



## Reasons and Percepts

**The Harvard community has made this article openly available. [Please share](#) how this access benefits you. Your story matters**

Citation	Jenkin, Zoe. 2020. Reasons and Percepts. Doctoral dissertation, Harvard University, Graduate School of Arts & Sciences.
Citable link	<a href="https://nrs.harvard.edu/URN-3:HUL.INSTREPOS:37365853">https://nrs.harvard.edu/URN-3:HUL.INSTREPOS:37365853</a>
Terms of Use	This article was downloaded from Harvard University's DASH repository, and is made available under the terms and conditions applicable to Other Posted Material, as set forth at <a href="http://nrs.harvard.edu/urn-3:HUL.InstRepos:dash.current.terms-of-use#LAA">http://nrs.harvard.edu/urn-3:HUL.InstRepos:dash.current.terms-of-use#LAA</a>

# Reasons and Percepts

A dissertation presented

by

Zoe Jenkin

to

The Department of Philosophy

in partial fulfillment of the requirements for the degree of

Doctor of Philosophy in the subject of Philosophy

Harvard University

Cambridge, Massachusetts

April 2020



Reasons and Percepts

**Abstract**

According to a traditional picture, only conscious, deliberately formed beliefs can be based on reasons. Because beliefs can be based on reasons, they are epistemically evaluable as justified or unjustified. Perceptions are taken to have a starkly different epistemic role. They are considered 'unjustified justifiers,' providing justification without being subject to its norms. I argue, in contrast to this traditional picture, that perceptions can be based on reasons and are thereby epistemically evaluable as justified or unjustified. Drawing on psychological research, I examine three cases of basing on reasons in perception: core cognition, perceptual learning, and crossmodal interactions. The scope of epistemic evaluability is not restricted to belief.

# Table of Contents

1. Title Page .....	i
2. Copyright .....	ii
3. Abstract .....	iii
4. Table of Contents .....	iv
5. Dedication .....	v
6. Acknowledgements .....	vi
7. Introduction .....	1
8. Chapter 1: The Epistemic Role of Core Cognition .....	5
9. Chapter 2: Perceptual Learning and Reason-Responsiveness .....	57
10. Chapter 3: Crossmodal Basing .....	80
11. Conclusion .....	101
12. Bibliography .....	103

*For my parents*

## Acknowledgements

The ideas in this dissertation were developed with the help of many people, and I am very thankful. My advisor, Susanna Siegel, has been a constant source of generosity, guidance, and astute philosophical insight. She went above and beyond in every respect, reading multiple chapter drafts, brainstorming about every argumentative hurdle, and helping me hone my work for conferences and publication. Our conversations about perception and epistemology while making hot sauce, driving to triathlons, and visiting museums were as incredibly useful as our official meetings. Susanna's 2011 paper, "Cognitive Penetrability and Perceptual Justification" sparked the initial ideas for this dissertation, and I am continually inspired by her work. Her energy and creativity are phenomenal—sometimes I suspect she is secretly three different people, because that is the only explanation for how she accomplishes so much. She has been a virtuoso dissertation advisor and a wonderful friend, and I am immensely grateful.

My committee has helped me enormously with developing the ideas in this dissertation. Selim Berker read every chapter with a fine-toothed comb and provided welcome onslaughts of feedback. His lightspeed-paced mind, eagle-eye for argumentative missteps, and kind encouragement have made my work vastly better. Susanna Rinard continually pushed me on how my work fits into the broader normative landscape, helping me step back from preoccupations with internal puzzles. I greatly admire her simultaneous quick-thinking and depth of ideas. Elizabeth Spelke has been a fount of invaluable knowledge. Her own work serves as the inspiration and argumentative grounding for Chapter 1, and I feel very lucky to have gotten the chance to work with her. Her superb feedback on the psychology side of things was only rivaled by her equally superb feedback on the philosophical ideas.

Other Harvard faculty members have been extremely helpful along the way, both in discussing the ideas in my dissertation and in supporting my overall philosophical development. I

am very thankful for guidance from Samantha Matherne, Bernhard Nickel, Mark Richard, Tim Scanlon, and Alison Simmons. The Harvard Metaphysics and Epistemology workshop also improved my work, as well as serving as a regular source of friendship and community.

A large group of philosophers outside the Harvard philosophy department also helped me along the way. Timothy Williamson gave me generous and sharp comments on multiple chapters. Ned Block gave me valuable feedback as well as encouragement, helping me navigate multiple philosophical terrains. Susan Carey has been an inspiration in her dedication to pursuing deep philosophical questions through innovative psychological methodologies. Eric Mandelbaum encouraged me to apply to grad school and introduced me to the awesomeness of cognitive science. For valuable comments in writing and discussion, I also thank Robert Audi, John Bengson, Casey O'Callaghan, Frederique deVignemont, E.J. Green, Christopher Hill, Fiona Macpherson, Ram Neta, Peter Railton, and Nicholas Shea.

My friends and family have been wonderfully supportive throughout the dissertation-writing process. The Harvard graduate student community has been a source of joy, and I am especially grateful for the friendship of Eve Bigaj, Rachael Goodyer, Thomas Pendlebury, and Kate Vredenburg. My mom, dad, and sister have cheered me on unconditionally, and I could not ask for better support.

Finally, Jake Quilty-Dunn deserves immense thanks for both his continual philosophical feedback and for his love. I have become a much better philosopher by talking to him every day. Having conveniently defended a philosophy dissertation a few years ahead of me, he has been endlessly generous in his wisdom and reassurance. I thank him for introducing me to exquisite cats, for making me laugh, and for sharing his extraordinary intelligence.



# Introduction

Perception bridges the gap between our internal and external realities. In *Modularity of Mind*, Fodor writes, “The *point* of perception is, surely, that it lets us find out how the world is, even when the world is some way we don’t expect it to be” (1983, 69). If perception operates free from the tethers of our expectations, we gain both evolutionary and normative advantages. On the evolutionary side, we are able to detect threats and opportunities across environmental contexts, independent of our prior knowledge. On the normative side, we have perceptual experiences that are unadulterated by the messy realm of reasoning. But despite these hypothetical advantages, the fact of the matter is that perception is written through with expectations. While perception is to a large degree insulated from belief, as Fodor was determined to defend, perception has its own rich set of assumptions that inform its processing. The core thesis of this dissertation is that perception’s own embedded information impacts its rational role. Perceptual expectations provide reasons for perceptual experiences, rendering them justified or unjustified.

The idea that perception draws on a rich store of information is by no means new. One of the central points of debate between the empiricists and rationalists in the early modern period was how much of our knowledge is innately housed in perception, and how much is grafted on through reasoning. Berkeley and Descartes proposed competing theories of the mechanisms by which we visually experience depth, differing as to the innateness, multimodality, and logical nature of the process, but agreeing that perception is richly informed by prior information. Such views are the early origins of the view that perception is a locus of intelligence and rationality.

This dissertation is written as three independent but closely interconnected papers. They share both a common methodology and a common argumentative goal. The methodology has two main steps. The first is to engage in relatively a priori theorizing about epistemic concepts, such as the basing relation, reasons, and justification. The second is to examine psychological data for

evidence of these epistemic entities, guided by the understanding gleaned in step one. The result is a picture of how and where these abstract philosophical ideas are manifested in actual human minds.

The shared argumentative goal across these three papers is to show that perceptual states are epistemically evaluable as justified or unjustified. A key foothold toward this goal is a sufficient condition on epistemic evaluability called ‘Reasons then Status’. This condition says that if a mental state is based on epistemic reasons, then it is epistemically evaluable as justified or unjustified. In each paper, I apply this condition to a different type of perceptual process with a corresponding focal experiment. In-depth examination of these psychological experiments reveals key markers of the basing relation, thereby meeting the Reasons then Status condition on epistemic evaluability.

In chapter one, I focus on core cognition, a set of mental systems that lie at the border of perception and belief. Core cognition consists of innate, domain-specific modules that generate basic conceptual representations of objects, agents, and numbers. Core cognition’s borderline states do not fit neatly into either side of the traditional epistemic divide between perception and belief, raising the question of their epistemic role. Focusing on core object representations, I argue that these states are based on reasons and are epistemically evaluable like beliefs, despite their many prototypically perceptual features. I draw on developmental psychology to argue that the core object system manifests key markers of the basing relation, such as epistemic support relations between inputs and outputs, rule-governed causal transitions, motivation of intelligent behavior, and rich inferential role.

In chapter two, I focus on perceptual learning in chess players. I argue that the flexibility of perceptual learning is a way of responding to new epistemic reasons. In these cases, not only are individual perceptions formed in response to stored information, but the body of information stored in the visual system also changes due to experience. This flexibility makes it especially plausible that

these perceptual states are based on reasons and are thereby epistemically evaluable. I also consider the particular epistemic statuses of perceptions formed through perceptual learning.

In chapter three, I focus on crossmodal interactions, in which information from one sensory modality influences processing in another modality. I argue that a perceptual representation from one modality can serve as the epistemic basis for an experience in another modality. I consider psychological results showing that the length of a visible gesture influences the perceived duration of an audible tone. This process is mediated by the perceptual system's Unity Assumption, a stored principle that governs attributions of causation in response to spatiotemporal convergence cues. The sophisticated causal representations involved in this process, as well as its reaches across distinct sensory modalities, make it strikingly similar to standard instances of epistemic basing in cognition.

While sharing an overall structure, each chapter brings out different aspects of the arguments for the epistemic evaluability of perception. Chapter one highlights how reasons that serve as epistemic bases can be both innate and entirely intramodular. Chapter two highlights that perception is sufficiently flexible to meet reason-responsiveness requirements on basing. Chapter three highlights that perceptual reasons can represent sophisticated causal properties and be accessible across mental subsystems. Taken together, these cases provide a comprehensive defense of the claim that perceptual states can be epistemically evaluable.

The role of psychology in these arguments is not only to make epistemic ideas concrete, but also to direct the philosophical inquiry toward untrodden and fertile areas. The three focal cases of core cognition, perception learning, and crossmodal interaction each present a unique set of epistemic puzzles and challenges that are ripe for philosophical exploration. Psychology pushes the boundaries of our armchair philosophical concepts, while simultaneously sharpening their contours. As to where the border is between philosophy and psychology, Ned Block puts the point eloquently: "Both are both!" (Block 2014, 570). While the two disciplines certainly have their share of

differences, in some modes of inquiry they mutually support each other to the extent that they become one joint enterprise.

# Chapter 1

## The Epistemic Role of Core Cognition

Published in *The Philosophical Review*, Vol. 129 No. 2, pp. 251-298, April 2020.

**Abstract:** According to a traditional picture, perception and belief have starkly different epistemic roles. Beliefs have epistemic statuses as justified or unjustified, depending on how they are formed and maintained. In contrast, perceptions are “unjustified justifiers”. Core cognition is a set of mental systems that stand at the border of perception and belief, and has been extensively studied in developmental psychology. Core cognition’s borderline states do not fit neatly into the traditional epistemic picture. What is the epistemic role of these states? Focusing on the core object system, I argue that core object representations have epistemic statuses like beliefs do, despite their many prototypically perceptual features. First, I argue that it is a sufficient condition on a mental state’s having an epistemic status as justified or unjustified that the state is based on reasons. Then I argue that core object representations are based on reasons, through an examination of both experimental results and key markers of the basing relation. The scope of mental states that are subject to epistemic evaluation as justified or unjustified is not restricted to beliefs.

### I. Introduction

According to a traditional picture, perception and belief have starkly different epistemic roles. Beliefs have epistemic statuses as justified or unjustified, depending on how they are formed and maintained. In contrast, perceptions are “unjustified justifiers” (Bonjour 1985, 22),<sup>1</sup> meaning they

---

<sup>1</sup> Bonjour introduces this term in the context of a critique of the traditional picture. Chisholm (1977, 30) uses the term “prime mover unmoved” to describe mental states with this epistemic role.

have the power to justify certain beliefs, but cannot themselves be epistemically evaluated as justified or unjustified (e.g. Pryor 2000, Huemer 2007, Bengson 2015).<sup>2</sup> While this position is most frequently explicitly articulated by epistemic internalists, it is commonly held by externalists as well (e.g. Goldman 1979 [2012], 2008, Lyons 2016a).

Such a view of the epistemic divisions in the mind can be applied most neatly to clear cases of perception and belief. From introspection alone, we might feel satisfied with this epistemic landscape. However, psychology can often point us toward interesting and untapped areas of normative inquiry. The developmental psychology research program on core cognition has uncovered mental states that stand at the border of perception and belief, defying such neat categorization (Carey 2009, Shea 2015). Core cognitive systems are innate perceptual processors that generate basic conceptual representations, such as OBJECT and AGENT.<sup>3</sup> These representations function as constituents of mental states that are crucial for early reasoning and action. Core cognitive systems are fundamental in the development of mature repertoires of empirical knowledge. Because core cognition does not fit neatly into the category of either perception or belief, its epistemic role is unclear.

In this paper, I consider the epistemic role of core cognition, given its unique place in cognitive architecture. Examining this borderline case of perception and belief sheds light on some of the

---

<sup>2</sup> The term ‘unjustified’ denotes lack of a positive justificatory status, and so is ambiguous between having a negative justificatory status and lacking any justificatory status whatsoever. Typically, by ‘unjustified’ I mean having a negative justificatory status, rather than lacking any justificatory status. Some authors use the term ‘anti-justified’ to pick out this property unambiguously (Siegel 2017). The only time I use ‘unjustified’ to mean lacking any justificatory status whatsoever is in the context of the phrase ‘unjustified justifiers’, where I preserve this terminology because it is widely used.

<sup>3</sup> I use all capital letters to denote concepts.

motivations for the traditional view that perception is always an unjustified justifier, and provides some reason to question whether that view is correct.

There is a wide range of questions one could pose about the epistemic role of core cognition. I focus on the basic issue of whether the outputs of core cognition have epistemic statuses as justified or unjustified, as belief do, or whether they are instead outside the scope of epistemic evaluability.<sup>4</sup> I argue that despite core cognition's many prototypically perceptual features, the outputs of these systems do have epistemic statuses. My strategy involves a detailed examination of the psychological features of core cognition to determine which are epistemically relevant and which are not.

The rest of the paper proceeds as follows: In section II, I outline the psychological basics of the core cognitive system for representing objects. In section III, I argue that it is a sufficient condition on a mental state's having an epistemic status that the state is based on epistemic reasons. In section IV, I argue that core object representations are based on epistemic reasons, and thereby have epistemic statuses. In section V, I discuss some objections to this view and attempt to defuse them. I conclude by discussing how focusing on this borderline case sheds light on the wider debate over the differences between the epistemic roles of perception and belief.

## **II. Core Object Cognition**

Core cognition has been investigated in a robust research program over the last thirty years, spearheaded by Susan Carey and Elizabeth Spelke. Carey and Spelke have unearthed at least three

---

<sup>4</sup> Hereafter I abbreviate 'epistemic status as justified or unjustified' as 'epistemic status'. I grant that there are other types of epistemic status that a state might have (e.g. being warranted, constituting knowledge); this is simply a terminological convenience.

core systems: object, agent, and number (Carey 2009).<sup>5</sup> Each relies on a proprietary store of information in its processing (as opposed to drawing on our general set of background beliefs), and integrates that information with sensory data. These systems are informationally encapsulated modules, operating largely independently from both beliefs stored in central cognition and from other perceptual subsystems. Carey hypothesizes that we have evolved these dedicated processing mechanisms because they help us efficiently navigate our environments and identify potential cooperative partners (Carey 2011). There is strong evidence that core cognitive systems are shared with other animals, including non-human primates (Hauser and Carey 1998, 2003, Uller, Hauser, and Carey 2001) and chicks (Regolin and Vallortigara 1995, Chiandetti and Vallortigara 2011).

While all of the core cognitive systems are worth investigating epistemically, I focus on the core object system, both because there is especially strong evidence that it is perception-like, and in order to have sufficient space to discuss one system fully. The core object system, or “object module,” takes in a set of spatiotemporal cues and relies on stored information to generate representations that are informationally richer than the spatiotemporal cues alone (Carey 2009). Evidence for the existence of a distinct object system comes from a wide array of studies on both infants and adults. Kahneman, Treisman, and Gibbs (1992), as well as Pylyshyn and Storm (1988), did much of the seminal work documenting the existence of a perceptual system that tracks mid-sized objects, independent of changes in many of their surface-level features. The representations this system generates are referred to as “object files” and are generally taken to be continuous with core object cognition (Scholl and Leslie 1999, Carey and Xu 2001, Carey 2009).

---

<sup>5</sup> In recent work Spelke proposes that there are as many as six core cognitive systems, including systems for the representation of space, geometrical form, and social persons (Spelke forthcoming).



A typical input to the object module is a minimally processed, early-stage visual representation that encodes a set of spatiotemporal properties. For example, the content of such a representation might be a sphere moving in a continuous arc (Gao and Scholl 2010). Because this state represents the particular type of spatiotemporal pattern it does, it is funneled into the object module instead of into other perceptual subsystems.

Within the object module, an input is classified as corresponding to an object, and the module's proprietary store of information is applied to it. This information consists of a set of constraints on objects' physical and motion properties.<sup>6</sup> The constraints can be formulated as a conditional with an antecedent concerning the inputs and a multi-part consequent concerning the item's properties:

If the typical spatiotemporal cues are present, then this item is...

- Bounded
- Solid
- Coherent
- Disposed to move along continuous trajectories
- Disposed to obey the laws of contact causality
- Disposed to fall when unsupported<sup>7</sup>

Characterizing the constraints of the object module as a conditional with a multi-part consequent is appropriate because once the spatiotemporal cues are present, all of these properties are attributed to the object. We expect a ball arcing through the air to not only continue the smooth motion of

---

<sup>6</sup> The constraints do not include information about object kinds, color, size, or geometric shape. The spatiotemporal input cues to the object module may contain some such information (e.g. size and shape), but it is not used in the module's processing.

<sup>7</sup> There is debate over whether the support constraint is innate or whether it is incorporated into the core object system through a domain-specific learning mechanism. For evidence that the support constraint comes online after three months, see Baillargeon (1998). For further discussion, see Carey (2009).

that arc, but also to bounce off a wall, to not spontaneously divide, and to eventually fall to the floor.

