J Gen Philos Sci (2015) 46:105–120
DOI 10.1007/s10838-015-9286-8

SPECIAL SECTION ARTICLE: THEORY-LADENNESS

Skill, Nonpropositional Thought, and the Cognitive Penetrability of Perception

Ellen R. Fridland

Published online: 22 March 2015

Abstract In the current literature, discussions of cognitive penetrability focus largely either on interpreting empirical evidence in ways that is relevant to the question of modularity (Pylyshyn Behav Brain Sci 22(3):343–391, 1999; Wu Philos Stud 165(2):647–669, 2012; Macpherson Philos Phenomenol Res, 84(1):24–62, 2012) or in offering epistemological considerations regarding which properties are represented in perception (Siegel Perceptual experience, Oxford University Press, Oxford, pp 481–503, 2006, Philos Q 59(236):519–540, 2009, Noûs 46(2):201–222, 2011; Prinz Perceptual experience, Oxford University Press, Oxford, pp 434–460, 2006). In contrast to these debates, in this paper, I explore conceptual issues regarding how we ought to understand the "cognitive" side of cognitive penetrability. I argue that it is only on its most narrow construal that a full-fledged defense of cognitive impenetrability has been forwarded. Specifically, I argue that the defenders of modularity (DOM from hereon) have tacitly identified cognitive states with propositional states, and have thus only defended the idea that early perceptual systems are immune to the impacts of propositional knowledge. My aim then is to raise doubts about the identification of cognitive states with propositional ones. In particular, by focusing on skill, I will broaden the conceptual space for a greater number of states to have the potential to impact perceptual processing in a way that would constitute a genuine instance of cognitive penetrability.

Keywords Cognition · Cognitive penetrability · Non-propositional thought · Skill

The debate concerning the relationship between cognition and perception is long and tortured. It includes figures as distinguished and varied as Aristotle, David Hume, Ludwig Wittgenstein, and Jerry Fodor. These days, discussions of cognitive penetrability focus

E. R. Fridland (✉)
Department of Philosophy, King's College London, London, UK
e-mail: ellen.fridland@kcl.ac.uk

largely either on interpreting empirical evidence in ways that is relevant to the question of modularity (Pylyshyn 1999; Wu 2012; Macpherson 2012) or in offering epistemological considerations regarding which properties are represented in perception (Siegel 2006, 2009, 2011; Prinz 2006). In contrast to these debates, in this paper, I explore conceptual issues regarding how we ought to understand the "cognitive" side of cognitive penetrability. I argue that it is only on its most narrow construal that a full-fledged defense of cognitive impenetrability has been forwarded. Specifically, I argue that the defenders of modularity (DOM from hereon) have tacitly identified cognitive states with propositional states, and have thus only defended the idea that early perceptual systems are immune to the impacts of propositional knowledge.

My aim then is to raise doubts about the identification of cognitive states with propositional ones. As such, by focusing on skill, I will broaden the conceptual space for a greater number of states to have the potential to impact perceptual processing in a way that would constitute a genuine instance of cognitive penetrability. It is important to note that it is not open to the DOMs to concede that there are cognitive states that are not propositional but that can penetrate perception since their thesis concerns *cognitive* penetrability and not *propositional* penetrability. If it turns out that the category of cognitive states is wider in scope than the DOM hold, and these states have a reasonable claim on penetrating perception, then this amounts to a significant challenge to the DOM position.

I will begin by presenting Jerry Fodor's defense of modularity in order to provide a reasonable understanding of his claim that long-term cognitive penetration is not a genuine instance of cognitive penetrability. I will then go on to consider skill possession as an example of a cognitive state that does not meet Fodor's criteria for being propositional. This move will allow me to widen the scope of "cognition" and, likewise, the number of relationships that could constitute legitimate cases of cognitive penetrability. I will end by gesturing to empirical evidence that suggests, though it does not prove, that the diachronic instantiation of practical knowledge penetrates perceptual processing.

1 Modularity, Informational Encapsulation, and Cognitive Impenetrability

In his seminal book, *The Modularity of Mind*, Jerry Fodor argues that input systems, i.e., those early-perceptual systems that are responsible for processing sensory stimuli and producing the qualitative character of a perceptual event, are modular. By modular, Fodor (1983) means that these systems are characterized by the following properties: domain specificity; mandatoriness; limited access by central functions; fast; informationally encapsulated; productive of 'shallow' outputs; exhibiting characteristic breakdown patterns and exhibiting specific pace and sequence. In this paper, I will focus on the claim that the early-perceptual systems are informationally encapsulated. It is this claim, which entails that early-perceptual input systems are cognitively impenetrable and it is also this claim that Fodor (2000) takes to be at the heart of modularity. In this paper, I will focus on Fodor's account since he is the father of modularity and the DOM[1] take Fodor's account to be foundational. As such, an objection to Fodor will constitute an objection to all the DOMs.

[1] In particular, I have in mind prominent defenders of cognitive impenetrability like Pylyshyn (1999, 2001, 2003) and Raftopoulos (2001, 2006, 2009) and Raftopoulos and Müller (2006).

2 Informational Encapsulation and Long-Term Cognitive Penetration

According to Fodor, the informational encapsulation of the early-perceptual systems necessitates that input systems are immune to cognitive influences of any kind. That is, the function that an early-perceptual system computes will remain identical regardless of the knowledge, skills, or experience that an organism acquires. Importantly, this means that the qualitative properties present in perception, that is, those properties that result from early-perceptual processing, are neither dependent on, nor sensitive to, what a creature knows or believes. This must be the case since it is postulated that cognitively impenetrable early-perceptual systems process sensory qualities and it is these properties that constitute the qualitative character of perception. As Pylyshyn (2003), a famous DOM, writes:

> [I]t would not be a great exaggeration to say that early vision—the part of visual processing that is prior to access to general knowledge—computes just about everything that might be called a "visual appearance" (ibid., 51).

