Book Review

The Border Between Seeing and Thinking, by Ned Block. Oxford: Oxford University Press, 2023. Pp. 568.

1. You should read this book

Ned Block has written a book. For most, Block's well-earned reputation as perhaps the most influential living philosopher of mind is reason enough to consider it required reading.

And people are. In its first year of publication, it has already appeared on graduate syllabi as the sole seminar reading, and seemingly every major conference has had a symposium on it. For a book of this length, authorial eminence alone would not ensure this much uptake. The attention is well deserved and not just because it is Block's first book, but more importantly because it is ruthlessly contemporary and agenda setting for *right now*. It is a document of the present—the most important summation of the last ten years of perception research and of where the field is going. Anyone who is seriously interested in how our minds work should read this book (bonus: it's open access).

2. The logical space of theories of perception

Perception science is the most advanced branch of cognitive science, and it is currently our best window into how the mind works. Block's book is his canonical statement on perception, specifically the perception/cognition border. The main theses of the book are, like those of all deep works, easy to state: there is a joint in nature between perception and cognition, and it is characterized by perception trafficking in iconic, nonconceptual, nonpropositional representations, whereas cognition is canonically discursive and conceptual, deploying propositional and iconic representations.

This is not a pop book. It is a cutting-edge, intricately detailed defence of a specific view of the perception/cognition border. It is a rich read—every time you return to it you will learn more. The breadth of issues and experiments canvassed is impressive, and the arguments, in virtue of their depth, are theoretical cognitive science at its best.

But this is not a book for outsiders. By reading it, you will learn an immense amount, but the uninitiated might walk away thinking that Block versus Green, Quilty-Dunn, Siegel, Firestone, and myself are the most fundamental divides in the philosophy of perception. This would be a skewed view. We all believe in a border between perception and cognition; we just differ on how to draw the line. Some of us are modularists (Mandelbaum 2015, 2018; Firestone & Scholl 2016; Quilty-Dunn 2020a; Clarke 2021); propositionalists (Green 2020; Quilty-Dunn et al. 2023; Hafri et al. 2023); conceptualists (Siegel 2011; Mandelbaum 2018; Neufeld 2020; Quilty-Dunn 2020c; Westfall 2023); dimensional restrictionalists (Green 2020); reasons/revisability theorists (Helton 2020; Hill 2022); or stimulus-dependence proponents (Beck 2018). The disagreements between these theorists are well-defined, serious, and driving the field forward both theoretically and empirically. I agree with Block that these disagreements are the most productive to explore, but they are also inhouse disagreements. Views further afield, such as enactivism, naïve realism, and embodied cognition, are left alone. The competitor views Block focuses on are ones that take there to be a border between perception and cognition yet also take the border to be defined by anything but format or take perception to involve concepts (especially propositional structures).

The book is a landmark achievement. But it is also a piece of contemporary theoretical cognitive science, so isn't short on tendentious claims. In what follows, I'll focus on a few disagreements that seem the most enlightening, even for those who haven't yet read the book.

3. Seeing between a rock and a hard place

Ned Block has been keeping score. In a book filled with accomplishments, the most impressive aspect may be Block's consideration of objections he has received, and the most admirable aspect is how he responds to objections regardless of whether they were lodged by an established figure in cognitive science or a visiting graduate student. I know this firsthand as Block and I have cotaught three seminars on perception and cognitive architecture. I have watched his position evolve as he responded to me and then to our seminar attendees whose work would inspire, inform, and often surpass our own.

His defence of the joint between perception and cognition touches on an array of specialist issues in the philosophy of mind. Take iconicity, for example. Block doesn't fully reject the 'holism' accounts of iconicity one finds in, for example, Green & Quilty-Dunn (2021), in which each part of an iconic representation represents more than one property simultaneously (for example, in a picture, colour and space don't have separate representational vehicles). Nor does he dismiss outright the 'parts principle' accounts, in which parts of an icon correspond to parts of what it represents (ibid.). But Block wants more than these 'Pictorialist' analyses of iconicity, as analogue magnitudes don't

naturally lend themselves to the *holism* or *parts* analyses. Instead, Block prefers an analogue tracking-and-mirroring account, in which changes in the mental representation correspond to changes in the external world (for example, as in Shepard rotation studies).