The result of the application of the constraints is an output that attributes these properties to the particular item present. The output represents that an item is an object, meaning it is bounded, solid, coherent, etc. (Carey 2009).<sup>8</sup> This representation has a rich content that goes beyond mere spatiotemporal primitives. The rich content is evinced by the kinds of inferences about objects' physical properties and future motion patterns that core object representations enable.<sup>9</sup>

After these properties are initially attributed to an object, their continued attributions tend to stand and fall together. For example, when an object is shown to be non-cohesive, infants no longer expect it to also be continuous (Huntley-Fenner, Carey, and Solimando 2003) or to obey the laws of contact causality (Muentener and Carey 2010). These results indicate that the object module applies the properties encoded in the constraints as a unit as opposed to in a piecemeal fashion.<sup>10</sup> Just as seeing your cat wearing a tuxedo would make you doubt he would settle for his usual Meow Mix for dinner, seeing an object pass through a wall would make you doubt whether it would obey the laws of gravity.

---

<sup>8</sup> The use of the term 'object' here does not perfectly map onto the use of our ordinary language term 'object'. This term instead picks out the content of a particular kind of psychological state. The term 'Spelke-Object' is often used for this purpose (e.g. Casati 2004, Goldman 2006, Green 2017).

<sup>9</sup> For a discussion of a particular experiment investigating such inferences and behavior (Stahl and Feigenson 2015), see section III.

<sup>10</sup> However there is evidence that basic capacities for tracking object motion are sometimes maintained even when the solidity constraint is violated, as in the "Pulfrich Pendulum" illusion (Wilson and Robinson 1986). There is also evidence that tracking capacities are sometimes maintained in the face of non-cohesion (vanMarle and Scholl 2003). This evidence indicates that the capacity to visually track objects need not always rely on the full-blown outputs of the core object system. The epistemic claims I argue for are specifically about the outputs of the core object system, and these claims are compatible with the existence of some more minimal kinds of object representations (Green 2017).

The core object system is in certain ways paradigmatically perceptual and in other ways paradigmatically cognitive. It is often described as a borderline case of perception and cognition, by both psychologists and philosophers (Carey 2009, Shea 2015, Spelke forthcoming). The topic of the perception/cognition border is notoriously vexed, although there has been some fruitful recent work on the topic (Burge 2010b, Quilty-Dunn 2019, Beck 2018, Block forthcoming). I aim to point out features that the core object system has in common with typical instances of perception and cognition, without taking a firm stance on the nature of the border. If it turns out that core object representations do fall on one or the other side of the perception/cognition border, my epistemic arguments still have significant and revisionary upshots (see section V.vii for further discussion).

The perceptual nature of core object representations is intuitively apparent. When we see a ball moving through the air, we do not merely form beliefs about it. We have a visual experience as of its trajectory, solidity, cohesion, and movement as a bounded whole—properties that are delivered by the core object system. The visual phenomenology of such object representations seems to be of the same kind as the phenomenology of ordinary visual experiences.

There is also experimental support for the perceptual nature of core object representations. There is much evidence that core object representations and the object files that are studied in vision science are convergent phenomena (Scholl and Leslie 1999, Carey and Xu 2001, Carey 2009). Object files are the representations of objects in adults that enable us to visually track and identify objects (Pylyshyn and Storm 1988) and are the objects of visual attention (Pylyshyn 2001). Like core object representations, object files are used for object individuation, tracking, and identification. Both core object representations and object files are produced independently of kind information, are triggered by the same types of spatiotemporal cues, and have set-size limitations of four (Carey and Xu 2001). Given that object files are uncontroversially perceptual, this convergence speaks strongly in favor of the perceptual nature of core object representations.

The core object system is also akin to perceptual systems in its modularity. Modular systems operate automatically over a limited domain of inputs and are informationally encapsulated from central cognition and other cognitive systems (Fodor 1983, Pylyshyn 1999, Firestone and Scholl 2016). Modularity is a hallmark of perceptual systems, as displayed by the persistence of visual illusion even once we discover their causes.<sup>11</sup> Like perceptual systems, the core object system is modular (Carey 2009). It takes in a specific type of spatiotemporal cue as inputs, and relies on a proprietary database in its processing (the constraints). Core object cognition proceeds automatically and independently from processing of other types of information (Xu and Carey 1996). Even an adult with sophisticated theoretical knowledge of physics has the same core object representations as an infant.

The inputs to the core object system are in some ways similar to typical perceptual inputs and in some ways similar to typical cognitive inputs. Perceptual systems take in sensory registration cues, such as patterns of light on the retina, and output states with contents such as 3-dimensional surface arrangements (Burge 2010a). The core object system takes the outputs of these early perceptual systems as its inputs (Spelke forthcoming). Evidence for this claim includes the core object system's ability to operate over information from multiple sensory modalities (Streri and Spelke 1988, 1989) and its sensitivity to motion relative to the 3-dimensional spatial layout rather than relative to 2-dimensional retinal activation (Kellman and Spelke 1983), indicating that its inputs are already significantly processed. These inputs are akin to the inputs to typical perceptual systems in that they are inaccessible to cognition and contain only data about basic physical properties.

---

<sup>11</sup> There are those who deny that perceptual systems are modular (e.g. Churchland 1988, Prinz 2006, Lupyan 2015). I do not claim here that perceptual systems are absolutely modular in the strict Fodorian sense (Fodor 1983), but I do take some degree of modularity to be a signature of perception.

However, they are also akin to typical inputs to cognitive systems in that they have already undergone significant processing and are low-level representations rather than mere sensory registration.

Core cognitive systems are also paradigmatically cognitive in certain key respects. Core cognitive systems are widely taken to be the developmental origins of conceptual thought, due to their innate function of transforming basic input cues into representations that go beyond perceptual primitives such as shape, location, and size (Carey 2009). Furthermore, core object representations are used as premises in inferences about spatiotemporal relations between objects, such as in predicting how objects continue to move once they are out of view.<sup>12</sup> While the initial processing that generates object representations is modular and encapsulated from central cognition, the outputs of the object system are available for reasoning, predicting, and motivating action in central cognition.

The core object system's position at the border of perception and cognition raises the question of whether core object representations have epistemic statuses as beliefs do, or whether they are unjustified justifiers as perceptions are standardly thought to be. In the next section, I approach this question by considering whether core object representations are based on epistemic reasons.

### **III. Basing on Reasons and Epistemic Status**

Underlying the traditional picture, on which beliefs have epistemic statuses while perceptions do not, is the idea that beliefs can be based on epistemic reasons while perceptions cannot. This idea

---

<sup>12</sup> There is good reason to think that core object representations themselves function as premises in inferences, rather than subsequent beliefs formed on their basis, because the young infants who perform such inferences lack an independent concept of objects in central cognition.

can be traced back to the tight conceptual connection between the notion of justification and the notion of having good reasons. For example, consider Conee's definition of justification: "JR: Justification is a matter of having good reason—to be justified in  $\Phi$ -ing is to have the relevant sort of good reason for  $\Phi$ -ing" (Conee 2016).<sup>13</sup> Beliefs that are based on good reasons are typically taken to be justified. Beliefs that are not based on good reasons (e.g. those formed through wishful thinking) are typically taken to be unjustified.

The central issue for present purposes is under what conditions a state is apt for having an epistemic status at all, rather than under what conditions a state has a positive epistemic status as justified. However, the key conceptual connection between reasons and justification is also useful in determining aptness for epistemic status. Underlying the standard take on the different epistemic roles of perception and cognition is the idea that beliefs are apt for having epistemic statuses precisely because they are a type of state that can be based on epistemic reasons. In contrast, perceptual experiences are not considered apt for having epistemic statuses because they are not a type of state that can be based on epistemic reasons. If being based on good epistemic reasons is what makes for an epistemic status as justified, then one might think that states that are of a type that could not be based on good epistemic reasons are exempt from such evaluation. In the game of achieving optimal epistemic justification, states that cannot be based on reasons never even stand a chance at winning, so it does not make sense to criticize them for falling short. It is also natural to think that if a state *is* of a type that can be based on epistemic reasons, that makes it apt for

---

<sup>13</sup> Conee uses 'reason' as a mass noun here, while I typically use it as a count noun to pick out a particular mental state that figures in the epistemic basing relation. Additionally, Conee discusses propositional justification, while my main focus is on doxastic justification. Nonetheless, the conceptual connection he highlights between justification and good reason carries over to the doxastic realm as well.

epistemic evaluation. It is, so to speak, a contender in the game. The following condition sums up this last thought:

**Potential Reasons then Status (PRS):** If a mental state is of a type that can be based on epistemic reasons, then that state has an epistemic status as justified or unjustified.

Determining what types a state belongs to is often a thorny matter. Furthermore, it is often difficult to ascertain which among multiple types that a state may belong to is relevant in a particular instance. To avoid these worries, I use a slightly weaker condition going forward:

**Reasons then Status (RS):** If a mental state is based on epistemic reasons, then that state has an epistemic status as justified or unjustified.<sup>14</sup>

This condition follows from **PRS** if one grants the uncontroversial (and trivially true) additional premise that states that *are* based on epistemic reasons are states that *can* be based on epistemic reasons. **RS** captures the idea that basing on reasons puts a state within the scope of epistemic evaluability as justified or unjustified. While **RS** is a sufficient condition on a mental state's having an epistemic status generally, it is particularly relevant to the question of the epistemic role of core cognition because I argue that core object representations are based on reasons. **RS** could in principle be used to consider whether other mental states, such as fears, desires, emotions, and unambiguously perceptual states, have epistemic statuses.

What is it for a state to be based on reasons? A reason is a consideration in favor of acting or representing the world in a certain way (Scanlon 2014). When a state is based on a reason, that

---

<sup>14</sup> The type of reasons referenced in the RS condition are particularly epistemic reasons because being based on prudential or moral reasons may not be sufficient for a state to have an epistemic status. Corresponding versions of **RS** for the prudential and moral domains may be independently plausible, but I do not seek to defend them here. If one denies that there are distinctions between different flavors of normativity and/or reasons, one could replace 'epistemic status' with 'rational status' and 'epistemic reasons' with 'reasons' in what follows, and the gist of my arguments would be unchanged.

reason is the reason for which the individual has that state (Korcz 2015, McHugh and Way 2018).<sup>15</sup>

The reason for which an individual has a state is her motivating reason.<sup>16</sup> Motivating reasons are reasons that guide an agent's behavior, belief formation, and perhaps the formation of other types of mental states such as emotions or desires (Audi 2015).<sup>17</sup> In contrast to normative reasons, motivating reasons need not always be good reasons, although they can be. I use the standard conception of motivating reasons as mental states of an agent (Davidson 1963, Audi 2001).<sup>18</sup>

Epistemic reasons are roughly truth-related considerations, in contrast to moral considerations, or considerations about one's well-being.<sup>19</sup> Basing on epistemic reasons is a kind of response to epistemic reasons in virtue of the epistemic support those reasons provide (or are taken to

---

<sup>15</sup> For a discussion of the possibility that the basing relation and the reason-for-which relation are not identical, see Rinard (2018).

<sup>16</sup> Motivating reasons are also sometimes referred to as "operative reasons" (Scanlon 1998).

<sup>17</sup> Motivating reasons are also sometimes characterized as reasons that an agent takes to justify her beliefs or actions, or as reasons in light of which an agent believes or acts (Dancy 2000). I prefer a characterization in terms of guidance because "taking to justify" and "acting in light of" are often thought to be conscious activities, and I do not want to assume consciousness is required for a reason to motivate. If these notions are interpreted without a commitment to consciousness, such characterizations are amenable to my discussion.

<sup>18</sup> If the reader prefers an alternative conception of motivating reasons (e.g. as propositions, or as facts), the preferred notion can be substituted throughout.

<sup>19</sup> There are multiple ways of more precisely delineating the domain of the epistemic, and the corresponding notion of an epistemic reason. One might define epistemic reasons as the kind of reasons that can aid in conferring knowledge, or as the kind of reasons that make a proposition probably true, or as the kind of reasons that play a certain technical role in epistemology. These three options are all compatible with my arguments. One other option is that epistemic reasons are reasons that make beliefs (as opposed to actions) rational. This definition is not compatible with my arguments when read as "only beliefs", because I claim that some epistemic reasons make perceptions rational. Less restrictive versions of this definition (e.g. 'reasons that make mental states rational' or 'reasons that can make at least beliefs rational') are compatible with my arguments. For further discussion of these options, see Cohen (2016a, 2016b), Conee (2016), Lyons (2016b), and McGrath (2016).



provide).<sup>20</sup> When this response goes well, it results in the transmission of epistemic support from the basis to the based state. Beyond this basic characterization, I will not offer a full account of the basing relation here. Instead, I rely on an understanding of basing that philosophers with a variety of views on its particulars can accept. I describe my focal cases on the assumption that basing is some kind of causal relation (Armstrong 1973, Moser 1989), but if readers are committed to another account, they can substitute in the details.

The **RS** condition invokes basing *on reasons*. On some views, there may be other basing or basing-like epistemic support relations that do not have reasons as their basis.<sup>21</sup> For example, the transition from perceptual experience to belief might be considered a form of epistemic basing even if perceptual experiences are not considered reasons (e.g. because they do not have a propositional format, and one holds that reasons must be propositional).<sup>22</sup> I leave it open whether there are such other forms of basing that do not involve reasons. What is key for the **RS** condition is that the state in question has an epistemic basis. If one prefers to reserve the term ‘reason’ for a more restricted class of mental states (e.g. only beliefs, or only the bases of conscious, voluntary inferences), one can substitute the term ‘ground’, ‘justifier’, or ‘basis’ where I use ‘reason’.

---

<sup>20</sup> I sometimes use the terms ‘basing on epistemic reasons’ or ‘epistemic basing’ to abbreviate ‘basing on epistemic reasons qua epistemic reasons’. I do not claim that it is sufficient for having an epistemic status that, e.g., a mental state is based on a consideration that is in fact an epistemic reason but is treated solely as a pragmatic reason in the formation and maintenance of the state.

<sup>21</sup> I thank an anonymous referee for raising this issue.

<sup>22</sup> Other potential criteria for reason-hood that might preclude perceptual experiences from being reasons (on certain conceptions of perceptual experience) include having representational content, functioning in inferences, being entirely consciously accessible, being under voluntary control, and being dialectically offerable as justification. For arguments that experiences are in fact reasons, see Pollock and Cruz (1999) and Brewer (1999). For the related claim that experiences can be the grounds of belief, see Alston (1988). For the claim that experiences can be evidence, see Feldman and Conee (1985) and Audi (1993).

In typical cases, basing on reasons results in mediate, rather than immediate justification. Immediate justification is *prima facie* justification that is not even partly constituted by justification for another mental state. Mediate justification is *prima facie* justification that is at least partly constituted by justification for another mental state (Pryor 2000, 2013).<sup>23</sup> For example, when you base your belief that the coffee shop is open on your belief that the time now is after nine am, your justification for the belief that the coffee shop is open partly rests on your justification for the belief that the time now is after nine am.

However, basing on reasons is also compatible with immediate justification. On some views, certain special types of basing on reasons may result in immediate justification when the reasons themselves are unjustified justifiers. On some versions of both epistemic internalism and externalism, perceptual beliefs are immediately justified (e.g. Pryor 2000, Goldman 2006, Lyons 2009). On these views, the justification we have for perceptual beliefs is not at all due to the justification we have for any other beliefs (e.g. background beliefs about the reliability of our perceptual experiences), but is instead due to the phenomenology of perceptual experience (Pryor 2000) or to the reliability of non-inferential perceptual processes (Goldman 2006, Lyons 2009). If one also holds that perceptual experiences are reasons on which perceptual beliefs are based (pace the potential concerns mentioned in the preceding paragraph), then perceptual beliefs will be based on reasons yet still immediately justified, because their bases are unjustified justifiers and thereby lack any justification that could partly constitute the justification of the based state. In section IV.ii, I

---

<sup>23</sup> Pryor defines immediate justification as *prima facie* justification for a belief that is not constituted by justification for any another belief (Pryor 2000). In my definition, I abstract away from belief to mental states generally, so as to be able to more comprehensively apply the notions of immediate and mediate justification to the cases at issue in this paper, which involve core cognitive states as potential mediating sources of justification, rather than only beliefs.

return to the issue of immediate justification with respect to core cognition specifically, and discuss where there is room left for immediate justification on my picture.

**RS** offers basing on epistemic reasons as a sufficient but not necessary condition on a mental state's having an epistemic status, leaving it open whether there are mental states that are not based on reasons but nonetheless have epistemic statuses. While the tight conceptual connection between justification and basing on reasons may make a necessary version of this condition appealing as well, I won't defend it here. One might resist the necessity of basing on epistemic reasons for a state's having an epistemic status because we often say that states are epistemically unjustified precisely because they are not based on epistemic reasons but ought to be (e.g. beliefs formed solely due to association when epistemic reasons were available, or beliefs that result from jumping to conclusions).<sup>24</sup> Refraining from endorsing basing on reasons as a necessary condition on a state's having an epistemic status also leaves it open whether beliefs can gain a status as justified in ways other than basing on reasons (e.g. whether innate beliefs can gain a status as justified through their evolutionary role).

Another avenue of support for **RS** comes from connections between one's reasons, one's mental states, and one's character. The epistemic statuses of an individual's mental states redound on her overall epistemic standing—e.g. having an unjustified belief negatively impacts how one is doing epistemically overall. One's overall epistemic standing should reflect at least one's reasons for believing and acting the way one does. So, when mental states reflect one's reasons, they are apt for having epistemic statuses. Being based on reasons is a paradigm way of reflecting reasons.

---

<sup>24</sup> The necessary version of **PRS** (if a mental state has an epistemic status as justified or unjustified, then it is of a type that can be based on reasons) is not subject to this sort of counterexample, and so may be more appealing than the necessary version of **RS**.

This conception of the connections between reasons, states, and character is also used in debates over moral responsibility. States formed in response to reasons are often taken to reflect a subject's moral character, rendering an individual subject to moral praise and blame for those states (Scanlon 1998, Smith 2005). While different factors (such as the kind of reactive attitudes that a state elicits) may underlie the aptness of normative assessment in the moral domain, there is a key similarity in the idea that the mental states that reflect an agent's character, either moral or epistemic, are subject to normative evaluation.

