1980) attempts to explain how such interactions occur. He argues that perception is based on hypotheses the visual system makes when it comes across a scene using knowledge acquired from past experience (i.e., prior knowledge):

"While simple creatures respond quite directly to stimuli, ‘higher’ animals [such as humans] see and behave in response to guessed causes of stimuli. This move from responding to stimuli, to planning behavior from attributed causes, to anticipated results is...moving from primitive reception to full-blown cognitive perception. It is cognitive because perception requires knowledge, knowledge of the world of objects...This knowledge is implicit, to be recognized from experiments on perception and behavior. (2009: 12-14)"

Such experiments involve mainly illusions, which “give evidence for implicit knowledge when it misleads. The knowledge may be of particular objects...or general rules applying to all objects (such as perspective convergence of lines signaling distance from any object) (2009: 13). Ambiguous figures “clearly...show that our perceptions are internal constructions of a hypothesized external reality” (Palmer 1999: 12). The same can be said of impoverished images (Frith and Dolan 1997). However, by far the most persuasive evidence that perception involves an interaction between sensory inputs and prior knowledge pertains to studies of two blind subjects who lost their sight early in their life and regained it much later. One such subject, S.B., lost his sight when he was ten months old and regained it at the age of 52 (Gregory 2001, 2004). After S.B. recovered from the surgery and the bandages were removed, he realized that he could see things that he had previously known by touch but could not make sense of things that he had not previously known by touch (Gregory 2009: 94). Lack of prior knowledge due to blindness affected his visual experience. For example, although S.B. was able to judge the distances and sizes of objects that he was familiar with from touch, such as chairs, “he was wildly wrong about distances to the ground from the hospital windows” (Gregory 2004: 1).

Gregory (2009: 96) describes S.B.’s reaction to a simple lathe he encountered at the Science Museum he was taken to as part of an experiment: “At first he was confused, then running his hand over it he said, ‘Now I have touched it I can see’.” For S.B. the sense of touch was “the primary source of information of forms and uses of objects.” His “earlier touch experience and behaviour such as walking, calibrated and gave sense to his vision, which was almost useless for untouchable objects or pictures” (Gregory and Wallace 2001). This case suggests that without prior “knowledge, initially from handling and interacting with objects, it is practically impossible for the brain to make sense of vision” (Gregory 2009: 97).

Gregory and Wallace (2001) conducted various tests on S.B. using illusions to determine whether his visual experiences were similar to those of normal-sighted subjects. Match to their surprise, they found that S.B.’s experiences were very different from those of normal-sighted subjects. S.B. “perceived far less distortion, and did not experience the flipping ambiguity of the Necker cube, or other such dynamic changes of appearances. Pictures looked flat and meaningless. Perspective meant nothing to his visual system” (2004: 1). The
Herring Illusion (Figure 1) involves two vertical lines that appear to diverge in the middle:

![Herring Illusion](image1)

When asked to describe what he saw, S.B. initially said that the lines were straight. “He then became doubtful, and thought that they might be further apart at the top and middle. When shown the figures again...he first said: “One goes out in the middle” and ended by saying that both were straight” (Gregory and Wallace 2001: 20). The experimenters concluded that the illusion was considerably less marked than in normal subjects.

When S.B. was shown the Necker cube (Figure 2), the figure was not seen in depth nor did it reverse. The results were the same with the Staircase Illusion (Figure 3). He again experienced it as having no depth and observed no ambiguity.

![Necker Cube](image2)  
![Staircase Illusion](image3)
When shown a Perspective Size Illusion (Figure 4), he reported that the “first man looks smaller, but the last three look the same” (Gregory and Wallace 2001: 21).

![Figure 4: Perspective Size Illusion](image)

S.B.’s reports suggest that “many illusions result from cognitive processing, rather than physiological signal processing occurring early in the visual system” (Gregory 2004:1). In other words, all these illusions involve cognitive penetration.

Another, more recent case, involving another blind subject, M.M., who also regained his sight while in his forties, mirrored those of S.B. (Kurson 2007, Gregory 2004, 2009). When M.M. was shown drawings of a stone man, a pumkin, and a face he could not identify any of them (Kurson 2007: 147). The results were similar with pictures of animals: he confused a bear with a dog and an elephant with a cat but was able to correctly identify a giraffe he was shown after working hard “to assemble the clues, thinking about why part of the picture showed something very long and slender and part showed something rounder and bumpier, while all the parts had brown patches” (Kurson 2007: 148). M.M. felt very frustrated with his vision since it required a great deal of effort. M.M. had similar difficulties recognizing faces and felt frustrated as a result (Kurson 2007: 223). These two cases offer strong support for the claim that perception arises from interactions between sensory inputs and prior knowledge.

5. Cognitive Penetrability Explained

The view that perception is active in the way described above allows us to easily explain a variety of illusions involving cognitive penetration. Gregory (2009: 20) distinguishes between illusions from reception and illusions from perception. The former are “primarily physiological distortions of signals from the senses” while the latter “include errors of interpreting signals, due to inappropriate knowledge and false assumptions. Here there is no a failure of the physiology; but rather, normally functioning processes are misapplied, and so inappropriate to the current situation.” It is the latter illusions that involve cognitive penetration.