In order to demonstrate the informational encapsulation of early-perceptual systems, Fodor relies on cases of persisting perceptual illusions. His claim is that if cognition could impact perception then what a creature knows or believes should change the way that things appear to that creature. Quite obviously, however, this does not occur. Take, for example, the Müller–Lyer illusion. Fodor reasons that if cognition penetrates perception, then a person who *knows* that the two lines of the Müller–Lyer illusion are of equal lengths, should *see* those lines as equal in length. But she does not; that's why it's called a perceptual illusion. No matter how sincerely one believes that the two lines are of the same length, the line with the arrows pointed inward always appears longer.

The fact that in many instances beliefs have no impact whatsoever on perception is crucial to take into account if one is attempting to do justice to the relationship between cognition and perception. That is, if we accept that the absence of change in conscious perceptual experience is indicative of a lack of change in qualitative character, as Fodor does and I am inclined to follow, then this is a strong counterexample to the pervasiveness of cognitive penetrability.[2] Cases such as this, and so many others like it, make it abundantly clear that if cognition is to impact perception, it certainly is not going to be a free-for-all. It will not turn out that most thoughts effect most perceptions.

From the fact that some thoughts do not impact the qualitative character of a perceptual event, however, it does not of course follow that cognition, in general, does not impact the qualitative character of a perceptual event. Fodor is sensitive to these considerations and so his argument for the informational encapsulation of the early-perceptual systems turns to the issue of long-term cognitive penetrability. Surprisingly, Fodor admits that cognition, in the long-term, can become internalized into the early-perceptual modules. However, he denies that such changes count as genuine instances of cognitive penetration.

Fodor (1983) states,

[2] Of course, we should be careful to distinguish between the qualitative character of a perceptual event and the judgment of that qualitative character. One could claim that qualitative experience changes as a result of cognition, but that one's conscious experience does not reflect this change. Or, that qualitatively the lines appear similar in length but that we judge them as different, and our judgment is not impacted by our knowledge. But the latter claim is rather odd since there doesn't seem to be a dispute as to whether intentional states can affect judgment, and the former would simply imply that Fodor is wrong about modularity.

> [S]uch connection is not knowledge; it is not even judgment. It is simply the mechanism of contextual adjustment of response thresholds. Or, to put the matter metaphysically, the formation of interlexical connections buys the synchronic encapsulation of the language processor at the price of its cognitive penetrability *across time* (italics in original).[3] The information one has about how things are related in the world is inaccessible to modulate lexical access; that is what the encapsulation of the language processor implies. But one's experience of the relations of things is in the connections among lexical nodes (ibid., 82).

The problem, and this really is *the* problem, is that Fodor does not argue for why such automatic, internal connections cease to bear the right connection to cognition, once they become automatic and internal. Clearly, however, Fodor must give us some *reason* to believe that the changes to automatic processing, which result from the impacts of cognition over time, should not be considered instances of cognitive penetrability. There are a number of differences between paradigmatically cognitive events and their proposed connection to perception and the potential diachronic effects of learning, experience and expertise on the internal processing of input systems. However, Fodor does not produce any argument for why *these* differences amount to the difference between the cognitive penetrability of perception and its denial.[4]

Such an account, however, is exactly what the modularity theorist owes us since it isn't usually thought that occurrent, conscious beliefs directly influence the processing of early-perceptual systems. As Paul Churchland (1988) writes, "if Fodor is attacking the view that perceptual processing always (or even usually) responds directly and immediately to changes in one's theoretical commitment, then he is attacking a straw man. This is not a view that anyone has defended" (176). In fact, proponents of cognitive penetrability often appeal to cases of perceptual learning and expertise in order to support their position. It is in cases of, e.g., expert radiologists, chess players, chicken sexers, artists, musicians, and athletes that changes in perception seem plausibly to occur. But in these cases the change in perception results from regular, long-term exposure to and training with a certain class of perceptual stimuli.

3 Detective Work

Though Fodor does not explicitly argue for why the long-term impacts of cognition on perception are *not* genuine instances of cognitive penetrability, I think that I can safely point to one major motivation on his behalf. This motivation stems from Fodor's commitment to the Language of Thought hypothesis (from hereon, LOT). In this section, I will justify reading Fodor's denial of genuine long-term cognitive penetrability as rooted in his commitment to LOT. In the following sections, I will provide arguments elucidating why an objection on these grounds is suspect.

[3] In this quote, Fodor is focusing on the lexical module, but he is adamant that what will be true of language processing will also be true of perceptual input systems.

[4] Pylyshyn confronts this same problem. He says: "it is consistent with the present framework that new complex processes could become part of the early vision system over time: cognitive impenetrability and diachronic change are not incompatible" (2003, 88). Like Fodor, Pylyshyn simply states, but does not argue for why we should accept that modularity is sustained when long-term cognitive penetration occurs.

3.1 LOT, Cognition and Cognitive Penetrabilty

Famously, Fodor (1975, 1988, 1990, 1991, 2008) is responsible for articulating the very powerful LOT hypothesis. According to LOT, all thought is propositional in nature. A proposition is composed of a propositional attitude, such as a belief or a desire that is directed at a propositional content, which is either a sentence in a real language or a sentence in the language of thought. Famously, one of the virtues of LOT is that it allows various attitudes to be directed at the same contents and various contents to be the objects of different attitudes. So, I can believe *that the weather will be cold tomorrow* and *that hot soup is great on cold nights* and I can fear *that the weather will be cold tomorrow* and you can believe and fear the same things, too.

Importantly, the propositional content, or the sentence at which a propositional attitude is directed, is also internally structured. Such sentences are compositional, which means that they are made up of atomic parts or concepts that can enter into meaningful relationships in an infinite number of sentences. It is important to note that these sentences are not necessarily in any real language. Rather, Fodor argues that thought is structurally, logically and grammatically like sentences in a natural language, except without necessarily being in language; hence, the language of thought. I will address compositionality and its implications further in Sect. 7. For now, we should simply note that this fact about propositional thought is genuinely explanatory in accounting for the systematicity and productivity of thought and language, two features which are thought to be central to human cognition.