There is also a central conceptual connection between the notion of basing on epistemic reasons and the notion of inference. Like epistemic basing, inference is standardly taken to be a process that transmits epistemic support when it goes well. However, inference may require additional features that go above and beyond the requirements of basing. For example, inference may require a taking condition (Boghossian 2014) or a discursive format of the states involved (Quilty-Dunn and Mandelbaum, 2018). I do not build any such requirement into my notion of basing, and so leave open the possibility of non-inferential basing. Some fairly uncontroversial examples of non-inferential basing are already available, such as endorsing the content of a perceptual experience (Korcz 2015). So, my arguments that core object representations are based on reasons does not entail that inference occurs in the core object system.<sup>25</sup>

#### **IV. Basing on Reasons in the Core Object System**

---

<sup>25</sup> The core object system and other perceptual systems may well be inferential in the weak Helmholtzian sense, meaning merely that they involve the systematic incorporation of stored information (Helmholtz 1910 [1867]). However, they need not be inferential in the more robust sense that is typically a matter of debate among epistemologists and is often taken to require the active following of a rule (Boghossian 2014).

I use a multi-pronged argumentative strategy in favor of the claim that core object representations are based on reasons. I first outline the details of a particular case of processing in the core object system and explain it in terms of basing on epistemic reasons. Second, I consider some alternative explanations and argue that they are unsatisfactory. Third, I note key properties this case has in common with paradigmatic basing. The final part of my argument comes in section V, in the form of objections and replies, which show that no psychological feature of the core object system precludes it from involving basing on reasons.

#### **IV.i Stahl and Feigenson (2015)**

In a study by Stahl and Feigenson (2015), eleven-month-old infants were shown object motion displays that violated the constraints of the object module.<sup>26</sup> For example, they saw a ball that seemed to pass through a wall, violating the solidity constraint, and a truck that seemed to continue to move in a straight path off a ledge, violating the constraint that objects fall when unsupported. Upon seeing these violations, infants expressed surprise.<sup>27</sup> The infants were then given the opportunity to explore these objects, as well as other objects that conformed to the core cognitive constraints. The infants were more drawn to exploring objects that had violated the constraints than ones that had conformed to them. Furthermore, the infants' exploratory behavior was specifically indexed to the type of violation each object displayed. Infants banged the objects

---

<sup>26</sup> There is much evidence demonstrating the presence of the core object system in infants as young as three and four months (Kellman and Spelke 1983, Streri and Spelke 1988, 1989, Aslin and Johnson 1996). I focus on a study involving older infants because they have the ability to demonstrate behavior in response to their core object representations, which younger infants lack.

<sup>27</sup> This surprise is detected through a looking-time methodology, which is widely used in developmental psychology. Infants look longer when they see something they do not expect. For background on this methodology, as well as a defense in light of critiques, see Carey (2009).

that had violated the solidity constraint (to test for solidity) and dropped the objects that had violated the support constraint (to test for whether they fall when unsupported).

Focusing on the condition in which the ball violates the solidity constraint, the key stages for understanding this case are the input, constraint, output, additional visual experience, reaction, and behavior. The input that the core object system detects is a representation of a set of spatiotemporal cues. The constraints then bring to bear the information that if something has these particular spatiotemporal properties, it is solid, bounded, coherent, etc. The output representation has the content that this item is an object, meaning it is solid, bounded, coherent, etc. The infant also has a visual experience of the object as non-solid due to its apparent motion through the wall. The conflict between the core cognitive output and this visual experience generates a reaction of surprise, so the infant bangs the ball to explore this contradiction.

The key aspects of this case can be described as follows:

**Input**

Content: This part of the surface layout has a particular set of spatiotemporal properties.

**Solidity Constraint**

Content: If something has these spatiotemporal properties, it is solid.

**Output**

Content: This is a solid object.

**Additional Visual Representation**

Content: This object moves through a wall.

**Reaction**

Surprise.

**Behavior**

Bang the object.

An explanation of the infants' mental states and behavior in terms of basing on epistemic reasons says the output state is based on the epistemic reason of the input and the solidity constraint. The

reason for which the infant represents the ball as a solid object is that it displays certain spatiotemporal properties, and that things with these properties are solid.

This explanation makes good sense not only of the infant's object representation, but also of how it motivates her behavior. The infant also has evidence from her visual experience that this object has behaved in a non-solid way by passing through a wall. She is motivated to confirm whether the ball really is non-solid. She represents the ball as solid in core cognition while simultaneously experiencing it as non-solid in her visual experience. This conflict is surprising, and so she explores to settle the matter. Appealing to the general rule contained in the solidity constraint (if something has certain spatiotemporal properties, it is solid) allows us to explain why her object representation contains the information that the object is solid, and thereby why she is justified in exploring the way she does.

In the following sections, I argue that the epistemic basing explanation is the best one, by pointing out similarities this case has with paradigmatic instances of basing (IV.ii), showing why rival explanations fail (IV.iii), and by arguing that none of core object cognition's features preclude it from involving basing on reasons (V).

#### **IV.ii Similarities with Paradigmatic Basing**

In this section I discuss six similarities between the formation of core object representations and paradigmatic instances of basing on reasons: 1) epistemic support relations between contents, 2) epistemic support relations between states, 3) representational states, 4) apt contents, 5) integration in central cognition, and 6) description in epistemic vocabulary.

##### **1) Epistemic Support Relations Between Contents**

An initial reason to think this is an instance of basing on epistemic reasons is that the contents of the input and constraint epistemically support the content of the output. The

information that something has a particular set of spatiotemporal properties, plus the information that if something has these properties, then it is solid, speaks strongly in favor of the conclusion that this object is solid. This mental transition has the structure of a standard modus ponens inference.

## **2) Epistemic Support Relations Between States**

The epistemic support relation does not merely hold between contents, but also between states. The output state is formed directly in response to both the input and the constraint, as is evident from numerous studies documenting the regular causal connections in the core object system between spatiotemporal inputs and outputs that attribute solidity (e.g. Spelke et al. 1992, Hespos and Baillargeon 2001; see Carey 2009 for an overview). This rule-governed connection stands in stark contrast to merely lucky transitions between states whose contents happen to stand in relations of epistemic support. For example, consider someone who first has the beliefs that  $p$  and that if  $p$  then  $q$ . She then gets a bonk on the head resulting in the belief that  $q$ . She transitions between states whose contents stand in a relation of epistemic support, but the resultant belief state is not epistemically supported by the initial belief states. This transition occurs due to brute physical factors, not in virtue of the contents of her mental states or the entailment relations between them. Unlike this kind of lucky epistemic support relation between contents but not states, in core object cognition the output state is formed precisely because the input and constraint epistemically support it, much in the same way we typically reach the conclusion of an inference in reasoning with beliefs.<sup>28</sup> This kind of transition between mental states in virtue of an epistemic support relation is central to the notion of epistemic basing.

## **3) Representational States**

---

<sup>28</sup> This point can also be put by saying that in the bonk-on-the-head case, the subject has propositional but not doxastic justification for the belief that  $q$ . In contrast, in core cognition the output is doxastically justified by the input and constraint.



Another point of similarity with paradigmatic basing is the representational nature of the states involved. The inputs to the core object system are genuine mental representations, as are the reasons that typically figure in epistemic basing in belief. Genuine mental representations stand in contrast to states of mere sensory registration. Retinal states, for example, are not representations and do not have content (Burge 2010a). This makes the earliest stages of sensory registration look quite distant from standard instances of basing on reasons. In contrast, states that are the outputs of early perceptual systems and have spatiotemporal properties as contents are genuine mental representations, and are thereby much more similar to inputs to reasoning in belief.

#### **4) Apt Contents**

The representational states involved in core object cognition have the kind of contents that are apt for participating in instances of the basing relation. An easy way to see this is to imagine the infant's core object processing being replicated as an instance of reasoning in belief, with individual beliefs corresponding to the input, constraint, and output. Consider someone who, through testimony, acquires the beliefs that 1) something has a particular set of spatiotemporal properties and that 2) things with those properties tend to be solid. She then concludes from these beliefs that the thing in question is solid. This process would be an uncontroversial instance of basing on epistemic reasons. This indicates that there is nothing about the contents of the states involved in core object cognition that precludes them from figuring in the basing relation.

#### **5) Integration in Central Cognition**

The outputs of core cognition are integrated in central cognition in much the same way as the results of ordinary reasoning. Beliefs that are based on reasons typically serve as premises in further inferences and motivate behavior. While core object processing is itself modular, its outputs are accessible for reasoning and action in central cognition (Carey 2009). This is evinced by the infant's exploratory response to the contradiction between her object representation and her perception of

the ball's non-solid behavior. The object representation is freely integrated with person-level psychological states, just as beliefs based on reasons typically are.

## **6) Description in Epistemic Vocabulary**

The same sort of epistemic vocabulary that is used to describe reasoning with beliefs in natural language is also often applied to core cognition. Evidence for this point comes from the way core cognitive states are often described as “knowledge,” both among psychologists (Spelke 2000, Carey 2009) and in ordinary discourse. For example, when describing an infant who behaves as the subjects in Stahl and Feigenson (2015) do, we might say that she sees the ball as solid because she knows that objects tend to be solid. The ‘because’ here is the ‘because’ of basing, indicating that we think of the infant’s object representation as based on the input and constraint. In contrast, it is much less natural to say that we know the rules used to transition from photoreceptor activation to early informational states in the primary visual cortex, or that those states are based on photoreceptor activation.

This linguistic evidence is defeasible, and only provides one indication of the presence of the basing relation. We might simply be wrong in our usage patterns, invoking epistemic vocabulary in situations in which it is not appropriate. Furthermore, linguistic intuitions acquired through ordinary discourse may not be fine-grained enough to distinguish between types of epistemic relations and properties. Linguistic evidence must be weighed with many other theoretical and empirical considerations. Nonetheless, the general appropriateness of using epistemic terms is one point in favor of an explanation involving basing on reasons.

Core object processing involves epistemic support relations between both contents and states, mental representations with contents that are typical of basing, integration with central cognition, and it lends itself naturally to descriptions in epistemic vocabulary. These features are all key markers

of the epistemic basing relation. The presence of these features supports the claim that core object representations are based on reasons.

The view that core object representations are based on reasons has implications for the nature of the justification these representations provide. If core object representations are based on reasons, then by **RS** they have epistemic statuses as justified or unjustified, rather than being unjustified justifiers. This in turn means that the justification we have for beliefs formed on the basis of core object representations is mediate rather than immediate justification. When the infant forms the belief that there is a solid object before her in response to her core cognitive representation of an object as solid, the justification she has for this belief is partly constituted by the justification she has for the core object representation—that is, the input and constraints of the core object system. As in a typical transition from one justified belief to another, the justification for the based state stems from the mental state(s) on which it is based. If the basis itself admits of justification (rather than being an unjustified justifier) then the based state has mediate, rather than immediate justification.<sup>29</sup> I have argued that core cognitive representations are in fact candidates for justification, so despite their perception-like nature, the beliefs we form on their basis will be mediately, rather than immediately justified.<sup>30</sup>

---

<sup>29</sup> It is in principle possible to have a picture on which some states have justificatory statuses but nonetheless provide justification in virtue of some other property (e.g. their phenomenology). However, this picture is unmotivated on its own, and would make the states in question disanalogous with beliefs, which are the paradigm states that transmit their justificatory status to subsequent beliefs formed on their basis. For arguments against this picture, as well as further discussion of immediate justification and the epistemic evaluability of perception, see Siegel (2017). Thanks to an anonymous referee for raising this issue.

<sup>30</sup> As noted earlier (footnote 23), Pryor's original definition of immediate justification is justification that is not even partly constituted by the justification of another *belief* (rather than by the justification of another mental state). If one were to use Pryor's definition rather than my modified version, then beliefs formed on the basis of core object representations would still count as immediately justified because their justification is due to the justification of core cognitive representations rather than that of any beliefs. However, it seems truer to the spirit of the notions of immediate and mediate

However, there is still room for immediate justification to play a role in this picture of the epistemology of perception. For one, immediate justification may reside one level lower down in the mind, in the transition from core cognitive expectations to core object representations, rather than in the transition from core object representations to beliefs. That is, core cognitive states may themselves be immediately justified, with the inputs (representations of spatiotemporal properties) and constraints (expectations about objects' solidity, cohesion, motion patterns etc.) of the core object system acting as unjustified justifiers. I claim here that these underlying states provide justification, but I leave it open whether they do so as unjustified justifiers or as states that are themselves within the scope of epistemic evaluability. Given that the core cognitive constraints are largely innate, and so are not formed in the standard way that mental states are formed, it is especially plausible that they are unjustified justifiers.<sup>31</sup> If so, core object representations may themselves be immediately justified, while rendering beliefs formed on their basis mediately justified.

Furthermore, my arguments leave open whether more ordinary perceptual beliefs (ones formed in response to perceptual experiences that do not include core cognitive states) are immediately justified. While object perception is a major part of our perceptual experience, it is by no means all of it. My arguments that the epistemic basing relation occurs in core cognition are specific to that

---

justification to say that such beliefs are mediately justified, rather than counting them as immediate on this technicality, because their justification is very much inherited rather than independent. My modified definition makes this point clear.

<sup>31</sup> One might instead hold that core cognitive constraints are justified in virtue of their evolutionary formation. A second possibility is that core cognitive constraints are justified in virtue of their role as start-up assumptions required to get the agent's belief formation system up and running. For a discussion of such start-up assumptions and their epistemic role, see Railton (2014b). A third possibility is that while the most distinctly innate core cognitive constraints are unjustified justifiers, the aspects of core cognition that are acquired or later modulated through experience (e.g. the addition of a support constraint to the core object system at around three months (Baillargeon 1998)) are justified by the experiences that lead to these changes.

system's psychological features, so one should not generalize an elimination or radical shift in the role of immediate justification from the presence of basing in core cognition alone. A separate examination of the psychological and epistemic features of other perceptual systems is needed in order to determine the prospects for immediate justification in the rest of perception.

#### **IV.iii Alternative Explanations**

The infant's exploratory behavior seems *prima facie* intelligent, so an explanation that traces back to her reasons is a natural starting point. We want to make sense not only of the underlying physical causes of her banging the ball, but also of why it seems rational for her to do so. One might wonder, though, whether any alternative analyses of the process are satisfactory. I consider three such alternatives here.

One might attempt to describe core object processing as merely a response to sensory data. Sensory receptors pick up cues about properties of the ball, and perceptual processing delivers an object representation in response to those cues. However, the sensory data taken alone does not indicate that the object is solid. The pattern of light registration on the retina is perfectly compatible with non-solidity, so given spatiotemporal information derived from sensory data alone, the infant would not be surprised by the movement of the ball through the wall or motivated to test the ball's solidity. To account for the infant's expectations, the influence of a state that contains information about object solidity must be cited. Mental states that contain this kind of rich information and are embedded in a structure of epistemic support look very much like reasons.

One might then admit that reasons are involved in producing object representations, but appeal instead to reasons outside the object system. One might say that object representations are based on our beliefs that objects tend to be solid, rather than on the constraints of the object module. Such

beliefs might be innate, or they might be commonsense or scientific beliefs learned through experience and teaching.

Given that the subjects in these experiments are infants, this account is implausible. Infants' ability to reason about the location of objects is strongly dependent on having some sort of perceptual contact with objects, indicating that their expectations about objects are housed within the core cognitive system, rather than in central cognition (Carey 2009). Unlike adults, they cannot spontaneously reason about how a hypothetical object might move. While an explanation that appeals to beliefs as reasons for object representations may have at least initial plausibility for adults, eleven-month-old infants do not display evidence of having beliefs about how objects behave. It is only via the stored information in core cognition that they expect objects to be solid.<sup>32</sup>

The third, and perhaps most formidable, rival explanation says that the object representation is formed in response to the input and the constraint, but through a merely causal process of information transfer that is not epistemic basing. A proponent of this position might say that core cognitive processing lacks the special epistemic oomph that is present in basing and that allows for the transmission of epistemic support.

This kind of merely causal explanation is plausible for various other mental processes. Associations are the paradigm example of brute causal transitions between representations. When you hear the word 'crime' and then think PUNISHMENT, it is not because your concept CRIME provides reason for the concept PUNISHMENT, but because there is a simple causal link between

---

<sup>32</sup> Furthermore, the potential nonconceptual nature of the solidity constraint and other object constraints may preclude these states from being beliefs. On a standard view, concepts are constituents of beliefs (Fodor 1975). The solidity constraint may fail to meet the generality constraint on concepthood (Evans 1982), and it is not stored in central cognition, where concepts are typically stored and accessed, but rather embedded within a perceptual input analyzer. Infants may represent the solidity constraint within the core object system without having the concept of solidity.

the two concepts in your mind, due to their constant conjunction. The strength of some associations can also be explained by merely causal principles. For example, smells tend to evoke particularly strong emotional memories because of the neural proximity of the olfactory bulbs and the amygdala (which is the seat of emotional experience), rather than due to any particularly strong rational connection between smells and memories (Herz 2016).

Transitions from phonemic to semantic representation within the language faculty are also plausibly governed by merely causal principles rather than by epistemic support relations. The string of phonemes /h/a/t/ does not provide epistemic support for the semantic representation HAT.<sup>33</sup> Despite the fact that this process begins and ends with mental representations, it is structured more like a look-up table than like an inference.<sup>34</sup>

Some learning processes are also governed by merely causal, rather than rational, principles. For example, face recognition abilities originate with an innate predisposition to look at configurations of items that are structured like a human face (e.g. two items above and one below, resembling eyes and a mouth). This looking bias allows an infant's visual system to extract the relevant information it needs to perform detailed facial recognition (Morton and Johnson 1991). The innate face recognition capacity causally enables the development of the mature face recognition capacity by providing it with representations that contain the relevant information (in the form of statistical properties), but the initial minimal three-item representations do not function as reasons that support the representation of particular faces.<sup>35</sup> Shea describes such cases as ones in which the

---

<sup>33</sup> I use slashes to denote separations between phonemes.

<sup>34</sup> Thanks to Jake Quilty-Dunn for suggesting this example.

<sup>35</sup> My claim here is specifically about whether the learning process from the initial looking bias to the face recognition system is driven by reasons. I leave it open whether an individual instance of face perception within the mature system is based on reasons.

formation of new representations is not explicable by the content of any pre-existing representation (Shea 2016).

While association, the phonemes to semantics transition, and the development of face recognition are each amenable to a merely causal explanation, such a story is less plausible for core cognition. A merely causal explanation fails to account for why core cognition's processing rules correspond to epistemic support relations between mental states. Unlike these other mental processes, the core object system's inputs and constraints stand in a structure of epistemic support to its outputs. A merely causal explanation also fails to explain the intelligent nature of the infant's exploratory behavior. Associations do not beg for a rational explanation, and are in fact often taken to be the paradigm of arational cognition. In contrast, we are very tempted to say that the infant in Stahl and Feigenson's experiment is justified in exploring the way she does, and to search for a deeply rationalizing explanation of her action.