The characterization of iconicity allows us to approach the book's core question: are perception and cognition two different systems, with one utilizing only nonconceptual iconic representations while the other has both conceptual and propositional representations? Block has many debunking arguments intended to show that perception is not conceptual or propositional. As for positive arguments, he has a chapter (Chapter 6) devoted to using nonconceptual colour perception as evidence for the iconicity of perception. But since that argument has been addressed in detail (Green, ms), I will instead focus on what I think is his strongest argument for the view that perception is iconic and nonconceptual, which aims to show that we can think things that we cannot perceive. One can think X OR Y (or NOT Y) but one cannot see something as a X OR Y (or NOT Y) (note that small caps are used to denote structural descriptions of concepts and angle brackets for properties). For Block, perception doesn't have anything like discrete constituents in the way that language of thought (LoT) might have discrete constituents, role-filler independence, or predicate/argument structure (Quilty-Dunn et al. 2023). We can see something as <brown>, we can see something as <green>, but we cannot see something as <brown or green>. If perception uses a LoT (for example, Quilty-Dunn et al. 2023; Hafri et al. 2023), then why can't we see things disjunctively when we can have thoughts containing disjunctions?

One way of responding to this worry is to argue that Block is conflating the question of what perception can represent with the question of what it can process (Mandelbaum 2019). For example, when discussing cases of binocular rivalry (for example, a house is presented to one eye and a face presented to the other), Block notes that we never end up with a percept that is a face superimposed on a house, or a tiny house superimposed on a face, or any other illusory percepts. Instead, we just end up seeing a house or a face, with alternations between them. However, just because we don't *see* disjunctions doesn't mean that vision can't use disjunctions—we don't see probabilities either but they are still used in perception. Block is correct that we never see something as (for example) <red or green>. But though this is true of our conscious experience, what does that tell us about the format and structure of the perceptual representations that are antecedent to (or underlying) conscious experience?

This problem is ubiquitous. Modularists regularly run together the modularity of processing with the modularity of experience. The former concerns whether there is an informationally sequestered, proprietary database whereas the latter concerns whether our phenomenology (and not just the outputs of perception, whether conscious or not) is fixed by a module's proprietary database in conjunction with the input. Fodor's use of the persistence of perceptual illusions helped solidify the field's tendency to elide these two

questions. Similarly, Firestone & Scholl (2016) ask: if perception is constantly being changed by what we think, then why don't we notice these differences? If our perception of a hill's steepness is changed by the weight of a backpack, then we should be able to look at a steep hill and see its slope change as we put on a heavy backpack (especially given the effect sizes; see Firestone 2013). The persistence of illusory experiences needs to be explained, but that doesn't mean that the explanation will be the same as the one for the modularity of processing. Which is simply to say: the modularity of experience and of processing stand on their own. Accordingly, one can't infer that because disjunctions don't seem to be represented in experience, perceptual processing can't represent disjunctions.

A different approach to Block's problem is to posit many different LoTs (Mandelbaum et al. 2022). One recent proposal posits that LoTs tend to have six properties: discrete constituents, role-filler independence, predicate-argument structure, abstract contents, inferential promiscuity, and logical operators (Quilty-Dunn et al. 2023). It is reasonable to suppose that perceptual faculties evolved prior to cognitive ones (Mandelbaum 2014). Perhaps human vision has its own LoT which includes only the first four or five properties of the full domain-general human LoT. After all, a LoT is supposed to be an amodal *lingua franca*. If modalities have their own unimodal (or multimodal) codes, then we would need a translation from one code to the other (that is, to allow the mapping from one to the other), but such a need would be obviated if perceptual LoTs were proper subsets of cognitive LoTs.

A lasting contribution of this book is the central question it raises: if perception has access to logical operators, where is the evidence for disjunction or negation in perception? I suspect this question will keep researchers busy for the foreseeable future.