Now, because Fodor is committed to understanding thought in this complex but narrow way, it should be quite obvious that if a state is not propositional, then Fodor would not classify that state as cognitive. After all, this is *exactly* what LOT says: that for something to be an instance of thought, that something must be propositional in nature. Therefore, we can formulate the following reason for Fodor's conclusion that the diachronic impacts of cognition on perception do not qualify as legitimate instances of cognitive penetrability*: the states that are responsible for the long-term impacts of cognition on early-perceptual systems are not propositional and, thus, they cannot count as genuine instances of cognitive penetrability.*

4 Cognitive Penetration: Definition and Analysis

In order to assess the force of the objection that I've ascribed to Fodor, it will be useful to have a definition of cognitive penetrability. Pylyshyn (1999) has defined cognitive penetration in the following way:

> If a system is cognitively penetrable then the function it computes is sensitive, in a semantically coherent way, to the organism's goals and beliefs, that is it can be altered in a way that bears some logical relation to what a person knows (343).

For my purposes, the most relevant consideration regarding this definition centers on the following question: what kind of states are goals, beliefs and knowledge such that they are representative of cognition? That is, how do the DOM define cognition such that they can be sure that it does not impact perception?

I'd like to note that the above definition does not stipulate that changes in perception must immediately follow from a connection to occurrent, conscious, thoughts. Such a limitation, of course, would rule out long-term cognitive penetration as a potential instance

of cognitive penetration not by argument, but by fiat. This would not only beg the question, it would also, as Churchland (1988) pointed out, argue against a straw man. The shear long-termness of cognitive penetration, therefore, cannot be the reason that changes in perceptual processing over time fail to qualify as instances of cognitive penetration. Of course, the idea that occurrent, conscious thoughts or beliefs do not directly cause immediate changes in perceptual processing is a robust thesis in and of itself but it most certainly is not the modularity thesis.

4.1 Cognition, Intentionality, and Propositional Content

To begin investigating my proposed reconstruction of Fodor's reasons for denying that the long-term impacts of cognition on perception constitute instances of cognitive penetrability, it is essential to identify which types of states Pylyshyn is referring to when he appeals to beliefs, goals and knowledge as representative of the category of cognition. After all, examples are not definitions and we must have some way to distinguish between states that will, like beliefs, goals and knowledge, turn out to be cognitive, and those states that will not.

First off, it is crucial that we agree that Pylyshyn (1999) appeals to beliefs, goals and knowledge as paradigmatic instances of cognitive states. This must be so since what Pylyshyn is concerned to define is a particular relationship between cognition and perception. He is not, after all, presenting a definition of *propositional* penetration or of *intentional* penetration, but of *cognitive* penetration. So, in the back of our minds, we should beware of the possibility that the category of states that is best represented by beliefs, goals and knowledge may not exhaust the category of cognition. If it turns out that this is the case (and not to spoil the surprise, but it will), then we must amend Pylyshyn's definition to encompass cognitive states more generally.

Quite clearly, beliefs, goals and knowledge are examples of intentional states. They are the types of states that Franz Brentano (1973) identifies as having the property of being about or directed at something. Contrast this with artifacts and states of affairs, which are not *about* anything, but just *are*. Not accidentally, intentional states are those states that are best accounted for by LOT; they are the kinds of states that are most likely to be cashed out in terms of propositions and concepts.

In lieu of these considerations, we should bear in mind that both Fodor and Pylyshyn hold that propositional states exhaust the category of cognition. So, the DOM seem to hold that if they have successfully established that perception is propositionally impenetrable then they have also established that perception is cognitively impenetrable. But, of course, the success of their defense will depend on the appropriateness of identifying cognition with propositionality.

5 Conceptual Space: Cognition, Intentionality, and Propositionality

In the following sections, it will be my goal to argue that cognitive states are not necessarily propositional in nature. I will do this by first, in Sect. 6, clarifying the nature of propositional content, and then, in Sect. 7, defending the position that skills are cognitive but not propositional. My intention here is not to present a full-fledged theory of non-propositional cognition, but rather, to sketch out the conceptual space that one could occupy should one wish to respond to Fodor's purported objection to long-term cognitive penetrability.

My strategy will be to show that DOM have too narrowly defined cognition and, therefore, have prematurely declared victory. To be clear, my goal will not be to argue that any kind of impact from any kind of mental state ought to qualify as cognitive penetration. What I maintain is that the DOM have not paid adequate attention to a certain class of cognitive states, which may hold the *right relationship*, that is, a relationship of semantic coherence or logical relatedness, to early-perceptual processes. If this is so, then the DOM have not adequately defended their cognitive impenetrability thesis. Just as a reminder, since both of our theses are about *cognitive* penetrability and not, i.e., *propositional* penetrability or *penetrability by occurrent, propositional thought*, these considerations do not beg the question against the DOM. We can be sure of this because the DOM cannot grant that the kinds of states that I will consider are genuinely cognitive states and admit that they may bear the right impactful relationship on early-perceptual processing but deny that this constitutes a challenge to the cognitive impenetrability thesis. The DOM cannot hold that their considerations about cognitive impenetrability are limited to only one type of cognitive state since they take their position to be a robust thesis about the nature of the relationship between perception cognition and not an anemic, trivial thesis asserting the obvious truth that not all cognitive states impact perception all the time.[5]

Returning to the argument, to better organize the conceptual landscape, it may be helpful to identify the possible positions that one may occupy regarding the nature of and relationships between cognition, intentionality, and propositionality:

1. Intentional states exhaust the category of cognition (i.e., all and only intentional states are cognitive) and all cognitive states (ergo all intentional states) are constituted by propositional content.[6]
2. Intentional states exhaust the category of cognition (i.e., all and only intentional states are cognitive), and some cognitive states (ergo some intentional states) may be constituted by nonpropositional content.
3. Intentional states do *not* exhaust the category of cognition, and whilst all intentional states are necessarily propositional, other cognitive states may be constituted by nonpropositional content.
4. Intentional states do *not* exhaust the category of cognition, and both intentional and non-intentional states may be nonpropositional.

The last option would be (5) Intentional states do *not* exhaust the category of cognition, but both intentional and cognitive states are necessarily propositional. But it seems that this would collapse into option one, since it is unclear that these other propositional cognitive states could be anything but intentional. For the same reason, (6), Intentional states do *not* exhaust the category of cognition, and while intentional states may be constituted by nonpropositional content, cognitive states are necessarily propositional, is not a genuine option.

At minimum, if (2), (3), or (4) are true, then it would be possible for nonpropositional states to be responsible for the cognitive penetrability of perception.

[5] Again, see Churchland quote above.

[6] This is the DOM position.

6 The Nature of Propositional Content

In order to determine which states count as examples of nonpropositional cognition, it is a good idea to have a working definition of "propositional content." According to Fodor, propositional content is necessarily compositional. In *LOT Revisited*, Fodor (2008) writes,

> LOT 1 ["LOT 1" refers to Fodor's (1975) book *The Language of Thought*] failed, just about entirely, to recognize the centrality of compositionality in constraining theories about the semantics of mental representation; that is, the implications of the requirement that the content of a thought is entirely determined by its structure together with the content of its constituent concepts (17).

We see then that the compositionality of propositional content is at the very heart of the LOT hypothesis.

What compositionality requires is that cognitive states, such as beliefs and desires, are composed of concepts. Based on Fodor's account, there cannot be propositional content if there are no concepts, since intentional content is determined exclusively by concepts and their structure. As he states, "If you are going to have beliefs in your ontology, you are also going to have concepts, since the latter are the constituents of the former" (Fodor 2008, 131). It should be clear that if a state is not conceptual, then it is not propositional either. And if it is not propositional, then, according to Fodor, it is not cognitive.[7]

Given these considerations, it seems obvious that next we should inquire into the nature of concepts.[8] The first thing to notice is that on the LOT hypothesis, concepts are not only defined as, but *must* be defined as, atomic. Individual concepts are independent of each other and also of their particular environment.[9] This means that, "in principle one might have any one concept without having any of the others" (Fodor 2008, 141). This also means that concepts are not identified with any one particular context.[10] It is this atomic quality of concepts that accounts for their ability to appear in different contents and as the constituents of more complex concepts. That is, the ability of concepts to break free from their particular situation allows them to show up in many others.

As Evans (1982) writes, concepts are characterized by two important features: generality and context independence. This means that to possess a concept one must be able to apply that concept in various situations; one must be able to think of that concept in multiple contexts. For example, if one has the concept COUCH, one must be able to think of different couches in different rooms. Further, for one to possess a concept, one must also

[7] There is a way of using "cognitive" where it refers to any process that contributes to cognition, or any process that takes place in the brain. I hope it is clear, that it is not this weaker sense of the word that I am using here.

[8] A huge number of philosophical misunderstandings, it seems, are rooted in the fact that different theorists have different conceptions of what it is to be a concept. See, for instance, Peacocke and McDowell. It is a great fortune, then, to have Fodor explicitly state what he takes the concept "concept" to entail. It is only Fodor's conception of concepts that I am working with here. Other concepts of "concept" may not be subject to the same characterizations or objections. For the purposes of my argument, however, such issues are entirely irrelevant.

[9] It is interesting to note that this characteristic of concepts makes it impossible that concepts are definitions. This is because, quite obviously, definitions require concepts and so, any concepts would be dependent on others.

[10] To be clear, this refusal to identify concepts with one context is not at all peculiar to Fodor. Even theories of demonstrative concepts such as those presented by Evans (1982), McDowell (1994), Brewer (1999) and Kelly (2001) claim that the minimal requirement on having a concept is meeting the re-identification constraint—this means that having a concept requires being able to identify it or use it in different contexts.

be able to think of that concept independent of any particular situation. For example, if one has the concept COUCH, one must be able to think of a couch without thinking of any one couch in particular. Evans writes,

> It is a feature of the thought-content *that John is happy* that to grasp it requires distinguishable skills. In particular, it requires possession of the concept happiness—knowledge of what it is for a person to be happy; and that is something not tied to this or that particular person's happiness. There simply could not be a person who could entertain the thought that John is happy and the thought Harry is friendly, but who could not entertain—who was conceptually debarred from entertaining—the thought that John is friendly or Harry is happy (102–103).

As we can see, what it is to be a concept is exactly what explains why concepts can build and recombine in such a way as to produce the variability and complexity of thought and language. It is the context-independent nature of concepts that explains how various contents can share constituent parts. If concepts did not break free of their environments, then one could not, as Fodor requires, bring them "before the mind as such."[11] One could not bring them or move them anywhere, as such. They would be glued to their particular environment. They could not generalize or recombine. They'd be stuck.[12]

However, it is exactly this requirement that makes it so unlikely that nonlinguistic animals and pre-linguistic children, and perhaps surprisingly, even human adult doers and movers, are best explained by appeal to propositional thought. For more on the quasi-propositional character of animal cognition, see Bermúdez (2003, 2006) and Hurley (2006). The bar for propositional thought is high and the fact remains that there is no need to posit concepts in order to explain all sorts of basic abilities and behaviors. In fact, many intelligent actions resist explanation in propositional or conceptual terms. It is vital that we understand this crucial fact: the atomistic requirement of concepts to move freely and recombine and generalize is not identical to a more basic ability to discriminate features of a perceptual array, recognize similarities and differences amongst features, to group instances into a stereotype, or possess the capacity to act skillfully.

7 A Problem for the Propositional View of Cognition: Skill

In this section, I will put forward a plausible instance of nonpropositional cognition, namely: skill. This example is meant to serve as a challenge to the propositional model of cognition. Further, skill should motivate our rethinking of the kinds of states and processes that we ought to take into account when considering the relationship between cognition and perception.

Recently, there has been resurgence in the debate about whether skill or knowledge how can be reduced to propositional thought (Stanley and Williamson 2001; Stanley 2011a, b; Noë 2005; Hawley 2003; Bengson and Moffett 2011; Brown 2013). The intellectualist claims that knowledge how is just another species of ordinary, garden-variety, propositional knowledge, while the anti-intellectualist, following Ryle (1946, 1949), argues that

[11] "[A] sufficient condition for having the concept C is: being able to think about something *as* a C (being able to bring the property C before the mind as such, as I'll sometimes put it)" Fodor, *LOT 2*, 138.

[12] I should note that there are many different notions of a concept floating around the philosophical literature. It should be clear that I am only concerned with the DOM notion. It should be clear that the more minimal one's notion of a concept is, the less my criticisms will apply.

knowledge how comprises a unique, *sui generis*, category of knowledge. We should note that if the anti-intellectualist is right, then the possibility of skill impacting early perceptual processing will not be ruled out by the fact that propositional or conceptual thought does not impact perception.

In what follows, I will run through what I call "the problem of particularity."[13] This problem is meant to motivate an anti-intellectualist understanding of skill by showing that skills can neither be governed by propositions nor composed of concepts. As such, these considerations open up the conceptual space for the cognitive penetrability of perception, not by propositional thought, but by the regular instantiation of skilled action.

Before beginning my argument, it is helpful to note that the problem of particularity in skill can be seen as a counterpart to the debate about conceptual and non-conceptual content in perception (Peacocke 1989, 1992, 1998; McDowell 1994, 1998). That is, the requisite fine-grained nature of action can be characterized in parallel to the fine-grained nature of qualitative content. And just like the failure to recognize at different times or re-identify a qualitative property serves as a challenge to the conceptual character of a perceptual event (Evans 1982; Peacocke 1989, 1992, 1998; Brewer 1999; McDowell 1994, 1998; Kelly 2001) the failure of reapplication of action elements in skill should serve as a challenge to the conceptual nature of skilled action.

8 Skills, Rules, and Propositions

Returning to considerations about the nature of skill, we should note that one way to understand skill as reducible to propositional thought is to think of skill in terms of practical reasoning. That is, we can understand knowledge how in terms of a proposition or a rule that is responsible for guiding skilled action. This way of framing the issue seems reasonable since, if propositions are going to be responsible for skilled action, then propositions will have to provide directives that will govern those very actions. The propositions, therefore, will have to be rules of a kind.[14]

We should consider, however, what kind of rules would be needed in order to adequately account for skilled action. The first thing to notice is that we need more from a rule than an imperative for action. That is, we need rules that will not only tell us *that* we ought to act but that will tell us *how* we ought to act, as well. Further, we should be cognizant of the fact that skills must always be executed in particular settings, the details of which can vary in an almost infinite variety of ways, many of which will be central for the successful performance of a skill. This is most obviously the case with embodied skills like riding a bike, or performing surgery.

Such skills require a sensitivity and responsiveness to the actual nuances of the very situation in which the skill is performed. Not being adequately responsive to the particular conditions under which a skill is instantiated sabotages the possibility of that skill's success. For example, if one does a handstand without being responsive to the very material, the very incline, and the very uniformity of the surface on which one places one's hands (e.g., a soft mat, or smooth concrete, or a bumpy earthen ground) then one will not be able to perform the *micromillimeter, microsecond* bodily adjustments required for holding a handstand.

[13] See Fridland (2012) for a full account of this problem.

[14] This construal follows Stanley's account of knowing how. Stanley states that "I have argued that in acquiring a skill, we first learn various rules. Practice allows us to move from the initial stage in which we repeatedly have to consult these rules, to skilled action, where we can act directly upon them." (2011b, 247).

This fact is made especially poignant when we think of expertise. When we think of what is required for instantiating the same skill at multiple times and circumstances, it becomes clear that it is precisely the way in which one deals with the unavoidable differences and details of the performance that constitutes the difference between a high-level skill and an amateur performance. After all, part of what makes someone a skilled actor is that she is able to cope in more circumstances than the novice.[15] It would seem reasonable to suppose that this is because the skilled actor is able to compensate, respond, and take advantage of variation in her instantiation of a skill. As Stanley (2011b) writes, "A mark of expertise is the ability to respond efficiently to novel situations. The expert surgeon is able to adjust her scalpel to a surprising complication in a way that the novice surgeon, even one with the same knowledge of what has been published in journals, is not" (244). It would follow that this aspect of skill is especially relevant to address, if we want to capture the skilled part of skilled action.

Taking these points seriously, when we return to our consideration of rules, we will have to say that the rule guiding a skilled action will need to incorporate all of the very particular, and very relevant details of this very situation here and now in order to satisfactorily account for the success of skilled, intelligent action. This is because, if what is learned when one learns a skill is how to cope with a variety of relevant but unstable features of one's voluntary actions in relation to one's environment, but we don't explain how this very thing is possible, then we have not explained that which is at the very heart of skilled action. The devil, it seems, really is in the details. As such, we must say that if a rule is going to be responsible for skilled action, then that rule will have to be concerned with the very particulars of the action. But we should wonder if it is reasonable to expect this from a rule. We may wonder why a rule is needed, if it can only applied in one situation. And we may wonder about the number of rules that we'll need to know in order to possess any one skill. Then we may wonder how we learn these rules, and, importantly, how we will choose amongst them when it comes time for implementation (will we need more rules?). And then we may wonder where we will store all of these rules.

9 Skills and Concepts

The problem of particularity is troubling for rules or propositions, but it becomes even more vexing when we move from propositions to concepts. At the very minimum, having a concept requires the ability to re-identify the object, property, or event that falls under that concept in different circumstances and situations: to use that concept in more than in one context (Evans 1982; McDowell 1994; Brewer 1999; Kelly 2001). After all, at the very heart of conceptuality is that idea that concepts can be abstracted away from particular circumstances in order to enter into various relationships while retaining their identity. In this way, concepts are, by definition, recombinatorial.[16] But abstracting away from the particular situation is devastating for the instantiation of a skill since it undermines its

[15] See Millikan (2004) for more on the connection between the level of ability and the number of circumstances in which an ability can be performed.

[16] One may object that demonstrative concepts are not context-independent in the way I have suggested. We should notice, however, that though rooted in their contexts, demonstratives are not tied to those contexts in any way that would prevent them from being re-identified at various times and in various ways. After all, a prerequisite for being a demonstrative concept that is accepted by everyone from Evans to McDowell is that one has the ability to recognize at different times and possibly even through different means, the property, event, or object that falls under the concept (cf. Evans 1982, Brewer 1999, McDowell 1994 and 1998, Kelly 2001).

successful performance. In order for a skill to be successfully performed one must adjust, shift and respond to the very particular circumstances of the environment in which the ability is being instantiated. The crucial point then becomes this: what is most explanatorily powerful about concepts is that they can be abstracted away from their particular environments. In contrast, skills develop by becoming more and more attuned to their specific circumstances. The movement, it turns out, is in opposite directions.

Importantly, we should notice that even if there were some context-independent elements that we could posit as constituting the state to which we hold the knowledge relation when we know how to ride a bike or dance ballet, that general, compositional content would not be able to account for skilled action. Again, this is because to successfully perform a skill what is needed is a sensitivity and responsiveness to context and circumstances, but concepts that meet the generality constraint, by definition, could not have this kind of specificity. Like the fineness of grain present in the qualitative character of a perceptual episode outstrips our conceptual capacities, it seems that the particularity of action is just too specific to count as genuinely conceptual as well.

Crucially, we should also notice how this is entirely different when it comes to paradigmatic instances of conceptual *thought.* My concept RED is the very concept that shows up when I think "apples are red" and "red is a primary color." Context independent concepts get tokened in propositional thought, but context-independent elements do not get tokened in skill.[17] As such, I think that it is safe to conclude that skills and concepts are importantly distinct.

We should notice, however, that even if skills could be cashed out in propositional terms, it would not follow that the DOM have adequately addressed *these* kinds of propositional impacts on early-perceptual input systems. That is, even if an adequate propositional account of skill is forthcoming, *pace* what I have been arguing, the ways in which these propositions are learned and instantiated may be significantly different from paradigmatic, garden-variety cases of propositional thought. As such, it would not be nonpropositional thoughts that would challenge modularity, but propositional states regularly instantiated and applied in skillful action. Recognizing this possibility is important since it shows that skills, in general, regardless of whether they are cashed out in intellectualists or anti-intellectualist terms, have not been taken seriously enough by the DOM.

10 Empirical Considerations

It follows from the above considerations that ruling out the impacts of paradigmatic varieties of propositional thought on perceptual processing does not entail that one has ruled out the possibility that skill may have robust, systematic impacts on the qualitative character of a perceptual event.

The fact remains that empirical evidence of cognitive penetration is hardly ever of an explicit, occurrent state directly penetrating perceptual content. If we think about plausible cases of potential penetration, we can think of, for example, the old experiments with inverting glasses, which suggest that skill in navigating one's environment is crucial to constructing a visual representation of that environment. What those experiments show is

[17] One can think of motor routines or sequences as potentially having an element-like structure. As I'm arguing, however, this kind of structure is not context-independent in a way that can make it genuinely conceptual.

that when subjects put on inverting lenses, there is not "an inversion of the content of experience (an inversion of what is seen) but rather a partial disruption of seeing itself" (Noë 2004, 8). It is only after subjects learn to move around their spaces and develop appropriate motor responses that they regain the ability to see in an orderly fashion. These experiments indicate that the qualitative character of a perceptual experience is intimately related to spatial understanding and motor skill. After all, if meaningful visual experience is available only when one has the ability to interact with one's environment, then it appears that understanding and expectations impact the qualitative character of perception.[18]

Additionally, numerous studies have found that training can induce neural changes in primary sensory areas (Pourtois et al. 2008; Fritz et al. 2003; Sanes and Donogue 2000; Recanzone et al. 1993; Cheung et al. 2005; Pantev et al. 2003; Bao et al. 2004). That is, studies have correlated skill learning with plasticity in the primary visual, motor and auditory cortices. This is significant since it shows that areas that are functionally responsible for processing the qualitative character of a sensory event can be affected by learning and experience. It is precisely these kinds of connections which may elucidate how experience and learning may impact our perceptual processing. And it is precisely these kinds of connections that are worth exploring in light of our interest in cognitive penetrability.

Lastly, studies of skill learning in the two-visual streams suggest the possibility of empirical support for diachronic cognitive penetrability of at least an indirect variety. To review: the two visual streams hypothesis posits the functional independence of processes leading to conscious visual perception and vision for action. According to this theory, the ventral stream processes information for conscious, visual experiences relevant to forming doxastic states while the dorsal stream computes egocentric information that is relevant for guiding motor actions like reaching and grasping. Studies with patients who have sustained brain lesions provide strong evidence of a double dissociation between ventral and dorsal stream processing. Further, dissociations can also be observed in healthy subjects who are susceptible to particular perceptual illusions in the ventral but not dorsal stream. That is, normal subjects' conscious perception can be tricked by various illusions while their reaching and grasping remains accurate. In light of these results, David Milner and Melvyn Goodale have argued that perception for action and perception for conscious visual perception are guided by two independent streams of informational processing.[19]

The relevance of the two-visual streams hypothesis for long-term cognitive penetrability becomes clear when we think of the role and relationship of the two streams in reference to overlearned skills. As Milner and Goodale (2010, 83) admit,

> "Not all movements will be mediated by the 'encapsulated' visuomotor networks in the dorsal stream. The more unpracticed and novel the action, the more likely it is to require a good deal of cognitive supervision and thereby to be influenced by perceptual processing. The first time you use chopsticks, for example, you are vividly aware of what you are doing and you monitor your movements quite consciously, something you do not do when using your fingers, or even a fork, to pick up food. Presumably, this conscious monitoring of unpractised movements depends on information provided by the perceptual networks in the ventral stream… Once the

[18] For more on inverted goggles see also Gibson (1979).

[19] For more on the two-visual systems see Goodale and Milner (1992, 2004) and Milner and Goodale (1995, 2010).

action is well-practised and becomes automatized, however, it seems that control of the constituent movement is passed to the visuomotor networks in the dorsal stream."

In the case of overlearned skills, it would seem that the automatic processing of the dorsal stream, though synchronically independent from ventral stream processing, is diachronically dependent on and determined by conscious visual perception. Because the ventral stream guides and directs actions prior to their automatization, we have a clear case of informational processing, the details of which are determined by vision for perception, being integrated or incorporated into the processing of the vision for action stream. This claim is further substantiated by neuroscientific findings that show that the dorsal stream can be modulated by higher-order expectations and understanding.[20] Of course, this does not give us a path directly from the dorsal stream back to the ventral stream, that is, it does not give us a way to understand qualitative perceptual experiences as being dependent on cognition, but it does give us a substantive connection between the function computed by the dorsal stream and that of ventral stream processing.

What's more, though it is unlikely that the dorsal stream directly impacts ventral stream processing, there remains an open question about whether dorsal stream processing could impact early-perceptual systems in the right way so as to spawn a plausible case of cognitive penetrability. The potential for such interaction is surely available since there is evidence of plasticity in the early visual areas following motor learning (Negyessy et al. 2006; Hager and Dringenberg 2010; Gervan et al. 2011; Swallow et al. 2012). If such evidence supports the view that attunement of early visual processing is sensitive to dorsal stream function then it would follow that the qualitative character of visual experience is dependent on the function of the dorsal stream, diachronically determined by ventral stream processing. To take stock, there are two important factors that may have theoretical repercussions for the question of modularity: (1) ventral stream processing determines which functions will be incorporated into the dorsal stream by guiding and directing skill learning, and (2) dorsal stream processing may result in significant impacts on early-perceptual processing.

From these considerations we can conclude that through the process of skill learning, we may have a case of indirect, diachronic cognitive penetrability where the function that the early-visual system computes may be impacted by the knowledge, goals, and beliefs of a subject via changes in dorsal stream processing. Given this possibility, we see that the cognitive states of an agent would be relevant for understanding the function that the early visual system computes. And this would constitute an important objection to modularity.

While alone, none of this evidence amounts to a smoking gun, it does amount to a good reason to think that it is in the realm of intelligent action where the most likely cases of cognitive penetrability will occur. Taken together, the above considerations raise the possibility that long-term cognitive penetration through skill learning may constitute a genuine instance of cognitive penetration despite the impacts on perception not coming from propositional states. Further, what should be clear is that *if* cognitive states can be nonpropositional, then the right relationship to the right sorts of nonpropositional states will qualify as an instance of cognitive penetration. As such, I insist that it is in the mud of this conceptual space that our theoretical and empirical resources should be focused.

[20] See Pylyshyn (1999, 347) for a discussion of motor-system modulation.

References

Bao, S., Chang, E. F., Woods, J., & Merzenich, M. M. (2004). Temporal plasticity in the primary auditory cortex induced by operant perceptual learning. *Nature Neuroscience, 7*(9), 974–981.

Bengson, J., & Moffett, M. (2011). Two conceptions of mind and action: Knowing how and the philosophical theory of intelligence. In J. Bengson & M. Moffett (Eds.), *Knowing how: Essays on knowledge, mind, and action* (pp. 3–58). New York: Oxford University Press.

Bermúdez, J. (2003). *Thinking without words*. Oxford: Oxford University Press.

Bermúdez, J. (2006). Animal reasoning and proto-logic. In S. Hurley & M. Nudds (Eds.), *Rational animals?* (pp. 127–138). Oxford: Oxford University Press.

Brentano, F. (1973). *Psychology from an empirical standpoint*. London: Routledge.

Brewer, B. (1999). *Perception and Reason*. Oxford: Oxford University Press, Clarendon Press.

Brown, J. (2013). Knowing-how: Linguistics and cognitive science. *Analysis, 73*(2), 220–227.

Cheung, S. W., Nagarajan, S. S., Schreiner, C. E., Bedenbaugh, P. H., & Wong, A. (2005). Plasticity in primary auditory cortex of monkeys with altered vocal production. *The Journal of Neuroscience, 25*(10), 2490–2503.

Churchland, P. (1988). Perceptual plasticity and theoretical neutrality: A reply to Jerry Fodor. *Philosophy of Science, 55*(2), 167–187.

Evans, G. (1982). *The varieties of reference*. Oxford: Oxford University Press.

Fodor, J. (1975). *The language of thought*. Cambridge, MA: Harvard University Press.

Fodor, J. (1983). *The modularity of mind: An essay on faculty psychology*. Cambridge, MA: The MIT Press.

Fodor, J. (1987). *Psychosemantics: The problem of meaning in the philosophy of mind*. Cambridge, MA: The MIT Press.

Fodor, J. (1988). A reply to Churchland's 'Perceptual plasticity and theoretical neutrality'. *Philosophy of Science, 55*(2), 188–198.

Fodor, J. (1990). *A theory of content and other essays*. Cambridge, MA: The MIT Press.

Fodor, J. (1991). Propositional attitudes. In D. Rosenthal (Ed.), *The nature of mind* (pp. 325–338). New York: Oxford University Press.

Fodor, J. (2000). *The mind doesn't work that way: The scope and limits of computational psychology*. Cambridge, MA: The MIT Press.

Fodor, J. (2008). *LOT 2: The language of thought revisited*. Oxford: Oxford University Press.

Fridland, E. (2012). Knowing-how: Problems and considerations. *European Journal of Philosophy*. doi:10.1111/ejop.12000.

Fritz, J., Shamma, S., Elhilali, M., & Klein, D. (2003). Rapid task-related plasticity of spectrotemporal receptive fields in primary auditory cortex. *Nature Neuroscience, 6*(11), 1216–1223.

Gervan, P., Berencsi, A., & Kovacs, I. (2011). Vision first? The development of primary visual cortical networks is more rapid than the development of primary motor networks in humans. *PLoS ONE, 6*(9), e25572.

Gibson, J. J. (1979). *The Ecological approach to visual perception*. Boston: Houghton Mifflin.

Goodale, M. A. & Milner, A. D. (1992). Separate visual pathways for perception and action. *Trends in Neurosciences, 15*, 20–25.

Goodale, M. A. & Milner, A. D. (2004/2005). *Sight unseen: An exploration of conscious and unconscious vision*. Oxford University Press.

Hager, A. M., & Dringenberg, H. C. (2010). Training-induced plasticity in the visual cortex of adult rats following visual discrimination learning. *Learning and Memory, 17*(8), 394–401.

Hawley, K. (2003). Success and knowledge how. *American Philosophical Quarterly, 40*, 19–31.

Hurley, S. (2006). Making sense of animals. In S. Hurley & M. Nudds (Eds.), *Rational animals?* (pp. 139–171). Oxford: Oxford University Press.

Kelly, S. (2001). Demonstrative concepts and experience. *Philosophical Review, 110*(3), 397–420.

Macpherson, F. (2012). Cognitive penetration of colour experience: Rethinking the issue in light of an indirect mechanism. *Philosophy and Phenomenological Research, 84*(1), 24–62.

McDowell, J. (1994). *Mind and world*. Cambridge: Harvard University Press.

McDowell, J. (1998). Reply to Peacocke on mind and world. *Philosophy and Phenomenological Research, 5*(8), 414–419.

Millikan, R. G. (2004). *On clear and confused ideas*. Cambridge: Cambridge University Press.

Millikan, R. G. (2006). Styles of rationality. In S. Hurley & M. Nudds (Eds.), *Rational animals?* (pp. 117–126). Oxford: Oxford University Press.

Milner, A. D., & Goodale, M. A. (1995). *The visual brain in action*. Oxford University Press.

Milner, A. D. & Goodale, M. A. (2010). Cortical visual systems for perception and action. In N. Gangopadhay, M. Madary & F. Spicer (Eds.), *Perception, action, and consciousness* (pp. 71–94). Oxford University Press.

Negyessy, L., Nepusz, T., Kocsis, L., & Bazso, F. (2006). Prediction of the main cortical areas and connections involved in the tactile function of the visual cortex by network analysis. *European Journal of Neuroscience, 23*(7), 1919–1930.

Noë, A. (2004). *Action in perception*. Cambridge, MA: The MIT Press.

Noë, A. (2005). Against intellectualism. *Analysis, 65*, 278–290.

Pantev, C. R., Bernhard, F., Takako, T., Laurel, J., Schulte, M., & Schulz, M. (2003). Music and learning-induced cortical plasticity. In G. Avanzini, C. Faienza, D. Minciacchi, L. Lopez, & M. Majno (Eds.), *The neurosciences and music* (pp. 438–450). New York: New York Academy of Sciences.

Peacocke, C. (1989). Perceptual content. In J. Almog, J. Perry, & H. Wettstein (Eds.), *Themes from Kaplan*. New York: Oxford University Press.

Peacocke, C. (1992). *A study of concepts*. Cambridge: MIT Press.

Peacocke, C. (1998). Nonconceptual content defended (Comment on McDowell's 'Mind and World'). *Philosophy and Phenomenological Research, 5*(8), 381–388.

Pourtois, G., Rauss, K. S., Vuilleumier, P., & Schwartz, S. (2008). Effects of perceptual learning on primary visual cortex activity in humans. *Vision Research, 48*(1), 55–62.

Prinz, J. (2006). Beyond appearances: The content of sensation and perception. In T. Gendler & J. Hawthorne (Eds.), *Perceptual experience* (pp. 434–460). Oxford: Oxford University Press.

Pylyshyn, Z. (1999). Is vision continuous with cognition? The case for cognitive impenetrability of visual perception. *The Behavioral and Brain Sciences, 22*(3), 343–391.

Pylyshyn, Z. (2001). Seeing, acting, and knowing. *Behavioral and Brain Sciences, 24*(5), 999.

Pylyshyn, Z. (2003). *Seeing and visualizing*. Cambridge, MA: MIT Press.

Raftopoulos, A. (2001). Is perception informationally encapsulated? *The issue of the theory-ladenness of perception, Cognitive Science, 25*, 423–451.

Raftopoulos, A. (2006). Defending realism on the proper ground. *Philosophical Psychology, 19*(1), 47–77.

Raftopoulos, A. (2009). *Cognition and perception: How do psychology and neural science inform philosophy?*. Cambridge, MA: MIT Press.

Raftopoulos, A., & Müller, V. C. (2006). The phenomenal content of experience. *Mind and Language, 21*(2), 187–219.

Recanzone, G. H., Schreiner, C. E., & Merzenich, M. M. (1993). Plasticity in the frequency representation of primary auditory cortex following discrimination training in adult owl monkeys. *The Journal of Neuroscience, 13*(1), 87–103.

Ryle, G. (1946). Knowing how and Knowing that. *Proceedings of the Aristotelian Society, 46*, 1–16.

Ryle, G. (1949). *The concept of mind*. Chicago: The University of Chicago Press.

Sanes, J. N., & Donogue, J. P. (2000). Plasticity and primary motor cortex. *Annual Review of Neuroscience, 23*, 393–415.

Siegel, S. (2006). Which properties are represented in perception? In T. Gendler & J. Hawthorne (Eds.), *Perceptual experience* (pp. 481–503). Oxford: Oxford University Press.

Siegel, S. (2009). The visual experience of causation. *Philosophical Quarterly, 59*(236), 519–540.

Siegel, S. (2011). Cognitive penetrability and perceptual justification. *Noûs, 46*(2), 201–222.

Stanley, J. (2011a). Knowing (how). *Nous, 45*(2), 207–238.

Stanley, J. (2011b). *Know how*. Oxford: Oxford University Press.

Stanley, J., & Williamson, T. (2001). Knowing How. *Journal of Philosophy, 98*(August), 411–444.

Swallow, K. M., Makovski, T., & Jiang, Y. V. (2012). Selection of events in time enhances activity throughout early visual cortex. *Journal of Neurophysiology, 108*(12), 3239–3252.

Wu, W. (2012). Visual spatial constancy and modularity: Does intention penetrate vision? *Philosophical Studies*, *165*(2), 647–669.