The epistemic basing explanation can account for why the principles governing core cognition correspond precisely to epistemic support relations between the input, constraint, and output. It is because the transition occurs in virtue of the epistemic support relations obtaining. When the epistemic support relations are absent (e.g. when the spatiotemporal cues represented in the input do not indicate the presence of an object), a core object representation is not produced. The epistemic basing explanation can also account for the intelligent nature of the infant's behavior. Her exploration (e.g. banging the ball) is justified in virtue of how she expects objects to move and the violation of this expectation that she has just experienced. On the view on which core cognition involves epistemic basing, we can make good sense of her justification for her exploration by tracing it back to the reasons embedded in the constraints of her core object system.

## **V.     Objections and Replies**



My claim that perception-like states such as core object representations are based on reasons is at odds with traditional conceptions of the scope of epistemic evaluability. There are many objections one might have to this claim. Features of core cognition that might motivate such objections include:

- Lack of conscious awareness of reasons
- Presentational phenomenology
- Innateness
- Modularity
- Lack of voluntary control
- Implicit representations
- Status as a borderline psychological kind

Some of these objections involve the role of a subject's perspective on her own reasoning processes, and have been discussed in traditional epistemology. Others arise from the particular psychological features of core cognition, and have not been much discussed elsewhere in epistemology. I argue that none of these objections are successful. My strategy in responding to these objections frequently takes the form of citing examples of basing on reasons in belief that share the controversial-seeming features of core cognition, demonstrating that such features do not preclude a process from being basing on reasons. The psychological properties that may initially seem to be marks of the part of the mind beyond epistemic evaluability can actually occur in instances of basing.

## **V.i Lack of Awareness**

A first objection comes from the idea that awareness of one's reasons plays a crucial role in the basing relation (Moser 1989).<sup>36</sup> The simplest version of this view requires only awareness of

---

<sup>36</sup> In a similar vein, some views of the nature of inference hold that there is a "taking condition" on inference, meaning, "Inferring necessarily involves the thinker *taking* his premises to support his conclusion and drawing his conclusion *because* of that fact" (Boghossian 2014, 5). "Taking" is typically understood as requiring some form of awareness. I stick to discussion of views of the

one's reasons. A second version of this view requires awareness of both one's reasons and the support those reasons provide. A third version of this view also requires awareness of one's response to those reasons (more complex permutations are of course possible (e.g. Tolliver 1982)). A proponent of any view in this family will deny that core object representations are based on reasons, because we are not aware of the inputs or constraints of the core object system, nor of the epistemic support they provide, nor of our response to these states.

However, these views of the basing relation are implausible, independent of the particular arguments about core cognition I make here. There are convincing cases of basing on reasons in belief that do not involve any of these forms of awareness of one's reasons. For example, consider cases of expertise in which knowledge is stored outside of awareness, but nonetheless informs reasoning. A seasoned pilot may have learned certain principles throughout the course of her training, such as how to best angle a plane when landing in different scenarios.<sup>37</sup> When she makes a routine landing, she relies unconsciously and automatically on such principles in her decisions about how to direct the plane (Dreyfus and Dreyfus 1980). She may even be unable to articulate these principles if asked. Nonetheless, it is natural to say that her belief that angling the plane thirty degrees downward is appropriate in her current situation is based on the reason that smaller angles are better for landings on longer runways. It also seems appropriate to say that this belief is

---

basing relation rather than inference here, to leave open the possibility that inference may be a subset of basing, rather than coextensive with it. For more on this point, see my discussion of inference at the end of section III.

<sup>37</sup> In some cases of expertise acquisition, knowledge is at one point conscious and then become unconscious. In other cases knowledge is unconscious throughout the acquisition process. I take either sort of example to be a plausible instance of basing on reasons without awareness.

justified.<sup>38</sup> If these natural verdicts are correct, then there can be instances of basing on reasons resulting in justified beliefs in which the subject is neither aware of her reasons, nor of the epistemic support those reasons provide, nor of her response to those reasons.

An alternative interpretation of such cases of unconscious expertise might say that they involve a nonintellectualist kind of know-how that is distinct from basing on reasons. For example, the pilot might rely on her embodied understanding of how to angle the plane across different conditions, without ever drawing on propositional knowledge.

Two points of reply are pertinent here. First, I do not take basing on reasons and implicit or embodied knowledge to be mutually exclusive. I address this issue in detail in section V.vi. Even when expertise does not involve discrete propositional states, experts' beliefs might nonetheless be based on reasons embodied in rules of their mental systems. These expert beliefs will be evaluable as justified or unjustified depending on how well know-how is governing belief formation in any particular case. Whether we think the pilot's belief that she ought to angle the plane a certain way is based on explicit propositional representations or is a result of nonintellectualist know-how, the intuition remains that the pilot's belief is justified.

Second, while some cases of unconscious expertise may be compatible with a know-how explanation, there are other compelling cases of unconscious basing on reasons that are not. For example, consider beliefs and actions that arise out of unconscious feelings of love. In Jane Austen's *Emma*, Emma is in love with Mr. Knightley, but is entirely unaware of this fact (Austen 2003 [1815]). She sees herself as a matchmaker but never a pawn in the game of romance. Nevertheless, when Mr. Knightley chastises Emma for insulting her tiresome elderly neighbor Miss Bates, Emma reacts with

---

<sup>38</sup> For similar examples of basing on reasons of which one is unaware, see Kornblith (2012, 46) and Quilty-Dunn and Mandelbaum (2018, 5).

extreme shame. She immediately resolves to visit Miss Bates and apologize. With Emma's willful and spirited personality, she would have typically shrugged off any such correction. Her unconscious love of Mr. Knightley, and her corresponding unconscious desire to appear virtuous in his eyes, serve as reasons for her belief that she should visit Miss Bates to atone. Such cases of beliefs and behavior based on reasons arising from unconscious love are common in human psychology, and they typically involve responses to particular discrete reasons rather than wholly non-intellectual skill.

Psychological evidence also supports the claim that there is basing on reasons of which we are unaware. Studies show that subjects who are presented with the first premise of a *modus ponens* inference schema consciously, and the second premise unconsciously, are reliably faster at recognizing the appropriate conclusion to the inference than when the second unconsciously presented premise does not support the conclusion (Reverberi et al. 2012). Subjects were consciously shown a premise of the form 'If  $p$ , then  $q$ ' and then unconsciously shown either a premise of the form ' $p$ ' (completing an instance of *modus ponens*) or a premise not of the form ' $p$ '.<sup>39</sup> This second premise was presented with both forward and backward masks, and was flashed for only 50 ms, which is not enough time for conscious perception in this context. Subjects identified the conclusion ' $q$ ' reliably faster when they had been shown a premise of the form ' $p$ ' than when they had been shown another premise. Subjects seem to be performing an unconscious *modus ponens* inference.

---

<sup>39</sup> For example, subjects were consciously presented with the premise 'If there is a 2, there is a 4', unconsciously presented with the premise 'There is a 2', and then at test shown either '4' or another numerals such as '5' or '8'. The correct conclusion of this inference is 'There is a 4'. When subjects form the belief that there is a 4 they are faster at identifying the 4 (and at subsequently evaluating it as even or odd, as Reverberi et al. also tested).

This experiment also controlled for effects of mere associative priming by unconsciously presenting subjects with a premise of the form ‘ $q$ ’, after being consciously presented with the same premise of ‘If  $p$ , then  $q$ ’. The conclusion ‘ $p$ ’ was not facilitated. The conclusions ‘ $p$ ’ and ‘ $q$ ’ should both be equally associated with ‘If  $p$ , then  $q$ ’, because both appear in the conditional with equal frequency, so associative priming cannot explain the unique facilitation for ‘ $q$ ’ after presentation of ‘ $p$ ’, and not the reverse. An inferential structure is required to explain the data. These results indicate that the unconscious premise can serve as a reason on which the conclusion is based, despite the fact that subjects are not aware of it.

Some forms of categorization may also be instances of the basing relation in which subjects are aware of neither their reasons nor the epistemic support those reasons provide.<sup>40</sup> In thinking that reflects “psychological essentialism”, adults and children form beliefs using the assumption that category members share a hidden essence (Medin 1989, Gelman 2003). While explicit endorsement of an essentialist metaphysics is rare (even among professional philosophers), reliance on essentialist thought patterns is common. This is particularly salient in the case of children, who typically lack explicit theories of kinds or categories. For example, seven-year-olds judge that a raccoon transformed to look and smell like a skunk is still a raccoon, despite its altered physical features (Keil 1989). Three and four-year-olds believe that a cow raised by pigs will still moo and have a straight tail, rather than oinking and having a curly tail (Gelman and Wellman 1991). These beliefs are based on an idea of the animal’s essence or “innate potential”, and the particular set of kind properties that essence engenders, independent of environmental influence. Despite lacking awareness of their own

---

<sup>40</sup> Thanks to an anonymous referee for suggesting the example of categorization.

essentialist ideas (let alone the underlying genetic codes or biological structures), children use them as reasons to support category judgments and predictions.<sup>41</sup>

If we denied such cases were instances of basing on reasons, we would lose the ability to classify them as members of the same family as conscious reasoning, despite their core intuitive and structural similarities. We might also lose the ability to epistemically critique and praise individuals for beliefs formed well or poorly in response to unconscious reasons, in a way that is in line with our common practices. Cases such as the pilot's expertise are precisely those in which we want to give the individual epistemic credit for her skilled belief-formation. Conversely, if the pilot had angled the plane slightly too sharply down despite her years of training, leading to a bumpy landing, we would say that she should have known this angle was suboptimal, and that her belief it was appropriate was unjustified. Given the extent of our psychology that operates unconsciously, any plausible account of the basing relation should not rule out that mental states can be based on reasons of which we are unaware. The presence of such instances of basing without awareness in belief shows that lack of awareness in core object processing cannot preclude core object representations from being based on reasons and having epistemic statuses.

## **V.ii Presentational Phenomenology**

A second objection comes from the idea that perceptual states provide a kind of default justification in virtue of their presentational phenomenology that does not depend on how they are formed or maintained. This position, called *phenomenal conservatism*, puts meat on the bones of the idea that perceptions are unjustified justifiers by appealing to the phenomenology of perceptual experiences to explain why they provide justification without themselves having epistemic statuses as

---

<sup>41</sup> For a related discussion of categorization as inference without awareness, see Siegel (2017, 95-98).

justified (Pryor 2000, Huemer 2007, Chudnoff 2011, Tucker 2013, Bengson 2015). A proponent of phenomenal conservatism might hold that core object representations have presentational phenomenology and so are unjustified justifiers, rather than having epistemic statuses as justified or unjustified.<sup>42</sup>

This objection effectively denies that a mental state's being based on epistemic reasons is sufficient for that state to have an epistemic status (the **RS** condition), by postulating that lacking presentational phenomenology is also a necessary condition on a state's having an epistemic status. According to phenomenal conservatism, having presentational phenomenology is sufficient for a state to be an unjustified justifier (and thereby lack an epistemic status). On this view, if core object representations have presentational phenomenology, then they do not have epistemic statuses, irrespective of whether they are based on reasons, because phenomenology alone is enough to ensure a state is an unjustified justifier.

I grant that core object representations can have presentational phenomenology of the sort that is typical of perceptual states. There is intuitively something it is like to see an object. Furthermore, core object representations bear many of the key psychological markers of perceptual states that typically have presentational phenomenology (e.g. they are formed modularly, they are the objects of visual attention).

However, presentational phenomenology does not preclude a state from having an epistemic status as justified or unjustified. While a full argument against phenomenal conservatism is beyond

---

<sup>42</sup> A phenomenal conservative might in principle grant that some perceptual states have epistemic statuses as justified or unjustified, depending on how they are formed and maintained, yet nonetheless provide default justification in virtue of their phenomenology. This position would allow for a state to be itself unjustified, yet still provide a default level of justification. Typically, the justificatory status of a state determines the amount of justification that state provides. Giving up this principle would significantly disrupt our framework for the transmission of epistemic justification.

the scope of this paper, my positive arguments for the **RS** condition in section III, taken together with my arguments that some mental states are both based on reasons and have presentational phenomenology (such as core object representations), show that phenomenology does not decisively determine a state's epistemic role. Phenomenal conservatism gains much of its intuitive plausibility from the idea that states with presentational phenomenology are not the sorts of states that can be based on reasons, and so can never vary in the amount or source of the epistemic support they provide. I have undermined this idea and defended the **RS** condition, rendering this aspect of phenomenal conservatism implausible. Siegel (2011, 2017) has also argued against phenomenal conservatism from the idea that perceptual experience is cognitively penetrable. If Siegel is correct that perceptual experiences whose etiologies mirror structures of irrational belief formation are irrational, such as wishful seeing, then presentational phenomenology is not enough to guarantee that a state is an unjustified justifier. At the least, the claim that states with presentational phenomenology are unjustified justifiers must be restricted to states that are not based on reasons.<sup>43</sup>

### **V.iii Innateness**

The next two objections I consider come from the idea that in order for a state to have an epistemic status, it must be adequately sensitive to reasons. We do not want to critique states as unjustified if they were never the sorts of states that could respond properly to reasons in the first place, such as brute reflexes. This line of thought is redolent of some views of moral responsibility on which an attitude must be sensitive to evaluative judgments in order for us to be for morally responsible for that attitude (Scanlon 1998, Smith 2005). One might worry that because core object

---

<sup>43</sup> For additional objections to phenomenal conservatism, see Markie (2005, 2006, 2013), Lyons (2011), and McGrath (2013).



representations are produced by an innate and modular system, they do not display the requisite sort of reasons-sensitivity for having epistemic statuses.

I will first consider this worry from the innateness angle. In contrast to information that comes from perceptual learning, the constraints of the core object system are likely fixed from birth, with signatures appearing as early as two months (Aguilar and Baillargeon 1999).<sup>44</sup> There may be some development of the sophistication of infants' ability to reason about objects' stability and support relations over the first year of life (Baillargeon, Needham, and DeVos 1992), but the constraints of the core object system are not malleable in the same way as, for example, learned visual correspondences between shape and color (Witzel et al. 2011). States that are innately hardwired are not appropriate candidates for epistemic evaluation in virtue of how they are formed because they are not formed on the basis of any other states in the first place.

However, while the constraints of the object system are largely innate and immutable, the outputs of the core object system are not. The outputs are generated in response to both the inputs and the constraints, so at any given time they are dependent on the stimuli one is presented with. My claim that core object representations are based on reasons and so have epistemic statuses concerns the outputs of the system, not the constraints. While the innateness of the constraints means that the outputs are formed by relying on the same reasons over time, this does not undermine the idea that the outputs are based on those reasons and so have epistemic statuses.

By point of comparison, consider someone who relies on a principle of induction widely and consistently in her reasoning. The principle says roughly that multiple particular observations

---

<sup>44</sup> Additional evidence for the innateness of the core object system comes from studies with nonhuman primates revealing the presence of a core object system nearly identical to that of humans, indicating the system's shared evolutionary lineage (Hauser and Carey 1998, 2003, Uller, Hauser, and Carey 2001).

together support a generalization. Her belief in the principle of induction may be sticky, in that even if she were to become convinced that the universe is wildly irregular, she would not be able to stop herself from performing induction. We would nonetheless find it apt to consider whether her beliefs formed on the basis of the principle of induction were justified or unjustified. While a lack of sensitivity of one's underlying reason may influence the particular sort of epistemic status one's beliefs merit (e.g. justified or unjustified, and to what degree), it does not preclude a beliefs from having an epistemic status at all. If the immutable nature of the reasons on which a state is based does not preclude that state from having an epistemic status in the case of beliefs, immutable underlying reasons should not preclude core object representations from having epistemic statuses either. The innateness of the constraints of the core object system does not jeopardize the epistemic evaluability of the system's outputs.

One might nonetheless wonder whether the constraints of the core object system themselves have epistemic statuses, so as to have a more complete picture of the epistemic role of core cognition.<sup>45</sup> While I do not have the space for a complete treatment of this issue here, I will sketch its parameters.

The constraints of the core object system do not seem to be based on reasons in the ordinary sense, because they are not formed and/or maintained in virtue of epistemic support. Because they are innate, the constraints are not formed in response to any incoming information whatsoever. They are maintained due to the fixed architecture of the system rather than due to any particular epistemic relations. The constraints' presence in the mind has more to do with the human evolutionary trajectory than with any particular instance of basing on reasons. So, the constraints do not meet the sufficient condition of basing on reasons for having an epistemic status (**RS**).

---

<sup>45</sup> I thank an anonymous referee for raising this question.

However, there may be routes to having an epistemic status other than basing on reasons. **RS** is a sufficient condition on having an epistemic status, not a necessary one. It is still possible, then, that the core cognitive constraints meet some other sufficient condition on having an epistemic status, despite their lacking an epistemic basis. For example, one might take being formed in response to evolutionary reasons over time to be sufficient for having an epistemic status. Or one might think that enabling a fundamental and extensive set of justified mental states is sufficient for having an epistemic status. The constraints of core cognition plausibly meet either of these potential conditions.

Alternatively, if one did not endorse any other sufficient conditions on having an epistemic status, the constraints of the core object system would function as unjustified justifiers, conferring immediate justification on the outputs of the system without themselves being epistemically evaluable. How the pieces fall with respect to the epistemic role of the constraints depends on one's other epistemic commitments, primarily the possibility of epistemic evaluability without basing on reasons.<sup>46</sup>

#### **V. iv   Modularity**

I next consider the lack-of-sensitivity worry from the modularity angle. The modularity of the core object system limits the class of reasons to which core object representations are sensitive.

---

<sup>46</sup> Correspondingly, one might also wonder whether the constraints bear on one's epistemic character. I take the relation between epistemic evaluability and redounding on epistemic character to be straightforward: mental states with epistemic statuses redound on individuals' epistemic characters, while mental states without epistemic statuses do not. We may still need to appeal to such status-lacking mental states to explain some of an individual's behavioral or cognitive tendencies, but they do not make her more or less epistemically rational overall. So, if core cognitive constraints have epistemic statuses, they will bear on her epistemic character, and if they do not, they will not. The outputs of the core object system will nonetheless bear on her epistemic character, because their epistemic evaluability is not hostage to the epistemic evaluability of the constraints.