4. Modularity and conceptualism

Despite his protestations, Block is a modularist. His main disagreement is with the strongest version of the modularity hypothesis, which predicts no cognitive penetration. Yet the examples of cognitive penetration Block discusses aren't ones that would bother most strong modularists (Firestone & Scholl 2016; Quilty-Dunn 2020c; Clarke 2021; Mandelbaum 2013, 2018), as the cases are either multimodal (for example, the McGurk effect) or attentional (for example, the Necker Cube). In this sense he is closer to the position opened up by Quilty-Dunn (2020a), which allows for widespread effects of attentional cognitive penetration without violating informational encapsulation. What distinguishes these different theorists isn't how much violation of informational encapsulation they allow. They all answer: at most a little. But serious differences can arise when we encounter positive characterizations of modules. And it is here that some internal tension can be found in Block's view: specifically,

between his modularism on the one hand and his nonconceptualism on the other, a combination of views that I think is inherently unstable. To see the problem will require a little stage setting.

Much recent discussion of modularity is due to Firestone & Scholl's (2016) already classic article. But that article was, in essence, a negative piece, one which took modularity to be the null hypothesis in vision science. The logic of the article was that if they could show that the supposed top-down effects were not actually instances of top-down penetration, then we could infer that modularity is safe. But Firestone & Scholl don't offer a positive characterization of modules. And the details of the positive characterization of modularity matter when evaluating Block's position.

So, what is a module? At the very least it is a domain-specific processor, with proprietary information. These processors output a limited range of values: number modules can only output values, cheater-detection modules can only output cheaters, and so on. But the outputs aren't just representations that happen to be caused by (for example) numerosities and cheaters. They couldn't be; numerosities and cheaters are everywhere. You just have to know how to look for them. What makes the cheater-detection module a module is that it outputs representations of cheaters—that is, something *conceptualized as a cheater*. To have any modularity, one has to have conceptualization or one loses the fitness-enhancing benefits of positing modules.

Consider candidate threat-detection modules. Fear-relevant stimuli, particularly snakes and spiders, are detected earlier than other objects in the environment (LoBue & DeLoache 2008, 2010; LoBue 2010). This makes evolutionary sense: snakes and spiders can kill, so identifying them right away, and having their presence break through the haze of perception, is important. But it only works if it is truly snake and spider *detection*.

To serve the function of a module, one can't just nonconceptually parse the shapes of snakes and spiders. Instead one has to see them *as* snakes and spiders. That is, the snake module has to output SNAKE. The output has to be conceptualized for it to play the right role in action (for example, avoidance). What good would a snake-detecting module be if it didn't tell you that there were *snakes* over there? Avoiding them is important enough that it's worth misperceiving garden hoses as snakes, but there is no such advantage in misperceiving hoses as snake-shaped objects. We want modules to inform decisive action in the split-second decisions between seeing a snake and avoiding its bite. The whole point of a module is to have a processor that solves a single problem very quickly by sharply delineating the amount of information it has access to, so as not to court the frame problem. But if the outputs aren't conceptualized, what work are modularity's informational restrictions doing?

Block goes to great lengths to defend nonconceptualism. But the theoretical goods of nonconceptualism sit uncomfortably with the *raison d'être* of modules, whose evolutionary function is to create subsets of mental processes that instantaneously detect the most important stimuli in our environment.

By being a nonconceptualist, Block loses much of the explanatory benefits of modularity.

5. Basic-level conceptualization

Modules are detection mechanisms. Traditional domains for modularity—faces, cheaters, and language—are all eccentric stimuli. Focusing on them seems at odds with the idea that modules function in part to conceptualize basic-level categories (for example, cars, not vehicles or jeeps; Rosch et al. 1976). Yet some have argued that many basic-level concepts are also outputted by perception (Fodor 1983; Mandelbaum 2018).

There are three reasons why we might think basic-level concepts are outputted by perception. First, they are the most abstract categories that are still detectable by shape. Birds tend to look like birds; even though creepers have hooked beaks and finches stout ones, their general shape is reliably similar, whereas birds and fish don't look alike at all. Second, basic-level concepts are often processed faster and more accurately than other concepts. Third, they can be detected with extremely short exposures. The length of these exposures can be truly shocking: basic-level concepts can be activated at thirteen-millisecond presentation rates even when masked with other pictures. As Block points out, subjects can detect basic-level stimuli even when they see twelve in a row in 156 milliseconds, less time than it takes to blink (Potter et al. 2014). Block also notes that these stimuli aren't always basic level, as they sometimes are actions such as 'bear-catching-fish'. But these examples include relations among basic-level categories. Consequently, we end up with even more evidence for the view that perception outputs relations and is thus propositional (Quilty-Dunn 2020b; Hafri & Firestone 2021).

Block is unconvinced that these data imply that there are concepts outputted by perception. First, he claims that the speed and accuracy advantage of basic-level concepts is baked into their functional characterization. He writes, 'postperceptual basic-level categorization is faster [than non-basic level categorization] because ... well, part of the definition of the basic level is that conceptualization at that level is faster and more accurate' (p. 330; ellipsis in original). Though Block is correct that the basic-level is functionally characterized, its characterization is not just 'that which is detected fastest'. Instead, basic-level concepts tend to be the middle of a taxonomic hierarchy (not completely abstract like OBJECT or specific like HOODED WARBLER, but like BIRD), monomorphemically lexicalized, acquired early in development, and so forth (see Mandelbaum 2018). None of those properties entail speed or accuracy advantages in perception.

Block also criticizes Potter's use of conceptual masks, pointing out that Maguire and Howe's (2016) subjects failed to activate concepts given thirteen-millisecond. exposures when using line and edge masks. However,

the dialectic here is skewed. Maguire and Howe *replicated* the Potter categorization task with thirteen-millisecond presentations, even when using landscape and 1/f noise masks. For geometric masks, the effect was replicated at twenty-seven milliseconds', and for coloured-line masks at fifty-three milliseconds, both incredibly short presentation times. Thus, the effect exactly replicates under two of the four mask types, and is close to replicating under the other ones. If anything, this seems like a vindication of Potter. Moreover, when Howe (2017) later tried the same coloured-line masks, he found feedforward categorization of natural scenes (*inter alia*) with just thirty-one-millisecond exposures.

Regardless, the evidence for modular conceptualization does not stand or fall with Potter (and to be clear, modular conceptualism does not entail that all the outputs of perception are conceptual). One needn't just look at stimulus presentation rates, but instead can look at whole trials, which—behavioural response and all—can be over in one-hundred milliseconds if one chooses a fast enough dependent variable. For example, one can detect faces (versus animals or vehicles) by saccading to the face in around one-hundred milliseconds. (Crouzet et al. 2010). Orienting to faces seems automatic—people are biased to saccade towards a face even when told to find the vehicle, exactly as one might expect if there were a face module. However, seeing Block's response shows me that in my earlier articles on the topic I hadn't taken enough care in clearly delineating two separate issues in arguing for modular conceptualism. On the one hand, there is the evidence about lightning-fast processing for eccentric properties, ones that themselves can constitute a domain for their own proper processor (such as faces). On the other, there is the evidence for basic-level concepts being outputted from general vision. Here, the best evidence isn't due to presentation rates but instead based on evidence that the moment you can tell that you see anything, you know what it is (but only for basic-level concepts; Grill-Spector & Kanwisher 2005). Nonbasic-level categories which, per hypothesis aren't conceptualized by vision, do show these increases in total processing time and error rate. If basic-level concepts aren't outputted by perception, then why is there no change in reaction time or error rates?

6. The big picture: what good are cognitive science books, anyway?

Being wrong isn't the worst thing. Being boring can be worse, and obscure and boring worse still. We will all spend our careers being wrong about mostly everything. A modest hope is that we are wrong in ways detailed enough that our errors propel the field forward.

Ned Block is human, so also gets some things wrong. But this happens in the context of a big book that makes a number of bold claims: there is a

border between perception and cognition, with perception characterized as iconic, nonconceptual, and nonpropositional. I have been chipping away at these theses, arguing that there are discursive, conceptual representations in perception. If one walked away from this review with the impression that Block and I have deep disagreements, then I have obscured the landscape; we agree far more than we disagree. There is a joint in nature between perception and cognition. Block is right that there is far more nonconceptual, iconic thought in perception than in cognition, and that cognition has LoT representations alongside iconic thought. Our disagreements are about proportions, not ontology. The thesis that there are *no* discursive, conceptual, propositional structures in perception (or outputted by perception) is an exceptionally strong position; I think too strong. But the field should appreciate Block laying out the strongest arguments for a strong position, even if that position is less subtle than the truth may prove to be. This is how cognitive science moves forward: put out a simple, elegant, justifiable, interesting view, argue for it as vigorously as possible, and let critics push back and show where the view may have overstepped.

A thesis needn't be true in order to be successful. What makes it successful is that when it errs, there are morals to be gleaned and the field advances accordingly. Let's focus on what to most may seem like a niche topic, numerical adaptation: our number-processing system's ability to adapt to numerosities. When I read this part of Block's book, I felt a sympathetic pang, as I'd recently heard Sam Clarke present data suggesting that numerical adaptation doesn't actually exist (Yousif et al. forthcoming). There is nothing Block could have done to presage these findings. We all will find our views upended, sometimes right after publication. In the time since Block submitted his final manuscript, a piece of evidence he relied upon to show that there was adaptation to high-level properties was seemingly disproven (though there is more evidence for adaptation to high-level properties—for example, adaptation to facial emotion (p. 75)). If the pace of research moves that fast, why bother writing a cognitive science book?

This question has bugged me for some time. Many of the most productive, deep, insightful cognitive scientists have never written a book, and for good reason: as new evidence comes in, one has to rewrite to stay current. And new evidence is always coming, especially in vision science. Book publishing is much slower than publishing in cognitive science journals, so why bother writing a book when so many of the posits you'll make will be disproven before the release date?

One reason is to give a telescopic view of the field. Part of the role of the philosopher of cognitive science is to be able to look at a broad swath of seemingly unrelated literature and weave together these otherwise disparate strands. In a single chapter, Block can go from looking at numerosity to face perception to phonetics to consciousness to retinotopic adaptation to gender to neuronal fatigue to motion aftereffects to haptic representations

of temperature to the methodology of continuous flash suppression. No one doing the day-to-day drudgery of running a lab—writing grants, analysing data, advising graduate students and postdocs, and the like—can keep their heads up long enough to have both depth of knowledge in their area of expertise and the breadth of knowledge required to see the commonalities between their area and other unrelated parts of cognitive science. It is this morass that gives the philosopher of cognitive science their central purpose. A book in cognitive science isn't meant to get everything right; it's meant to look across the wilds of cognitive science and pull out a simple, elegant, empirically tractable theory for making sense of how the mind works. Block has done exactly that.

This type of project demands relentless energy. Doing first-rate philosophy of perception is *hard*. The evidence is constantly coming in, and the vanguard is in flux. In this work, Block is focused less on arguments with his peers and is instead in conversation with Jake Quilty-Dunn, E. J. Green, and Chaz Firestone. Their work is so novel, so exciting, so pressing that it has to be responded to, and Block spends most of the book responding to it. This is the way cognitive science should be. Each generation makes an evolutionary advance over the last, Kuhn be damned.

People sometimes bemoan the lack of progress in philosophy. I do not know enough philosophy to try to adjudicate whether the discipline, as a whole, advances. But the subfields I know certainly have progressed, and the advances are clear in the philosophy of perception. You cannot do philosophy of perception in your spare time, and the new generation does not. The work of Quilty-Dunn, Green, and Firestone isn't just excellent, it is legitimately exhilarating to anyone who cares about these issues. They aren't serving up objections to old questions; they are opening whole new avenues of research. Seeing the work of that trio (and that of their contemporaries including Will Davies (for example, 2022), Zoe Jenkin (for example, 2023), Kevin Lande (for example, 2023), Matthias Michel (for example, 2023), Jorge Morales (for example, Morales et al. 2020), and Jessie Munton (for example, 2022)) makes the rest of us wonder how we can keep up. The pace of vision science is reason enough to stop working on perception, which many philosophers of mind have done. But not Ned Block. He just keeps on doing the same thing a postdoc would do—plugging away, searching far and wide for evidence, thinking late into the night and arguing with their opponents. Block's book can serve as a blueprint for philosophical work regardless of one's stage of career.

In his final chapter Block says, 'This book has been all about evidence'. It is. Block has spent over half a century on the absolute cutting edge of cognitive science and he has always been all about the evidence. And, blissfully, the evidence is constantly coming in. At the start of this section, I mentioned how Yousif et al. showed that experiments on numerical adaptation were poorly controlled, and in fact it looks like just a version of perceptual scotoma. But in fact, brand new work suggests that maybe there really *is* numerical adaptation

(Myers et al. 2024). By the time this review comes out, who knows what the evidence will show?[*]

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