4 The image shown to S.B. contained four men.

In the beginning of the discussion, it was noted that the Müller-Lyer illusion is often used to motivate that perception is not cognitively penetrable. However, if perception is active, in the way described in the previous section, then that motivation quickly vanishes. In fact, the Müller-Lyer illusion can be used to demonstrate that perception involves prior knowledge of depth, which dominates the sensory input. Curiously, MacPherson’s discussion of the Müller-Lyer illusion presupposes the view that perception is active. She correctly notes that “there is evidence that if one has not grown-up in a “carpentered” environment (one that contains many right angles) then one is less likely to be subject to [the Müller-Lyer] illusion” (2012: 56). The claim here is that knowledge from prior experience—in this case of experiences a “carpentered” environment—affects the subject’s perceptual experience.

MacPherson nevertheless goes on to suggest how the two-stage mechanism she proposed can explain such illusions. She suggests that her two-stage mechanism would provide the following explanation:

It may be that people who suffer the illusion are not able to help themselves imagining lines of the upper horizontal sort in the Müller-Lyer figure above as being further away than the bottom horizontal sort of line because of their experiences with corners of rooms or buildings. And their imagination may combine with their perception of the two lines to yield an experience in which the top line looks longer (because it is imagined to be further away) than the bottom line. (MacPherson 2012: 56)

According to this explanation, previous experiences of corners of rooms or buildings induce the imagined experience that one line is being further way from the other. This imagined experience is then combined with perception to produce the illusion. The imagined experience that functions as an intermediary between cognitive states and perceptual experience is a necessary step here because perception is assumed to be passive. The idea is that we experience the lines as being equal in length. Therefore, the non-perceptual state is needed to explain the illusion.

The problem with this explanation is that once the view that perception is passive is rejected, there is no need to postulate such an indirect mechanism. On the active view of perception, the Müller-Lyer illusion is easily explained since it arises from incorrect, but probable, hypotheses the visual system makes about depth. The arrow shapes of the corners at the ends of each line are depth cues the visual system uses to interpret the image (i.e., the two lines) based on prior knowledge. Objects represented as distant on a flat-perspective picture lack depth. This misleads the visual system, thereby forming the incorrect hypothesis that one line is longer than the other. The hypothesis the visual system makes in normal depth cases is inappropriately applied here giving rise to the Müller-Lyer illusion. Cognitive penetration is thus directly explained once we acknowledge that perception is active in the sense described in the previous section.

The same explanation can be provided for the Hollow Face illusion; a hollow face cannot be experienced as such even when one knows that the mask is hollow (Gregory 2009: 129).
This is also a case of cognitive penetration even though initially it might seem to be another paradigmatic case of cognitive impenetrability. Cognitive states – that is, prior knowledge the visual system uses to give meaning to incoming sensations – often generate and affect perceptual experiences. In typical circumstances, we never experience faces as hollow. This knowledge from past experience affects our perceptual experience. The visual system forms the incorrect, but plausible, hypothesis – that the face is not hollow because it does not recognize that the experience arises from atypical circumstances. Faces are the very first objects infants are able to recognize (Gregory 2009). It is this prior knowledge that the visual system cannot easily override.

Let us now return to the colour case. The view that perception is active provides the best explanation for cognitive penetration in the colour case. Recall that the colour study showed that the reddish-orange cutouts that were characteristically red were experienced as being more red than the cutouts that were not characteristically red (although they were all made using the same reddish-orange paper). The subject’s phenomenal character and content of the experience of the reddish-orange cutouts that have characteristically red colours result from prior knowledge of particular objects (i.e., objects that have characteristically red colours). The phenomenal character and content of the experience is thus generated by hypotheses the visual system makes when analyzing the scene. Normally functional processes of the visual system are in this case “misapplied, and so inappropriate to the current situation” (Gregory 2009: 20). The subject’s visual system generates the hypothesis that the orange cutout is red on the basis of prior knowledge of objects that have characteristically red colours. The subject is of course unaware of this process. That is why perception seems to be effortless. On the basis of prior knowledge, the visual system hypothesizes that the cutouts that are characteristically red are in fact red and that the cutouts that are not characteristically red are not in fact red. This, in turn, gives rise to experiences whose phenomenal character differs. Delk and Fillenbaum assessment is consistent with this explanation. Their conclusion is that “past association of color and form does in some way influence perceived color” (1965: 293).

6. Conclusion

MacPherson’s proposed indirect mechanism involves two steps: first cognitive states affect non-perceptual states; then the phenomenal character of those non-perceptual states affect the phenomenal character of perceptual experience. It has been argued that this indirect mechanism is based on the
flawed assumption that perception is passive. Two cases of blind subjects who regained their sight late in life were used to illustrate that perception arises from interactions between sensory inputs and prior knowledge. Lastly, it was shown that this view of perception provides a natural explanation for cognitive penetration.

References: