Why cognitive penetration of our perceptual experience is still the most plausible account

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Abstract
To what extent is our perceptual experience influenced by higher cognitive phenomena like beliefs, desires, concepts, templates? Given recent arguments against the possibility of cognitive penetration, we present striking evidence against the impenetrability claims. The weak impenetrability claim cannot account for (1) extensive structural feedback organization of the brain, (2) temporally very early feedback loops and (3) functional top-down processes modulating early visual processes by category-specific information. The strong impenetrability claim could incorporate these data by widening the “perceptual module” such that it includes rich but still internal processing in a very large perceptual module. We argue that this latter view leads to an implausible version of a module. Therefore, we have to accept cognitive penetration of our perceptual experience as the best theoretical account so far given the available empirical evidence. We outline that this does not have any problematic consequences for the relation between perception and cognition.

1. Clarifying the claims and shifting the burden of proof

What is cognitive penetration? Cognitive penetrability is a phenomenon that occurs if higher-level cognitive phenomena (states or events or processes), such as beliefs, desires, intentions, and concepts, directly influence our perceptual experience. In other words, if cognitive penetration takes place, what one believes, desires, intends, etc., may alter what one sees, hears, etc. To get the debate adequately off the ground, we need to be more precise. As a first step, we can rely on the definition of the necessary conditions for cognitive penetration (being altogether sufficient) as offered by Macpherson (2012). What is held constant is: 1. the object or scenario causing the visual input, 2. the perceptual conditions, 3. normally functioning sensory organs and 4. the absence of spatial attentional shifts. If a higher-level cognitive process (we will speak of a “process” as the paradigmatic phenomenon but also allow for states or events) can nevertheless change the perceptual experience, this is a case of cognitive penetration in a narrow sense, What penetrates and what gets penetrated? Just to repeat: the penetration comes from an activation of higher cognitive processes like beliefs, desires or concepts, more precisely, it comes from the activation of the content of these higher cognitive processes. The object of penetration is my perceptual experience. What is the nature of the penetrating relation? Regarding the question on whether cognitive penetration is a causal

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(Siegel, 2005) or a rational (Pylyshyn, 1999) relation, we take the side of Siegel and presuppose that it is sufficient if there is a relevant causal relation\(^1\) between the content of a higher cognitive process and the percept that is influenced by it (given that the content of the higher-cognitive process is part of the relevant causal factors). On the contrary, the claim of cognitive impenetrability is the principle claim that cognitive penetration of our perceptual experience never happens. So far, the community is still concerned with the principle debate of whether perceptual experience is penetrable or impenetrable (Vetter & Newen, 2014).

Before entering the discussion, it helps to clarify what exactly the claims of the two opposing camps in the discussion are. In the classic paper of Pylyshyn (1999), he defends a weak version of cognitive impenetrability since he limits his claim such that cognitive impenetrability is only valid for early visual processes. Thus, he allows for two possible interventions of higher cognitive processes onto perceptual processes that do not conflict with an impenetrability thesis: 1. the modification of sensory input by change of attention prior to early visual processes and 2. the “interpretation” which takes place after early visual processes but – as we read him – prior to the completion of our perceptual experience.

“Our hypothesis is that cognition intervenes in determining the nature of perception at only two loci. (...) These two loci are: (a) in the allocation of attention to certain locations or certain properties prior to the operation of early vision (...) (b) in the decisions involved in recognizing and identifying patterns after the operation of early vision. Such a stage may (or in some cases must) access background knowledge as it pertains to the interpretation of a particular stimulus.”

[Pylyshyn, 1999]

Thus, Pylyshyn defends cognitive impenetrability only for a module of early visual processes (leaving those underdetermined). In an updated view, Raftopoulos (2014) even constrained an early visual processing module to those areas which are involved in the first 100 ms after visual stimulation. A much more radical claim is taken in the recent paper by Firestone and Scholl (2015). After having discussed important methodological pitfalls and thereby setting a new bar for proofs of cognitive penetration, they express their view very clearly: “Until this high bar is met, it will remain eminently plausible that there are no top-down effects of cognition on perception.”

Thus, they claim that influences from higher cognitive processes only occur prior to any kind of visual processes and after the completion of a visual percept: in between, visual perception is created in a large visual processing module that is cognitively impenetrable.

**What is our strategy of argumentation?** To oppose the claim of cognitive impenetrability, we should consider at least the two versions of the claim: the **weak impenetrability claim** that only some early visual processes form a cognitively impenetrable module (Pylyshyn, 1999) or the **strong impenetrability claim** that all processes forming our visual experience are cognitively impenetrable (Firestone & Scholl, 2015); in both cases the perceptual conditions mentioned in the definition above should remain constant, i.e. the visual input, the focussed attention, normally functioning sensory organs as well as the external perceptual conditions. In our defence of cognitive penetrability we will present the most striking evidence and aim for a scientific evaluation of the most plausible theory accounting for it. We will conclude that despite lacking an *experimentum cruxis* for the time being, there is a large amount of evidence supporting the thesis of cognitive penetration according to the principle of best explanation. This line of approach also requires highlighting the most important evidence in favour of the opposing impenetrability thesis. However, our argumentation will shift the burden of proof towards the defenders of cognitive impenetrability. Furthermore, we will outline the most plausible view of the interface between perception and cognition that is compatible with our main defence of cognitive penetrability of perceptual experience.

**Why should we accept the radical claim of cognitive impenetrability in the first place?** What is the most striking evidence in favour of cognitive impenetrability? First of all, we have to account for the phenomenon of visual illusions that remain stable even if we are fully informed about the illusionary status of our experience. Let us stick with the simple and well-known example of the Müller-Lyer illusion: two arrows (with different orientation of the arrowheads) are perceived as having different length even after measuring the length of the main lines and assuring myself that they are indeed of the same length.

1️⃣ It is common ground in the literature that we need to exclude some causal chains as irrelevant, e.g. if my thinking about an upcoming exam causes migraine and this induces light flashes as part of my visual experience. This would not count as a case of cognitive penetration as the light flashes are not systematically caused by my thinking about the exam, but are only accidentally related. For most persons, thinking about an exam does neither cause migraine nor does it lead to light flashes. To exclude these cases, some philosophers argue that we need to presuppose a rational (or semantic) relation in addition to a causal chain. But the latter is too demanding (without further argument) since it is more straightforward to demand a relevant causal chain. Furthermore, let us presuppose – for the sake of argument – that the following would be a paradigmatic case of cognitive penetration, e.g. we activate different color concepts and thereby have a different color experience (while all the other perceptual conditions as defined above remain fixed). It seems to be going much too far to claim that we need a rational or semantic relation concerning this effect: Cognitive penetration just claims that there is a modified perceptual experience caused in a relevant way. Why should we presuppose that any step in the complex causal route resulting in a modified perceptual experience must not only be a causal but also a rational or semantic relation (as argued by MacPherson, 2016)? Why should we exclude such an ideal case if there is a causal chain involved which we do not understand any more than just by the fact that it is a non-accidental and systematic way the brain processes such situations?
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