Because the system is modular and informationally encapsulated, beliefs in central cognition do not influence how core object representations are formed. However, the fact that the class of reasons used in a state's formation is limited does not disqualify the state from having an epistemic status. Very often we want to say that a given belief has an epistemic status as unjustified precisely because it is not based on some of an individual's reasons. For example, consider a person who believes global warming is a hoax solely on the basis of what she hears on Fox News, despite also hearing and accepting various particular pieces of scientific evidence that the atmospheric temperature is increasing. We would say that her belief that climate change is a hoax is unjustified because it is based on too small a subset of her reasons. This case demonstrates that basing on a limited set of epistemic reasons is a factor that plays into epistemic evaluation, rather than one that exempts states from evaluability at all.

One might still wonder whether mental states formed by strictly modular systems should be given a different epistemic treatment from those formed on the basis of limited sets of reasons within central cognition. Yet some modularly formed beliefs are based on reasons and have epistemic statuses. Consider the cheater detection module, which is a specialized, informationally encapsulated system that relies on social cues to detect cheaters (Cosmides and Tooby 1992).<sup>47</sup> This module takes in inputs that indicate when individuals have reaped the benefits of a social agreement without paying the corresponding entry requirements. It then relies on stored information in the form of conditionals about how such agreements work, and produces beliefs classifying individuals as cheaters. Despite the fact that these beliefs are only sensitive to the inputs and the limited store of information in the module, it is nonetheless natural to say that when the module is working

---

<sup>47</sup> For criticism of the view that there is a cheater detection module, see Sperber, Cara, and Girotto (1995).

properly, the beliefs it produces about cheaters are justified because they are formed on the basis of reasons about the conditions on being a cheater and whether those conditions are met. For example, the automatic judgment that a sixteen-year-old drinking beer is breaking a rule seems justified, despite the fact that this judgment is the output of the cheater detection module rather than of a process of slow, deliberate inference in central cognition. If modularity in belief does not preclude states from having epistemic statuses, the modularity of the core object system should not preclude its outputs from having epistemic statuses either.

## **V.v Voluntary Control**

A related worry is that core cognitive processing is outside of the agent's voluntary control, and that only states under an agent's voluntary control are truly based on reasons and thereby have epistemic statuses. This position has connections to the debate over the criteria for moral responsibility, where some theorists take voluntary control (of at least some sort) to be a precondition for moral responsibility (e.g. Fischer and Ravizza 2012). This view originates in the Kantian doctrine of "ought implies can" (Kant 1997 [1787]). One might hold that there is an analogous notion of epistemic responsibility for which voluntary control is also required, and that we must be epistemically responsible for a state in order for it to have an epistemic status.<sup>48</sup> One might then object to the epistemic evaluability of core object representations on the grounds that they are not voluntarily formed.

---

<sup>48</sup> In the rest of this section, I take the scopes of epistemic evaluability and epistemic responsibility to be the same. The states that are epistemically evaluable are the ones for which we are epistemically responsible. One might argue that these notions can come apart, but for my purposes here they can be treated as having the same extent.

There are a number of reasons to question voluntary control requirements on responsibility, in both the moral and epistemic domains. First, there is debate over whether ordinary belief formation is typically under voluntary control, calling into question the legitimacy of voluntary control requirements on normative evaluation (Alston 1989). Even granting that some belief formation is voluntary, volitionalism is not the only game in town. There is a prominent set of non-volitionalist views on the conditions on responsibility, which deny that control is required for responsibility for attitudes or actions (e.g. Adams 1985, Scanlon 1998, Smith 2005, Arpaly 2006, Sher 2006). Such views offer alternative conditions on responsibility, such as the appropriateness of asking for reasons for an attitude or action (Scanlon 1998), or an attitude's standing in rational relations to our evaluative judgments (Smith 2005). These views have the significant advantage of accommodating many of our most basic normative practices of evaluation. Non-volitionalist views can explain how and why we hold people morally responsible for involuntary omissions, such as forgetting a good friend's birthday (Smith 2005), or leaving a dog in a hot car (Sher 2006). They can also explain why we hold people responsible for outbursts of uncontrolled anger, and for the actions that ensue from them.

The **RS** condition on epistemic evaluability that I argue for here shares much in spirit with non-volitional accounts of moral responsibility. In both cases, the conditions for normative evaluation have to do with a state's relations to reasons, rather than with properties tied to the perspective of the subject, such as consciousness or control. Non-volitionalist views also have a distinct explanatory advantage in the epistemic domain. For example, a non-volitionalist about epistemic responsibility can explain why we might hold someone responsible for booking conflicting appointments, deeming her irrational, even though she did not voluntarily choose to do so (Siegel and Silins 2015). Non-volitionalist views also allow us to give epistemic credit where it is due, such as when a deft logician automatically arrives at the answer to a logic problem through unconscious

reasoning, the regulation of which is outside of her voluntary control. A volitionalist about epistemic responsibility will have trouble dealing all such cases in which a state is involuntarily formed yet our common practice says to accord it an epistemic status. These sorts of cases across normative domains push strongly against a voluntary control requirement on normative evaluation.<sup>49</sup>

Applying this non-volitionalist idea to core cognition, I claim that subjects are epistemically responsible for the outputs of core cognition, despite the fact that these states are produced outside of their control. The transitions of the core object system and the resulting object representations are processes and states of the individual, in the sense that they are attributable to her and redound on her normative standing. Epistemic responsibility goes hand in hand with epistemic evaluability. When we consider what we are like as epistemic agents overall, the scope of consideration includes at least some of the inner happenings of our automatic modules, not exclusively our voluntary belief formation in central cognition. Core cognition exemplifies how the heart of the basing relation can be present in uncontrolled processes. The fact that core cognitive states and processes are outside of our voluntary control does not preclude them from being a part of us.

To illustrate this point further, many of the examples I have already offered in response to the previous objections also directly target the idea that basing on reasons requires voluntary control. Unconscious modus ponens reasoning and the expert pilot's judgments both operate automatically and involuntarily, outside of the agent's control. The cheater detection module is likely outside of even indirect voluntary control, given the strong evidence that it is innate. These examples illustrate that even restricting our consideration to belief formation, control does not seem to be necessary for

---

<sup>49</sup> There is of course much more to say on behalf of both the volitionalist and non-volitionalist camps, but these additional epicycles are beyond the scope of this paper. For further defense non-volitionalist positions, see Scanlon (1998) and Smith (2005).

the basing relation. So, lack of control should not rule out core object cognition as an instance of basing on reasons.

## **V.vi Implicit Representations**

The next objection comes from the idea that the constraints of the object module may be implicit rather than explicit, and that only explicit representations can be reasons on which a state is based. By ‘implicit’, I mean embodied in a transition rule. By ‘explicit’, I mean represented outright, in the content of a state.<sup>50</sup> A standard example of implicit representations is the rules of generative grammar that operate within the language faculty (Chomsky 1986). If the constraints of the core object system are implicit, there are no states stored within the object module with the content that if an object has a certain set of spatiotemporal properties, it is solid, bounded, coherent, etc. Instead, the system simply responds to inputs of certain sets of spatiotemporal properties by producing outputs that represent objects and have the inferential role dictated by attributions of solidity, boundedness, coherence, etc. The constraints are rules of cognitive architecture that govern the system’s operation.

The psychological evidence has not decisively shown whether the constraints of the core object system are implicit or explicit. I next consider how it might impact my arguments if they turn out to be implicit.<sup>51</sup>

---

<sup>50</sup> The terms ‘implicit’ and ‘explicit’ are used in a variety of ways. For example, they are sometimes used to mean ‘unconscious’ and ‘conscious’, respectively. They are also sometimes used to pick out whether or not additional inferences are required to extract information from a system. While these alternative notions may be in some ways relevant to the question at hand, to prevent confusion I stick to the definitions outlined in the text above.

<sup>51</sup> Carey favors a view on which the constraints are implicit (Carey 2009, 104).



Paradigmatic cases of basing on epistemic reasons involve explicit reasons. For example, when a juror deliberates during a trial and forms a belief that the defendant is guilty on the basis of the reasons that 1) the defendant had a strong motive and that 2) the defendant's fingerprints were found on the murder weapon, the juror's belief is based on explicit reasons. It is central to the notion of successful basing that one state provides epistemic support for another. One might worry that implicit representations are not fit to play the role of providing epistemic support. Transition rules simply tell us how to move from one state to another, hopefully while preserving truth. They may not themselves seem to provide epistemic support, but instead merely facilitate its transmission.

Would the implicit nature of the constraints of the core object system preclude the outputs from being based on reasons? A first point is that even if the constraints are implicit, there is still some aspect of the overall reason that is explicit. I proposed earlier that the input and solidity constraint together constitute the reason on which the output is based. The objection from implicitness only affects the constraint, because there is no reason to think the inputs (which are representations of sets of spatiotemporal cues) are implicit. At least part of the reason on which the output is based is explicit, so the process is not such a far cry from a typical instance of basing on explicit reasons.

A second point is that despite the fact that stereotypical cases of basing involve explicit reasons, it is plausible that mental states can in fact be based on implicit reasons. The paradigm case of basing on reasons as deliberation on a jury need not perfectly extend to all cases. Consider beliefs formed in response to information stored implicitly in the language faculty. When someone is presented with a sentence and judges that it is poorly formed without being able to articulate why, it seems right to say that her judgment is based on her reason of e.g. the underlying phrase structure principle, even if that principle is stored as a transition rule in the language faculty.

Or consider again the cheater detection module, which produces beliefs classifying individuals as cheaters. The criteria for cheater-hood stored in the module (such as that if someone is under twenty-one, it is illegal for her to drink) may be stored as transition rules rather than as explicit states, but we would nonetheless say that an individual's belief that someone is a cheater is based on the criteria for cheater-hood embodied in the constraint. For example, we would say that our automatic belief that a sixteen-year-old drinking beer is doing something illegal is based on our knowledge of the age requirements on drinking, even if this knowledge is stored as a rule that modulates transitions between beliefs about age and beliefs about illegal behavior.

Some cases of expertise may also involve basing on implicit reasons. For example, much of the seasoned pilot's knowledge of aviation may be stored as transition rules that govern how she responds in certain contexts rather than as the explicit content of mental states. We would nonetheless say that her belief about how to best land the plane is based on reasons about when different angles are appropriate, even if this knowledge is implicit.

In these examples, when a mental state is based on implicit reasons, the epistemic merit of the transition rule modulates the epistemic status of the outputs, just as it would if it were an explicit state. Our grammatical judgments are justified precisely because of the way the rules of the language faculty work together with linguistic inputs to give rise to verdicts about the acceptability of sentences. In individuals with properly functioning language faculties, the phrase structure principles, in conjunction with sentential inputs, epistemically support judgments of grammaticality. For example, the rule that nouns but not verbs are optionally preceded by determiners (Chomsky 1957), in conjunction with an input of the sentence 'We often go walking on Sundays and then the have a picnic', gives rise to a justified belief that this sentence is ungrammatical. The input alone is not sufficient to confer an epistemic status of justified on the output, because the input says nothing about what sentence forms are acceptable. It is the particular nature of the implicit phrase structure

principle, and the epistemic support it lends when combined with the input, that makes the output justified.

Similarly, the pilot is justified in her belief about how to angle the plane in virtue of the expertise that is housed in the principles governing her skillful responses. To see more precisely how the epistemic quality of implicit representations might modulate the quality of outputs, compare two pilots who form the same belief about how to angle a plane in a given context: a first who has just recently past her licensing exam, and a second with a decade of experience flying. We would likely say that the second pilot is more justified in her belief. The implicit rules that store her expertise and guide her belief formation confer additional justification due to her more extensive experience. To continue the comparison in the other direction, a third aspiring but still unlicensed pilot, with minimal experience and overhasty mechanisms of encoding implicit rules, might happen to form the same belief about the correct way to angle the plane through a lucky guess, even if the rules according to which her system operates are of poor overall epistemic quality. This lucky amateur would be unjustified in her belief due to the poor quality of the implicit rules she relies on, despite her chance accuracy.

Returning to core cognition, if its constraints are implicit, they will similarly modulate the epistemic quality of its outputs, helping to confer a positive justificatory status upon them. As in the case of the language faculty, core cognitive constraints are crucial to the epistemic support provided for the outputs, because the spatiotemporal information represented in the inputs alone is not sufficient for representing objects as solid, bounded, coherent, and so on.<sup>52</sup> If it turns out that the

---

<sup>52</sup> In the cases of both the language faculty and core cognition, the constraints are innate, so experience-based variation in the epistemic quality of the constraints will not occur in the way it does in the pilot example and other cases of learned expertise. There may still be instances of the constraints of these systems malfunctioning or of individuals with selective deficits. Whether such occurrences reduce the epistemic support the constraints provide depends on whether one thinks

constraints of the core object system are implicit, core object representations will nonetheless have epistemic statuses, as indicated by the wide range of plausible cases of basing on implicit reasons.

### **V.vii Not at the Border**

The last objection I consider has a slightly different target from the previous six. Those objections all questioned whether core object representations meet the conditions on having an epistemic status, given certain psychological features. What I call the “not-at-the-border” objection instead grants that core object representations are based on reasons and have epistemic statuses, but claims that this conclusion is not really news about a borderline case of perception and cognition. Instead, it claims that as a matter of descriptive psychological fact, core object representations fall neatly into our extant psychological categories. I address three versions of this objection in turn, and argue that whatever sorts of states core object representations turn out to be with respect to the perception/cognition border, my arguments lead to a significant shift in the epistemic landscape.

One version of the not-at-the-border objection says that object representations are purely perceptual states. This position is often advocated on the grounds that we can entirely explain subjects’ performance on tasks such as object tracking and identification by only appealing to perceptual capacities (see Bogartz, Shinksey, and Speaker 1997 and Melkman and Rabinovitch 1998 for strong versions of this view, and Pylyshyn 2001 and Scholl 2001 for more moderate articulations of it).

If core object representations are in fact strictly perceptual states, then the upshot of my arguments is that some perceptual states can be based on reasons and thereby have epistemic

---

the constraints are unjustified justifiers or are themselves epistemically evaluable. For further discussion on this point, see section V.iii,

statuses. This upshot would be even more destabilizing to the traditional picture of the stark divide between perception and cognition than my original conclusion as stated about a borderline case. If core object representations are entirely perceptual, basing on reasons and epistemic evaluability extend not only as far down as the border of perception and cognition, but also have tendrils into perception itself.<sup>53</sup> While proponents of the traditional idea that perception is never epistemically evaluable may balk at this outcome, my arguments so far regarding lack of awareness, presentational phenomenology, modularity, and voluntary control, show that at least the core cognitive type of perceptual state is apt for having an epistemic status.

A second version of the not-at-the-border objection says that core object representations fall neatly on the cognition side of the perception/cognition border. Some psychologists have claimed that core object representations must be cognitive because they parse the world into discrete units, which is not a task within the realm of perception (Spelke 1988).<sup>54</sup> Core cognition's key role in the ontogenetic origin of concepts also ties it closely to cognition (Carey 2009). This version of the objection would threaten to reduce the significance of my conclusion that core cognitive states have epistemic statuses, because having an epistemic status is a standard property of cognitive states.

A first point in response to this objection is that the view that core object cognition is purely cognitive has fallen out of favor among psychologists, and for good reason. As noted in section II, there is a broad base of evidence that the outputs of the core object system are the same representations that are used to visually track objects (Scholl and Leslie 1999, Carey and Xu 2001).

---

<sup>53</sup> For a defense of the view that perception is epistemically evaluable, see Siegel (2017).

<sup>54</sup> Spelke has since revised her view and now holds, in line with Carey, that core cognitive systems are at the border of perception and cognition (Carey 2009, Spelke forthcoming). The explanation for Spelke's change in view is in part historical. In her earlier work she advocated the view that core object representations are beliefs in order to provide stark opposition to skeptics who denied that core cognition was interestingly distinct from ordinary perception.

Core cognition is also perception-like in its inputs, automaticity, innateness, modularity, and phenomenology. Given these features, core cognition simply does not appear to be a purely cognitive system.

There is a plausible position in the vicinity, though, which is that the core object system is a borderline perceptual/cognitive system that produces cognitive states. While the picture I have been operating with says that core object cognition has borderline processing that produces borderline outputs, this proposal says that core object cognition has borderline processing (e.g. modular like perception but with rich constraints like cognition), but produces strictly cognitive outputs. The truth of this proposal depends on exactly what makes a given state cognitive or perceptual. Given the elusive nature of the perception/cognition distinction (see Beck 2018, Quilty-Dunn 2019, Burge 2010a, 2010b, and Block forthcoming for discussion), even if this proposal were correct, my arguments that core object representations are based on reason would still have substantive epistemic implications. Even if core object representations are beliefs or other cognitive states, their formation is significantly different from standard belief formation. The view I argue for here expands the domain of states that can be epistemic reasons to include unconscious outputs of early perceptual input analyzers and constraints stored within innate, modular systems. It is a substantive epistemic discovery that basing on epistemic reasons can begin so close to the interface between the world and the mind.

A third version of the not-at-the-border objection says that core object representations involve a mix of purely perceptual and purely cognitive states. This position asserts that the core object system is not actually a single unified system, but instead a heterogeneous set of mechanisms that generate multiple types of mental representations for performing different tasks (Block forthcoming). The psychological evidence speaks in favor of a single unified object system through the convergence of success conditions across multiple experimental paradigms (Scholl and Leslie 1999, Carey and Xu

2001, Carey 2009), but even if the mixed view were true there would be significant epistemic implications. The mixed view and my arguments taken together would imply that some purely perceptual states are based on reasons and so have epistemic statuses, and some purely cognitive states are based on reasons that reside farther down in the mind than previously thought possible. Whether the core object system turns out to be purely perceptual, purely cognitive, a mix of both, or squarely at the border, acknowledging that core object representations are based on reasons causes the epistemic landscape to undergo a major transformation.

## **VI. Conclusion**

I have argued here that core object representations are based on epistemic reasons, and so have epistemic statuses as justified or unjustified. Given that core object representations are formed on the basis of reasons that do provide epistemic support, they have will likely have epistemic statuses as justified to some degree. The details depend on one's particular views about how various factors influence justificatory status. Regardless of how these details shake out, the epistemic role of core object representations is more like the standard epistemic role of belief than that of perception.

However, my arguments do not merely neatly slot core object cognition into the belief side of the traditional divide, leaving the overall epistemic picture unchanged. By examining a particular borderline case of perception and cognition in detail, I have made headway toward unearthing which psychological properties are also critical epistemic properties and which are not. The fact that a mental system is unconscious, modular, responsive to sensory input cues, implicit, and in many ways paradigmatically perceptual does not preclude it from involving basing on epistemic reasons.

My arguments here open the door for the idea that other types of states that have been traditionally considered outside the scope of epistemic evaluability, such as perceptions, may in fact be based on reasons and so have epistemic statuses. From here on out, the task is to examine other

potential unconventional instances of basing on reasons with just as careful an eye to the psychological details as I have given to core object cognition here. Ripe candidates include cases in which the formation of a state is dependent upon a particularly rich store of information that may serve as reasons. Examples include the core agent and number systems, perceptual learning, crossmodal interactions, and causal perception. While there may be a joint in nature between perception and cognition, the normative joints in the mind do not all neatly map onto it.



## Chapter 2

### Perceptual Learning and Reason-Responsiveness

**Abstract:** Perceptual experiences are not immediately responsive to reasons. You see a stick submerged in a glass of water as bent no matter how much you know about light refraction. Due to this isolation from reasons, perception is traditionally considered outside the scope of epistemic evaluability as justified or unjustified. Is perception really as independent from reasons as visual illusions make it out to be? I argue no, drawing on psychological evidence from perceptual learning. The flexibility of perceptual learning is a way of responding to new epistemic reasons. The resulting perceptual experiences are epistemically evaluable as justified or unjustified.

#### 1. Introduction

There is a central connection between responding to reasons and rationality. On some views, rationality consists in responding correctly to reasons (Parfit 2001; Kiesewetter 2017; Lord 2018; cf. Broome 2007). Reason-responsiveness also plays a major role in determining which mental states are rationally evaluable, in both the moral and epistemic domains (Fischer and Ravizza 1998; Railton 2014a; Nolfi 2015; McHugh 2017). States that cannot respond to reasons, such as delusions or innate beliefs, are typically exempt from rational evaluation, while states that can respond to reasons are subject to our rational scrutiny.

To see the intuitive motivation for the tight connection between responding to reasons and rational evaluability, consider the persistence of illusions. Even if you know that the lines in the Muller-Lyer illusion are the same length, you cannot help but see one as longer. Your belief about the lines' relative lengths responds to reasons, but your visual experience does not. According to a

common line of thought among epistemologists, it is wrong to call your experience irrational given that no reason could change it. Yet it also seems wrong to say your experience is rational, given that it is formed without consulting reasons at all. Given this apparent isolation from reasons, perceptions are traditionally considered outside the scope of rational evaluation.

Is perception really as independent from reasons as illusions make it out to be? Preliminary support for a ‘yes’ answer comes from the idea that the fundamentals of perception are innate (Fodor 1983; Carey 2009). Perceptual systems for detecting object motion, depth, and human faces are present in infancy, and so appear prior to our acquisition of reasons. Additional support comes from the idea that perception is modular (Fodor 1983). Modular systems respond rapidly and automatically to a limited domain of input. Crucially, they are informationally encapsulated from central cognition, meaning that beliefs and other cognitive states such as desires, fears, emotions, and moods, do not influence their processing (Fodor 1983; Pylyshyn 1999). Cognition is where reasons are typically thought to be housed. If perceptual systems cannot access cognition, one might think that perception is not responsive to reasons, and so perceptual states are not rationally evaluable.

Recent debates over whether perception is rationally evaluable have focused on the possibility of cognitive penetration (Siegel 2011, 2017; McGrath 2013). If cognitive states such as beliefs, fears, or desires influence perceptual experience, those experiences may fail to provide justification. For example, if your desire to win a race causes you to see your opponent as crossing the finish line behind you when she was actually ahead, your cognitively penetrated visual experience may fail to justify the belief that you won. Siegel argues that in such cases, perceptual experience is epistemically downgraded (Siegel 2011, 2017). Cognitive penetration is one way in which perception might respond to reasons and so be rendered rationally evaluable

There is much debate among philosophers and psychologists over how cognitive penetration is best defined and whether it occurs. Proposed definitions of cognitive penetration vary as to whether attentional influences are included, whether both synchronic and diachronic effects are included, whether there must be a semantic connection between cognitive and perceptual states, and how stages of processing are carved up.<sup>55</sup> Some theorists hold that cognitive penetration is rife (Prinz 2006; Lupyan 2015; Block forthcoming), while others argue that perception is informationally encapsulated from cognition and all purported cognitive penetration effects can be explained away (Fodor 1983; Pylyshyn 1999; Firestone and Scholl 2016). The psychological terrain of cognitive penetration is a rocky one.<sup>56</sup>

If perception is not cognitively penetrable, one major epistemic upshot is that the possibility of the irrationality of perception due to cognitive influence is ruled out. However, other interactions between perception and reasons may still render perception rationally evaluable. In this paper, I pursue a line of argument for the claim that perception is rationally evaluable that avoids the complexities of cognitive penetration. I consider whether information stored within a perceptual system can provide a reason on which a perceptual state is based. I consider psychological studies on perceptual learning and argue that in some such cases, perceptual states are based on epistemic reasons and thereby epistemically evaluable as justified or unjustified.<sup>57</sup> While the role of perceptual

---

<sup>55</sup> For definitions of cognitive penetration, see Fodor (1983), Pylyshyn (1999), Siegel (2011), Macpherson (2012), Firestone and Scholl (2016), and Quilty-Dunn (forthcoming).

<sup>56</sup> Siegel's arguments circumvent these worries about cognitive penetration by focusing on perceptual experience, which need not be identical to the outputs of modules (Siegel 2011, 2017).

<sup>57</sup> I abbreviate the phrase 'epistemically evaluable as justified or unjustified' as 'epistemically evaluable'. I grant that there are other forms of epistemic evaluation (e.g., as warranted or unwarranted, as reliable or unreliable); this is a terminological convenience. The kind of epistemic justification I have in mind is doxastic rather than propositional. A state's being epistemically

learning in the epistemology of perception has received some recent attention (Brogaard and Gatzia 2017; Chudnoff 2017; Chudnoff and Chomanski 2017), the idea that the outputs of perceptual learning are based on reasons is as yet unexplored.

Perceptual learning's flexible responses to new information makes it especially plausible that perceptual states are based on reasons. Not only are individual perceptual states formed in response to learned information, but the body of information stored in a system also changes. This flexibility demonstrates that perception is sufficiently responsive to reasons to house epistemic basing. While perceptual learning involves diachronic changes, it does not involve the kind of synchronic cognitive influence that constitutes cognitive penetration. Even without direct influence from cognition, perceptual states can be based on reasons and thereby epistemically evaluable. The debate over the epistemic role of perception does not turn on the truth of modularity.

The rest of the paper proceeds as follows. In §2, I propose a sufficient condition on epistemic evaluability: If a state is based on epistemic reasons, then that state is epistemically evaluable. I also discuss a necessary condition on epistemic basing: A cognitive mechanism can involve epistemic basing only if that mechanism is responsive to epistemic reasons. In §3, I examine perceptual learning experiments on chess masters. I argue that their perceptual mechanisms are responsive to epistemic reasons, meeting the above necessary condition on epistemic basing. In §4, I argue that chess masters' visual states are based on epistemic reasons, meeting the sufficient condition on epistemic evaluability. In §5, I consider what epistemic statuses these perceptions have.

My conclusions are diametrically opposed to views that foreground the special role of consciousness in the epistemology of perception (e.g. Pryor 2000; Huemer 2007; Chudnoff 2011;

---

justified is equivalent to its being epistemically well-founded and a state's being epistemically unjustified is equivalent to its being epistemically ill-founded (Feldman and Conee 1985).

Bengson 2015). On some such views, conscious access to one's reasons is another necessary condition on epistemic evaluability. On other such views, the conscious phenomenology of perceptual experiences precludes their epistemic evaluation. If one takes the epistemic import of consciousness to be an immovable tenet, my arguments will not have much sway. However, if the role of reasons, rather than consciousness, is the driving force in one's epistemology, my arguments here vindicate the epistemically evaluability of perception.

## **2. Conditions on epistemic evaluability**

The relationship between reasons and mental states is often taken to determine the scope of epistemic evaluability (e.g. Nolfi 2015). Beliefs are typically based on reasons and are the paradigm of epistemically evaluable states. But when beliefs are instead formed associatively, they are not epistemically evaluated.<sup>58</sup> Purely physical pains and pleasures are widely thought to operate independently from reasons and so elude rational assessment (Parfit 1984). Desires and emotions are often exempt from epistemic evaluation because they are not sufficiently responsive to epistemic reasons.<sup>59</sup> Imaginative states are rarely epistemically evaluated, and then only when they participate in counterfactual reasoning (Byrne 2005). Imagistic and experiential memories are not standardly epistemically evaluated, whereas beliefs based on such memories often are (Audi 1998).<sup>60</sup> In general,

---

<sup>58</sup> For discussion, see Mandelbaum (2017). Purely physical pains and pleasures are widely thought to operate independently from reasons and to lack rational evaluability (Parfit 1984).

<sup>59</sup> For discussion of the rationality of desire, see Smith (1994), Scanlon (1998), and Railton (2012). For discussion of the rationality of emotions, see de Sousa (1987), Gibbard (1990), Brady (2009), Vance (2014), Cowan (2018), and Dietz (2018).

<sup>60</sup> Memory is unusual because the justification it provides is often taken to be preservative rather than generative, meaning that it simply transfers justification across mental states without modulation or addition (Audi 1998). Whether a given memory is rationally evaluable may depend

whether or not mental states are epistemically evaluable hinges on how they interact with reasons. In the rest of this section, I formulate two conditions on a state's epistemic evaluability stemming from its relationship to reasons.

## *2.1 Basing on reasons*

Epistemic status is not only a property of mental states but also impacts an individual's epistemic standing. An individual with predominantly justified mental states is in better epistemic standing than an individual with predominantly unjustified mental states, all else equal. Epistemic status is not only a measure of how well a state functions within a causal system but is a form of normative evaluation tightly tied to agent-level assessment.

When a mental state is epistemically based on epistemic reasons, it is formed in virtue of the epistemic support those reasons provide.<sup>61</sup> States based on reasons can be evaluated for whether they are formed epistemically well or poorly. When mental states are properly based on good epistemic reasons they are justified. When they are badly based on poor epistemic reasons they are unjustified. A key relation between basing on epistemic reasons and epistemic evaluation is captured by the following condition:

**Reasons then Status (RS):** If a mental state is based on epistemic reasons, then that state has an epistemic status as justified or unjustified.

**RS** proposes a sufficient condition on epistemic evaluability. This condition allows us to

---

not only on how the memory is retrieved but also on how the original remembered state was initially formed.

<sup>61</sup> I sometimes drop the 'epistemic(ally)' modifier in front of 'based' and/or 'reasons' for concision. I have epistemic basing on epistemic reasons in mind throughout.

learn which states are epistemically evaluable by examining how they are formed.<sup>62</sup> When the basing relation is present, we have the raw material needed to perform epistemic evaluations. **RS** picks up on central conceptual connections between the notions of epistemic basing and epistemic justification.

The core of the basing relation is a response to reasons in virtue of the epistemic support those reasons provide. When a state is based on a reason, that reason is a reason for which a belief is held. When a state is properly based on good epistemic reasons, epistemic support is transmitted from the reasons to the based state.

The kinds of reasons that figure in the basing relation are motivating reasons. Motivating reasons are reasons that guide an agent's behavior and mental state formation. They can be good or bad normative reasons. My arguments are compatible with a conception of motivating reasons as mental states (Davidson 1963; Audi 2001) or as facts (Williamson 2000). On the view that reasons are mental states, my arguments show that states within the visual system are reasons on which experiences are based. On the view that motivating reasons are facts, my arguments show that the visual system can grasp and respond to facts in a way that is suitable for use in the basing relation.

While perceptual states provide reasons for belief, they are not typically thought to be themselves based on reasons (Chisholm 1977; Fumerton 1985; Bonjour 2003; Bengson 2015). Their standardly granted epistemic role follows suit. Perceptions are considered 'unjustified justifiers', meaning that while they can justify, they cannot themselves be epistemically evaluated as justified or unjustified (Chisholm 1977). One version of this view, phenomenal conservatism, explains why

---

<sup>62</sup> On many views of the basing relation, a state can also be based on reasons in virtue of how it is maintained (or 'rebased'). I focus on formation because the way perceptual states meet this sufficient condition is through their formation (see §4). If the reader is concerned about the role of maintenance in the basing relation, she can addend 'and/or maintained' to my claims about formation here.

perceptual states provide justification despite lacking epistemic status by appeal to presentational phenomenology (Pryor 2000; Huemer 2007; Chudnoff 2011; Bengson 2015). While epistemic internalists are the prototypical proponents of the view that perceptions are unjustified justifiers, some externalists hold this position as well (e.g. Lyons 2016).

## *2.2 Reason-responsiveness*

While perception regularly incorporates stored information, such as the assumption that light comes from above (Ramachandran 1988), such processes are taken to be mere information transfer rather than epistemic basing. What precludes perceptual states from being based on reasons? A key factor is perception's reluctance to respond to new reasons. Perceptual systems are modular, meaning they are comprised of distinct functional units that respond rapidly automatically to a limited domain of inputs (Fodor 1983). One of the central features of modular systems is that they are informationally encapsulated. They have a proprietary information database, and they cannot access information stored in other parts of the mind. Due to information encapsulation, perceptual states do not change in light of newly acquired beliefs. If you are seeing spots and then learn that those spots are caused by an afterimage, you will nonetheless continue to see them despite your good reason for believing there are no spots out in the world. Systems that respond to inputs in the same way irrespective of reasons do not display an appreciation of epistemic support. Such automatic, unalterable responses look more like brute causal transitions than basing. The reason-responsiveness condition on basing sums up this thought:

**Reason-Responsiveness (RR):** A mental state can be based on epistemic reasons only if it is formed or sustained by a mechanism that is responsive to epistemic reasons.

Given **RR**'s intuitive appeal, as well as the prevalence of related conditions among epistemologists (e.g. Kelly 2002, Wedgwood 2006, Evans 2013, Nolfi 2015, McHugh 2017), it is



important to show that it can be met by perceptual states. Those who antecedently reject **RR** are already one step closer to accepting my conclusion that perceptual states are epistemically evaluable.

**RR** employs the idea of a cognitive mechanism. Examples of mechanisms include perceptual modalities (e.g. vision, audition), circumscribed belief formation systems (e.g. cheater detection (Cosmides and Tooby 1992), and the language faculty (Chomsky 1965). If a system is roughly modular, it is a good candidate for being its own mechanism. Some non-modular systems such as imagination and memory retrieval are also good candidates for being mechanisms in the sense relevant to **RR**.

**RR** applies to mechanisms rather than individual states to allow for epistemic critique of states that fail to respond to reasons when they could have and should have. For example, consider a competent reasoner who supports a politician. She believes the politician is honest and a force for good, based on extensive research. The supporter devotes many hours to canvassing for the campaign. She then receives new evidence that the politician is corrupt. Instead of revising her belief in the candidate's honesty in light of this evidence, she maintains it, perhaps due to an unconscious desire to preserve her self-image as a good judge of character.<sup>63</sup> The supporter's persistent belief that the politician is honest is unjustified precisely because it did not respond to reasons. If **RR** stated that only states that respond to reasons can be based on reasons, then this belief would not count as based on reasons. Yet it does seem to be both based on reasons and epistemically evaluable. At first, the belief that the politician is honest is based on her research and is justified. Later, it is poorly based on the belief that the supporter is a good judge of character. It is now irrational because it neglects the counterevidence of corruption. The version of **RR** that appeals to mechanisms gives

---

<sup>63</sup> This case is plausibly an example of cognitive dissonance, in which individuals feel psychological discomfort at having contradictory beliefs, and then often irrationally suppress one of the beliefs to relieve the discomfort (Festinger 1957).

these correct verdicts, because while the individual belief does not respond to reasons, the supporter's belief-forming mechanism is in general responsive to reasons. This overall capacity allows us to critique failures of reasons-responsiveness in particular cases.

**RR** specifies responsiveness to *epistemic* reasons because responsiveness to moral or pragmatic reasons is not necessary for epistemic basing. For example, a psychopath who can respond to epistemic but not moral reasons still has beliefs that are based on reasons. Psychopaths are still subject to epistemic evaluation, even though on some views they are exempt from moral evaluation (e.g. Watson 2011).<sup>64</sup>

What is it for a mechanism to be responsive to epistemic reasons? A paradigmatic way of responding to reasons is revising one's beliefs in light of evidence. This kind of response is not merely causal but occurs in virtue of the epistemic support that reasons provide. A mechanism that is responsive to reasons need not respond to reasons in every instance of its operation, but it must at least sometimes respond to reasons. Responding to reasons is a broad genus that includes the species of basing on reasons, inference, and reasoning, among others.<sup>65</sup>

Reason-responsiveness crucially involves flexibility. A baker who believes that she should make rhubarb pie for her cousin because she thinks her cousin loves rhubarb pie is in one basic sense responding to a reason. However, the sense of responsiveness at issue in **RR** also requires differential responses when new reasons are encountered. For example, if the baker discovers that

---

<sup>64</sup> If the reader denies that there are different flavors of normative reasons and/or basing, she can substitute 'reasons' for 'epistemic reasons' and rational status' for 'epistemic status' in **RS** and **RR**. The gist of the ensuing arguments remains unchanged.

<sup>65</sup> The requirements on inference may be more stringent than those on basing. For example, there may be a taking condition on inference (Boghossian 2014; cf. Siegel 2017), without there being such a condition on basing or other forms of responding to reason. My arguments do not entail that perception is an instance of inference.

her cousin has only been pretending to like rhubarb out of politeness and then forms the belief that she should make blueberry pie instead, she demonstrates reason-responsiveness. Put simply, a mechanism is responsive to reasons if the way it forms outputs in response to inputs can change in light of new reasons.

### **3. Reason-responsiveness in perceptual learning**

It is often thought that a failure of reason-responsiveness precludes perceptual states from being a locus of the basing relation because they operate according to fixed principles of causal response. In this section, I argue that some perceptual mechanisms are in fact responsive to reasons through perceptual learning, meeting **RR**. Perceptual learning consists in long-lasting changes to how perceptual systems process stimuli, typically caused by repeated exposure to a stimulus-type over time (Gibson 1963).<sup>66</sup> Perceptual learning can improve sensory discrimination (Goldstone 1994), change attentional allocation patterns (Goldstone, Landy, and Brunel 2011), integrate information crossmodally (Shams and Kim 2010), and enable representation of new properties (Gauthier and Tarr 1997).<sup>67</sup>

Here, I focus on the learned perceptual expertise of chess masters. The research program on the cognitive science of chess was kicked off in the 1940's by Adriaan de Groot, and has run strong for the last half-century (de Groot 1965; Milojkovic 1982; Holding 1985; Calderwood, Klein, and Crandall 1988; Charness 1992; Gobet and Simon 1998; Charness et al. 2001; Leone et al. 2014). In one seminal study, William Chase and Herbert Simon showed that chess masters far outperform

---

<sup>66</sup> Some types of perceptual learning are also partly due to maturation (e.g. Smith 2009).

<sup>67</sup> For recent philosophical discussions of perceptual learning, see Connolly (2019), Prettyman (2019a), and Stokes (forthcoming).

novices at reconstructing chessboards after viewing them for only five seconds (Chase and Simon 1973). The explanation for this effect is that chess masters see chunks of pieces that make up salient moves, while novices see only each piece at its individual location. The number of individual pieces far outstrips working memory, whereas the number of chunks is closer to its limits, allowing for more accurate reconstructions. Masters gain this ability from their extensive experience seeing chessboards and considering moves. Their perceptual systems store the information that certain configurations of pieces make up certain useful chunks, so when they encounter those configurations they perceive not only the individual pieces but also the chunks.

There is good reason to think this is truly a perceptual form of learning. Early data from de Groot undermines the hypothesis that chess masters' success at board replication comes from an enhanced memory capacity. When chess pieces are placed on the board at random rather than as if stopped mid-game, masters perform just as poorly as novices at replication (de Groot 1965). In this condition, no useful chunks are present due to the random arrangement, so masters lose their perceptual chunking advantage. They have no special memory for chess pieces beyond what is made perceptually available. Additionally, there is evidence from eye movement recordings that chess masters visually scan the board differently from novices, fixating on fewer locations and saccading with greater amplitude (Charness et al. 2001). These expert patterns of visual attention enable perception of chunks and are in turn directed by them. Chunking in chess is a distinctly perceptual capacity.

The perceptual learning process that enables chunking is a response to reasons. When chess masters' visual systems store the information that a configuration of pieces makes up a chunk, they are responding to reasons of past visual representations of the locations of pieces, together with

knowledge of the available moves.<sup>68</sup> Once this information is stored, perceptual processing uses it to add a layer of content to representations. The system is not fixed and insulated but changes in light of reasons.

Not all changes to perception are responses to reasons. Neural signals sent along the optic nerve change depending on patterns of light on the retina, yet those neural signals are not responses to reasons. Associations can be modulated through conditioning, but association is a paradigmatic antithesis of reasoning, rather than an instance of it (Siegel 2017; Quilty-Dunn and Mandelbaum 2018). Why is perceptual learning in chess a response to reasons, while these cases are not?

In perceptual learning in chess, the changes to perception are both caused by epistemic reasons and occur in response to their reason-giving force. How exactly this response works depends on details of the psychological processing. There are multiple models of how the visual system updates its stored information that are compatible with the empirical evidence. These models differ as to which mental representations drive learning. I will now sketch three such models and locate the reason-responsiveness in each.

On the first model, visual experiences are the starting point for learning. Consciously seeing arrangements of chess pieces on the board causes the visual system to store the information that certain configurations of pieces make up salient chunks. With repeated experience over time, the body of stored information is expanded and reinforced. Visual experiences provide the reasons to which the system responds. Visual experiences are not an unusual source of reasons. They are widely

---

<sup>68</sup> Although this perceptual learning is partially due to cognitive states (the knowledge of available moves), it is not an instance of cognitive penetration because the influence is diachronic rather than synchronic. There is no penetration from belief in individual instances of processing. Even staunch proponents of modularity such as Fodor (1983) allow for such diachronic changes to perception.

taken to provide reasons for endorsing their contents and for forming further beliefs on their basis. In this case, they provide reasons for a change in perception.

Responses to visual experiences contrast with both optic nerve transmission and brute association. The states that kick off these other processes are not apt to play the reasons-role. Reasons are provided by mental states with truth-evaluable contents. Optic nerve transmission is instigated by sensory registration on the retina, which is merely a physical state, not a mental state. The components of associations are typically concepts like SALT and PEPPER that are not truth-evaluable. Unlike these more minimal states, visual experiences are mental states of agents with truth-evaluable contents, and so provide reasons.

Perception responds to reasons from experience by storing information in the visual system. The visual experiences stand in a relation of epistemic support to the states they induce and enforce. Experiences of chess boards and corresponding beliefs about available moves support representations about which configurations make up salient chunks. If the experiences did not epistemically support the changes to perceptual processing (e.g. if they represented different configurations of pieces), this form of perceptual learning would not occur. The changes to perception occur because of the experiences' particular content and the reasons they provide. If perceptual learning in chess is driven by experience, it is a response to reasons.

On a second model of perceptual learning, the visual system responds to unconscious visual representations. While conscious experiences of the chess board are eventually produced, the key triggers in the learning process are earlier states of processing. These states have similar contents to visual experiences, although they may be more minimal in some respects. For example, such a state may conjointly represent the locations of chess pieces without filling in details about their color or texture. Repeated tokenings of these unconscious states causes the visual system to store the information that a configuration of pieces makes up a salient chunk.

This model allows for feedback at an earlier stage than the prior, increasing the system's efficiency. If unconscious states with the relevant information occur in the course of processing, it is unnecessary for perception to rely on conscious experience for learning. States embedded within a system's stream of processing are more easily accessible than its outputs. While there is no direct experimental evidence supporting this model of perceptual learning in chess over an experience-driven model, it has advantages from a design standpoint.<sup>69</sup>

This second model shares many features that make the first one a response to reasons. An unconscious representation of locations of chess pieces is still a fully-fledged mental representation with truth-evaluable content, unlike the representations that instigate optic nerve transmission and association. This state also epistemically supports the stored perceptual information, given that the relevant aspects of its content are the same. The formation and strengthening of stored information still depend on this epistemic support. If the states had different contents that supported storage of different information, that other information would be stored instead. On this second model, perceptual learning is a response to reasons given by an unconscious perceptual state.

Lack of consciousness does not preclude states from providing reasons. Responses to unconscious reasons are pervasive in belief. For example, if a colleague asks when you would like to have coffee on Thursday, you may automatically reply, '4:00 p.m.'. You know that time works without consciously sifting through your schedule. Your belief that 4:00 p.m. is a good time is formed in response to unconscious reasons—e.g. that you teach until 3:30 p.m. and that it takes you half an hour to walk to the coffee shop. These reasons are never conscious, but nonetheless you

---

<sup>69</sup> Some Bayesian models of perceptual updating support this second model. If one is a realist about the priors, likelihoods, and posteriors that are the currency of Bayesian models (i.e. one thinks they correspond to mental representations), then the posteriors serve as reasons to which the priors respond, generating new priors for subsequent use. For Bayesian approaches to perceptual psychology see Stone, Kerrigan, and Porril (2009), Brainard (2009), and Rescorla (2013).

respond to them in forming the belief that 4:00 p.m. is a good meeting time. Unconscious states can provide reasons.

A third model of perceptual learning has a more minimal associative structure. Associative learning involves brute causal connections between representations (Mandelbaum 2017). These unstructured connections are formed and reinforced through repeated exposure. On this model, chess masters' visual systems encode certain chunks as salient due to concurrent representations of locations of pieces, rather than due to reasoning-like structures emerging from representations of pieces and background knowledge.

Given that associations are a paradigm contrast to reasoning (Peirce 1905; Broome 2013; Boghossian 2014; Siegel 2017; Quilty-Dunn and Mandelbaum 2018), a basic associative model may be the limit of responding to reasons in perception. However, such a minimal associative model of perceptual learning in chess is implausible. Temporal contiguity alone does not explain why some configurations of pieces are stored as chunks while others are not, despite all the pieces being viewed simultaneously. Perceptual learning tracks the epistemic support provided by certain piece configurations and certain available moves, which temporal contiguity alone does not account for. There are more sophisticated models of associative learning that take into account factors such as time intervals, regularity of reinforcement, and past predictive success (Rescorla and Wagner 1972) and so have more promise in explaining the data, but such models are also richly structured enough to plausibly be responses to reasons.

There is a diverse range of forms of perceptual learning, encompassing the models outlined here and others. My arguments do not hang on the details of any one experiment. Perceptual learning in chess is an especially compelling case of reason-responsiveness, but other strong candidates abound. Examples include learning to see the novel category of 'Greebles' (Gauthier and Tarr) and learning to hear new phonemes (Logan, Lively, and Pisoni 1991). Abstracting away from



individual experiments, the discussion here illustrates that the perceptual nature of a processes does not preclude it being a response to reasons. While we may debate which states provide reasons and which transitions are driven by epistemic support, the factors upon which reason-responsiveness depends are not intrinsically cognitive.

So far, I have argued that perceptual learning mechanisms are responsive to epistemic reasons. The Reason-Responsiveness condition (**RR**) says that a mental state can be based on epistemic reasons only if it is formed or sustained by a mechanism that is responsive to epistemic reasons. The flexibility of perceptual learning shows that perception meets this condition. Perceptual states are viable candidates for being based on reasons.

#### **4. Epistemic basing in perceptual learning**

The next step in the argument is to show that the outputs of perceptual learning meet the Reasons then Status condition (**RS**). If these perceptual states are based on reasons, then they have epistemic statuses as justified or unjustified.

The reasons on which perceptual states are based differ from the reasons to which perceptual learning mechanisms respond. The perceptual learning mechanism stores chunking information in response to reasons from past representations of pieces and knowledge about available moves. Once the system has learned this chunking information, it provides reasons for visual experience. When a chess master confronts a chessboard, her visual experience of chunks is based on her preliminary visual representations of the locations of individual pieces and her knowledge about which configurations make up salient chunks. The aspects of this basing relation are as follows:

##### **Input**

Content: Chess pieces x, y, and z are in locations a, b, and c.

##### **Stored Information**

Content: When chess pieces x, y, and z are in locations a, b, and c, this makes up chunk C.

**Output (Visual Experience)**

Content: Chunk C is present.

Why is this epistemic basing rather than a merely causal response? First, the input and stored information epistemically support the output, as is characteristic of epistemic basing relations. To see this support relation, consider a scenario in which you are tasked with determining which chunks are present on a chessboard while blindfolded. Your chess tutor tells you where each piece is located, as well as which configurations make up useful chunks. You draw an epistemically justified conclusion about which chunks are present based on this information. This scenario parallels the perceptual processing a chess master undergoes when looking at a chessboard. Just as the blindfolded reasoner's belief is epistemically supported by the reasons from her chess tutor, the chess master's visual experience is epistemically supported by the input and stored information in her visual system.

Second, the input and stored information are apt to provide reasons. The input is not a state of sensory registration, but is already significantly processed. It represents objects at locations. In other contexts, this state might provide reason to believe, e.g. that there is a rook on square C4, or that your opponent's queen has not yet been captured. The stored information is a learned rule represented in the visual system. It was formed in response to reasons from past experience, so it is already shown to interface with reasons. This rule provides reason for seeing chunks whenever the right pieces are at the specified locations.

Third, the transition occurs in virtue of the epistemic support provided by these reasons. The chess master's mind does not just incidentally move from seeing pieces to seeing chunks. It is guided by stored information that consistently and reliably guides visual processing across a range of cases. The epistemic support relation between inputs and outputs does not just happen to be tracked in one case but is consistently tracked whenever these learned perceptual principles are used.

We can also see the epistemic nature of this transition by considering counterfactuals that vary the epistemic support provided. If different information were stored, the output would correspondingly differ, in line with the epistemic support provided. For example, if a chess player were taught non-standard chess rules on which pieces moved differently, she would perceive pieces at the same locations as making up different chunks. The outputs depend on the epistemic support provided by the inputs and stored information, indicating these states stand in an epistemic basing relation.

The basing relations that lead to perceptual states are not conscious or voluntary, making them unlike standard exemplars of basing. One may worry that basing requires conscious access to one's reasons and/or voluntary control, precluding perceptual systems from instantiating basing entirely. Such worries should be assuaged by the profligate cases of unconscious and involuntary basing in the familiar realm of belief. For example, if you ask a lifelong New Yorker which subway line goes to Sunnyside, she may confidently tell you it is the seven, despite being unable to articulate her reasons. In forming this belief, she draws on a broad unconscious base of knowledge about the subway system, but subjectively the belief just seems to pop into her head. If pressed, she may conjecture that her belief was caused by memories of subway maps or a previous experience on the seven, but this would be only post-hoc speculation. Despite lack of consciousness and voluntary control, her belief is based on reasons, just like many of our unscrutinized everyday beliefs. Given the extent of our cognitive lives that operate unconsciously, denying that such beliefs are based on reasons and epistemically evaluable would wrongly exclude a huge swath of beliefs from the scope of epistemic evaluability.<sup>70</sup>

---

<sup>70</sup> There is support for the claim that much of our mental lives are unconscious from a wide variety of perspectives, including dual-systems theory (Evans and Stanovich 2013), classical cognitive architecture (Fodor 1983), and mental logic (Braine and O'Brien 1998).

The last two sections argue that perceptual mechanisms are reason-responsive and that perceptual states are based on reasons. These ideas are mutually supporting. If one accepts that perceptual systems respond to reasons in their storage of new information, then it is natural to think this stored information also provides reasons for perceptual states. Perceptual systems are governed not only by causal principles, but also by reasons.

## **5. Epistemic status**

If the perceptual experiences that result from perceptual learning in chess are based on reasons, then they meet the Reasons then Status condition. They are epistemically evaluable as justified or unjustified. What epistemic statuses do chess masters' perceptions have? The answer to this question depends on whether these states are formed and maintained epistemically well or poorly in response to the reasons provided for them.

Before delving into analyses of these cases, it is worth considering whether the epistemic norms governing perception are the same as those governing belief. Architectural differences between these two parts of the mind, such as the modularity of perception compared to the free-flowing nature of central cognition, may engender corresponding normative differences. Belief may be held to stricter epistemic standards, given that cognition has access to a larger and more diverse store of information than circumscribed perceptual systems.<sup>71</sup> In turn, the justificatory requirements on perception might be less harsh, given that modularity greatly limits the reasons it can access.<sup>72</sup>

---

<sup>71</sup> Although there is also evidence for cognitive modules (e.g. Cosmides and Tooby 1992).

<sup>72</sup> Even given cognitive architecture differences, we might still formulate epistemic norms that are common across perception and belief, so long as they make the standards for justification dependent on the range of reasons a system can access.

A complete treatment of the normative impact of modularity is beyond the scope of this paper. My arguments address the question of whether perceptual states are epistemically evaluable independently from the question of the metrics by which such epistemic evaluation proceeds. However, much of the argumentative force comes from the ways perceptual processing is strikingly similar to belief formation. These similarities also give us reason to think there is much in common between the epistemic norms of perception and belief, at least on a general level. Perceptions and beliefs both meet **RS**, and so are epistemically evaluable because they are based on epistemic reasons. The same basing relation that renders a state epistemically evaluable will also determine its epistemic status, depending on its quality.

When chess masters see a board as segmenting into chunks, their visual experiences are properly based on good reasons and so are epistemically justified. The input <Pieces x, y, and z are at locations a, b, and c,> and the stored information <When pieces x, y, and z, are at locations a, b, and c this makes up chunk C>, epistemically supports the experience <Chunk C is present>. These contents stand in roughly the structure of a modus ponens inference, which is a valid logical form. The reasons used are good ones, making the mental transition sound. The input state arises from an unobstructed, close-up view of a well-lit chessboard, providing high quality information. The stored information is itself well-supported by the masters' extensive experience. There is no other information in the system that undercuts or overrides these reasons. Together, they are sufficient to justify the experience of salient chunks.

The status of the chess master's experience as justified fits with the intuitive idea that experts have an epistemic advantage over non-experts. Not only can they perceive certain properties that amateurs cannot, such as structural chunks, but their experiences are also justified. Amateurs lack not only the capacity to perceive certain properties, but also the robust justification endowed by expertise.

While perceptual learning leads to justified experiences in chess masters, it can also lead to unjustified experiences. For example, consider a mid-level chess player who has a moderate amount of practice seeing chess boards and considering available moves. Her visual system has stored some information about which configurations make up salient chunks, although far less than a master's. When this player encounters a new chessboard, her visual system does not properly respond to its stored reasons. Instead of seeing the chunks that correctly correspond to the configuration on the board, she sees different sets of pieces as making up an alternate, incorrect chunks. Her visual experience is unjustified because the reasons provided by the input and stored information do not epistemically support it. Unjustified experiences will be more common in early stages of perceptual learning, just as unjustified beliefs are more common when reasoners encounter a new cognitive domain.

Another perceptual phenomenon with an interestingly different epistemic structure is memory color (Delk and Fillenbaum 1965; Hansen et al. 2006; Bannert and Bartels 2013). In these experiments, objects appear closer to their canonical colors than they actually are. Grey bananas look yellow and grey Smurfs look blue. Vision draws on justified priors about objects' colors yet ends up with non-veridical experiences. Siegel (2017) argues that such experiences are rationally evaluable because they are the conclusions of perceptual inferences. On the one hand these experiences seem justified in virtue of the well-used priors. On the other hand, the visual system ignores occurrent color processing, looking like a case of neglected evidence. There is heated debate over whether memory color is perceptual learning, cognitive penetration, or not a perceptual effect at all, so I do not take it to necessarily provide further evidence for the basing relation in perception.<sup>73</sup> But the

---

<sup>73</sup> For discussions, see Macpherson (2012), DeRoy (2013), Zeimbekis (2013), Brogaard and Gatzia (2017), and Valenti and Firestone (2019).

epistemically complex structure of these effects illustrates a hypothetical contrast to neatly justified perceptual expertise. The epistemic landscape of perception may be nearly as diverse as that of belief.

## 6. Conclusion

I have argued here that chess masters' learned perceptual experiences are epistemically evaluable as justified or unjustified because they are based on reasons. Other cases of perceptual learning with similar structures will also meet the **RS** condition and so be epistemically evaluable. Candidates include learning to visually recognize bird species (Tanaka and Taylor 1991), learning to see Greebles (Gauthier and Tarr 1997), learning to hear new phonemes (Logan, Lively, and Pisoni 1991), and learning to see familiar dot patterns (Palmieri 1997). In contrast, simple perceptions that do not result from learning present a weaker case for involving the basing relation. While perception widely relies on stored information, beyond perceptual learning it is less clear that this stored information provides reasons. One exception is particularly sophisticated innate perceptual systems for visually representing objects and agents (Carey 2009) that also store reasons that can be used in basing.

Perceptual learning illustrates that even absent cognitive influence, perception exhibits the flexibility that is characteristic of reason-responsiveness. Perception instantiates the basing relation all on its own, through the transmission of reasons from perceptual information stores to experience. The psychological and epistemic features that yield epistemic evaluability are not proprietary of cognition.

## Chapter 3

# Crossmodal Basing

**Abstract:** What kinds of mental states can be based on epistemic reasons? The standard answer is only beliefs. I argue that perceptual states can also be based on reasons, as the result of crossmodal interactions. A perceptual state from one modality can serve as the basis for an experience in another modality. My argument identifies key markers of the basing relation and locates them in the crossmodal Marimba Illusion. I argue that a subject's auditory experience of musical tone duration is based on her visual representation of the length of the musician's gesture.

### I. Introduction

Illusions are unfortunate epistemic situations. When a ventriloquist performs, the dummy appears to speak when the sound in fact originates from the human controller. When you hear loud crunching sounds while eating potato chips, the chips seem especially crispy (Spence 2015b). When you smell strawberries, sugar tastes sweeter (Frank and Byram 1988). In illusions such as these, you are fooled by your own perceptual system into having nonveridical experiences.<sup>74</sup> These illusions are the result of crossmodal interactions, in which information from one sensory modality influences

---

<sup>74</sup> These examples are illusions according to most standard accounts, because they are non-veridical perceptions (Smith 2002; Macpherson 2009; Fish 2010). Contra such standard accounts, Prettyman defines illusions as perceptions that are not only non-veridical but also imprecise (Prettyman 2019b). Whether these examples are illusions on Prettyman's definition depends on the precision of the discriminatory capacities they enable.



processing in another modality.<sup>75</sup> For example, in the ventriloquist illusion, visual information influences auditory processing, leading to misattribution of the source of the speech.

While crossmodal illusions may lead us astray, they are not typically thought of as unjustified. Standardly, only beliefs are epistemically evaluated as justified or unjustified, in virtue of whether and how they are based on reasons. We do not label individuals irrational when they experience crossmodal illusions. Crossmodal illusions are considered mere unfortunate perceptual happenings, bad luck without a deeper normative impact.

In this paper, I argue that crossmodal illusions are in fact rationally significant. Crossmodal interactions can be instances of basing on epistemic reasons, when a perceptual state from one modality provides a reason on which another perceptual state is based. Such crossmodally based perceptual experiences are within the scope of epistemically evaluability.<sup>76</sup> Surprisingly, some crossmodal illusions may involve justified perceptual states, despite the fact that they disconnect us from reality.

The rest of the paper proceeds as follows. In section II, I describe key markers of the epistemic basing relation that can help identify its presence in the mind. In section III, I argue that these key markers are present in some crossmodal interactions, taking the Marimba Illusion as a focal case (Schutz & Kubovy 2009). Perceptual states can be based on reason, and can be epistemically evaluated as justified or unjustified.

---

<sup>75</sup> Not all crossmodal interactions result in illusions. E.g., in multisensory flavor perception, gustation and olfaction cooperate to produce veridical experiences of flavors, such as fruitiness or meatiness (Spence 2015a).

<sup>76</sup> Other proponents of the view that perception is epistemically evaluable include McGrath (2013), Siegel (2017); and Munton (2017).

## II. Epistemic Basing

The epistemic basing relation is a transmission of epistemic support (or lack of support) from one mental state to another. When one belief is based on another, the first belief is formed and/or maintained in response to the second. This second belief is the reason for which the first belief is held. Sherlock Holmesian deduction exemplifies epistemic basing. Consider a scene from Conan Doyle's *The Final Problem*, in which Holmes and Watson are on the way to Reichenbach Falls when Watson receives a letter calling him away (Conan Doyle 1893). Holmes forms the belief that Professor Moriarty is setting a trap at the falls (call this 'the trap belief') on the basis of his belief that the letter is a fake (call this 'the letter belief'). The trap belief is formed and maintained in response to the letter belief. The trap belief inherits its epistemic support from the letter belief. The trap belief is justified because the letter belief is both itself justified and provides good epistemic support for the trap belief.

Holmes' letter belief provides an epistemic reason. A reason is a consideration in favor of acting, believing, or mentally representing in a certain way (Scanlon 2014). Epistemic reasons are roughly truth-related considerations. They differ in kind from moral, prudential, and aesthetic reasons. There may be corresponding forms of moral, prudential, and aesthetic basing relations, but I focus on epistemic basing here.<sup>77</sup>

The reasons involved in epistemic basing are motivating reasons. My arguments are neutral as to whether motivating reasons are facts or mental states.<sup>78</sup> Either way, the reasons involved in

---

<sup>77</sup> I use the phrases 'epistemic basing' and 'basing on epistemic reasons' interchangeably. For my purposes, a reason is what plays the basis role in the basing relation, so all basing is basing on reasons.

<sup>78</sup> For an argument that reasons are facts, see Williamson (2000). For arguments that reasons are mental states, see Davidson (1963) and Audi (2001).

basing guide agents' behavior and mental state formation. If reasons are facts, then the relevant mental entities involved in basing are agents' grasps (or mental representations) of those facts. For concision, I will at times talk as if reasons are mental states, but a conception of reasons as facts can be substituted throughout.

Motivating reasons can be good or bad normative reasons. When reasons are both good and properly used, epistemic basing results in justified mental states. When reasons are bad and/or improperly used, epistemic basing results in unjustified mental states. For example, if after learning the letter was a fake Watson had jumped to the conclusion that every letter ever written to him was a fake, his belief would be unjustified because its basis does not provide sufficient epistemic support.

When the basing relation holds between a reason and a mental state, it links them both psychologically and epistemically. Basing is a rational support relation that is instantiated through mental processes. For example, when Holmes responds to his belief that the letter is a fake by forming the belief that Moriarty is setting a trap, his belief formation realizes normative properties, conferring justification on his conclusion. Mental states that are based on reasons are both psychologically and epistemically dependent on those reasons. Basing is not unique as a hybrid normative-psychological relation. Other relations that bridge the normative and the psychological include inference, knowledge, and moral responsibility.<sup>79</sup> These hybrid relations allow human minds to be governed by norms.<sup>80</sup>

---

<sup>79</sup> For discussion of the normative-psychological nature of inference, see Audi (2008), Siegel (2017); Quilty-Dunn and Mandelbaum (2018), Neta (2019), and Railton (forthcoming). For discussion of the normative-psychological nature of knowledge, see Kim (1988) and Sosa (1999), cf. Sylvan (2018). For discussion of the normative-psychological nature of moral responsibility, see Fischer and Ravizza (1998), Scanlon (1998), and Levy (2014).

<sup>80</sup> I restrict my arguments to basing rather than inference to leave open whether inference has the additional requirement of a taking condition (Boghossian 2014; cf. Siegel 2017).

The basing relation plays a crucial role in epistemology, both in determining the justificatory status of mental states and in determining which mental states are ripe for epistemic evaluation in the first place. States that are based on reasons can be epistemically evaluated as justified or unjustified, depending on whether they result from good or bad basing. States that are instead formed by mere causal responses are not epistemically evaluable in the same way. For example, it is inappropriate to epistemically evaluate the state of thermoreceptor activation in your palm because it is a purely physical state, independent from reasons. Similarly, if your friend shows you her new red shoes and you think “We’re not in Kansas anymore”, we would not evaluate this thought as justified or unjustified. It is associatively formed, orthogonal to the domain of reasons. The presence of the basing relation serves as a guide to when mental states are epistemically evaluable.<sup>81</sup>

The central role of the basing relation in epistemic evaluation makes it important to identify its presence in the mind. The basing relation is not always introspectively transparent, so we cannot locate it through reflection alone. Sometimes our mental states are based on reasons unbeknownst to us. For example, in *Wuthering Heights* the teenage Heathcliff convinces himself he no longer has affection for Catherine, based on an unconscious belief that he is not good enough for her (Bronte 1847). He tells himself that his cold, angry suspicion is a true change of heart, unaware of the underlying basing relation.

Given this lack of introspective transparency, one way to approach the search for the basing relation in the mind is to identify key markers of its presence. With these markers in mind, we can examine potential instances of basing from a third-person perspective, informed by psychological evidence. I will discuss four key markers of basing: 1) the states that serve as bases represent causal

---

<sup>81</sup> Some mental states may be epistemically evaluable even though they are not based on reasons, such as beliefs formed in response to emotions when they ought to be based on reasons.

relations, 2) the states that serve as bases are widely available for use by other psychological systems, 3) the contents of based states are propositionally justified, and 4) the transition rules governing the process are sensitive to epistemic support.<sup>82</sup> The first two are markers of the presence of reasons in the mind, while the second two are markers that those reasons are used in basing. Having key markers of both types helps us get a comprehensive sense of the basing relation. All four markers may not be necessary for basing, but when they occur together they provide good evidence that it is present. These key markers are likely not exhaustive, but they are diagnostic for a wide range of cases.

The first key marker of basing is that the mental transition involves representations of causal relations.<sup>83</sup> Causal representations are indicative of basing because they are the backbone of reasoning. When we reason about which brand of ice cream to buy, we consider which one caused us the most gustatory pleasure in the past. When we reason about who left muddy footprints in the hallway, we consider who has feet of the right size to cause the tracks. Causal representations tell us which features are indicative of which other features, naturally serving as considerations in favor of believing or acting in certain ways. Causal representations bring along a structure that allows the mind to move from causes to effects. When we represent that A causes B, and we encounter A, we can infer B. Causal representations are one of the most basic and useful forms of dependency

---

<sup>82</sup> I use the term ‘based state’ to refer to states that are based on reasons. I use the terms ‘basis’ or ‘bases’ to refer to a reason or reasons on which another state is based. When considering potential instances of basing in the mind, I use the term ‘input state’ to refer to inputs to psychological processes that are candidate bases, and the term ‘output state’ to refer to outputs of psychological processes that are candidate based states, so as to not assume that the basing relation is instantiated.

<sup>83</sup> I use the terms ‘representations of causal relations’, ‘causal representations’, and ‘states with causal contents’ interchangeably. I intend these terms to pick out states whose contents include causal relations, without implying any special kind of causal efficacy.

relations in the mind. While not all reasons are causal, states with causal contents are especially apt to provide reasons.

While causal contents are the currency of much sophisticated reasoning in cognition, they are also quite plausibly represented by vision (Michotte 1963; Siegel 2010). There is retinotopic adaptation for causal launching events, which indicates that causation is represented in vision rather than only in belief (Rolf, Dambacher, and Cavanagh 2013). Yet at the same time, perceptions of causality are often considered conceptual or proto-conceptual, due to their rich inferential role and integration with other conceptual representations (Leslie 1988; Carey 2009). When looking for reasons in perception, visual states with causal contents are particularly good contenders.

The second key marker of basing is that reasons that serve as epistemic bases are often available for use in a range of different reasoning tasks. For example, Holmes uses the reasons that the letter is a fake to conclude that Moriarty is setting a trap, but he could also use it to calculate the ratio of real-to-fake mail Watson received that week. Reasons are typically available for a range of different epistemic purposes rather than restricted to one inference-type. In contrast, states that are embedded within modules and only usable for the subsequent stage of intermodular processing (e.g. early visual representations of texture gradients used to calculate distance) are not commonly considered reasons.

The availability for multiple forms of use is sometimes taken as a sufficient condition on a state's being person-level (Burge 2010). States that are available to guide action and belief formation serve the individual's overall functioning, in contrast to states that are embedded within modular processing. For example, a visual experience of an oncoming bicycle can guide an individual's movement to avoid a crash, and so is person-level. In contrast, sensory registration on the retina is only used within a visual subsystem, so is not person-level. States can also serve individual functioning by initiating processes in other subsystems. A representation of a sentence meaning

produced by the language faculty can be used in inference, meeting Burge's criterion for being person-level.

Person-level states are prime candidates for serving as epistemic bases. Basing is not a mere whirring and grinding of mechanisms but is a relation that redounds on an individual. Person-level states are apt to participate in such normatively laden processes. I leave open whether basing can ever occur within modules, but availability for use outside a module is a diagnostic property for epistemic bases.<sup>84</sup>

The third key marker of basing is that contents of based states are typically propositionally justified. When a mental state that *P* is propositionally justified for an individual, that individual has good epistemic reason to represent that *P*.<sup>85</sup> Holmes' belief that there is a trap at Reichenbach Falls is propositionally justified by his reason that the letter is a fake. Before even considering how Holmes' trap belief was formed, we can see that he has good reason for it. While some poorly based states lack propositional justification, in the good case propositional justification is a fundamental element of the basing relation.<sup>86</sup>

The basing relation requires not only propositional but also doxastic justification. When a mental state that *P* is doxastically justified, an individual represents *P* for good epistemic reason. She has good reason for *P* and also uses that good reason to form and maintaining her representation

---

<sup>84</sup> For further discussion of reasoning or basing within a subsystem, see Lewis (1982) and Egan (2008).

<sup>85</sup> Both propositional and doxastic justification are standardly defined in terms of belief rather than in terms of the wider category of mental representations. My definitions are in terms of mental representations to allow for the possibility that other kinds of states (such as perceptual experiences) can be justified.

<sup>86</sup> E.g., when Watson jumps to the conclusion that every letter ever sent to him was a fake, his conclusion is not propositionally justified yet it is still a form of bad basing.

that *P*.<sup>87</sup> To illustrate the point, consider a situation in which Holmes' brother Mycroft hears of the fake letter but fails to connect it to Moriarty. Mycroft coincidentally dreams up that Moriarty is setting a trap at Reichenbach Falls. Despite the fact that Mycroft's letter belief provides good reason for his trap belief, the letter belief plays no psychological role in its formation, so the epistemic basing relation does not hold between them. When looking for the epistemic basing relation, we should be attuned to not only propositional but also doxastic justification.

Given the importance of doxastic justification, the fourth key marker of basing is that based states are sensitive to the nature and amount of epistemic support provided. Psychological evidence can reveal transition rules between mental states, shedding light on whether mental processes are driven by epistemic reasons. For example, the deductive principles of human reasoning are uncovered by examining data on subjects' competency with arguments and proofs (Rips 2004).<sup>88</sup> The rules of mental logic may differ from the rules of formal logic, but they match up at least well enough for us to navigate our environments and arrive at truth much of the time. Knowing the principles the mind obeys can help identify when mental states are responses to reasons and when they are the result of merely causal processes.

Taken together, these key markers of 1) bases with causal contents, 2) widely available bases, 3) propositionally justified based states, and 4) epistemically sensitive transition rules equip us with the tools to identify the basing relation in the mind. These markers are particularly useful for inquiring

---

<sup>87</sup> Some linking theses between propositional and doxastic justification make a related point, holding roughly that a belief that *P* is doxastically justified if it is both propositionally justified and based on the reasons that propositionally justify it. For discussion of linking theses, see Feldman (2002), Kvanvig (2003), and Siegel (2013). For an argument against linking theses, see Turri (2010).

<sup>88</sup> For challenges to Rips, see Johnson-Laird (1997) and Oaksford and Chater (2007).



into whether epistemic basing occurs in parts of the mind beyond belief, such as perception. In the next section, I turn to this task.

### III. Crossmodal Basing

In a striking example of crossmodal interaction called the Marimba Illusion, the length of a visible gesture influences the perceived duration of an audible tone. In experiments documenting this effect, subjects are shown a musician playing a marimba using striking gestures of varying lengths (Schutz and Lipscomb 2007). The tones produced have the same duration regardless of gesture length. When the musician uses longer gestures, subjects hear the tones as lasting longer than when the musician uses short gestures. In this crossmodal illusion, the subject's auditory experience of the length of the sound is dependent on her visual experience.<sup>89</sup>

The states involved in this psychological process are as follows:

**Input from audition:** Representation of a tone starting at time T1 and location L1.

**Input from vision:** Representation of a long gesture occurring from time T1 to T2 and from location L1 to L2.<sup>90</sup>

**Crossmodal causal representation:** The gesture causes the tone (due to spatial and temporal congruence of inputs).

**Stored crossmodal information:** When a gesture causes a tone, the length of the gesture is proportional to the length of the tone.

**Output:** Auditory experience of a long tone.

---

<sup>89</sup> The Marimba Illusion is a rare case of visual domination (i.e. having a stronger influence) in a temporal task. Typically, vision dominates in spatial tasks while audition dominates in temporal tasks. This is a useful rule for perceptual systems because vision generally has greater spatial precision while audition has greater temporal precision (Welch and Warren 1980).

<sup>90</sup> In the long gesture condition, the majority of the gesture occurs *after* the key is hit and the tone begins, as if the musician were physically drawing out the note. T1 is before the Marimba is struck, when the musician begins the striking gesture, and T2 is after the Marimba is struck, when the musician finishes the extended post-strike gesture.

This process starts off with inputs from vision and audition. These states are already the result of significant processing within their respective modalities. They have the kind of contents that perceptual experiences often have, but these states are not yet conscious. The input from audition contains information about the starting time and location of the marimba tone. The input from vision contains information about the starting and ending times and locations of the gesture.

The two inputs are then used to generate a crossmodal causal representation. The perceptual system relies on general principles that guide transitions from representations of spatiotemporal features to representations of a causal relation. Because of the spatial and temporal coincidence of the gesture and tone, we represent the gesture as causing the tone.

The principle that guides this process is in the same family as the Unity Assumption. The Unity Assumption says that when congruence of two sensory events is high, they are perceived as having a single common cause (Welch and Warren 1980). Congruence cues include spatial and temporal coincidence, shape, size, orientation, and texture. The Unity Assumption helps perceptual systems determine the cause of sensory signals by combining information across modalities. Other crossmodal effects that exploit the Unity Assumption include the McGurk Effect (McGurk and McDonald 1976), the Rubber Hand Illusion (Botvinick and Cohen 1998), and the Tone-Flash Illusion (Shams, Kimitani, and Shimojo 2002). The Unity Assumption governs representations of common cause, while the principle used in the Marimba Illusion governs representations of one event causing another, but they share the same basic structure.

Once the crossmodal causal representation is produced, it is combined with stored information that says that when a gesture causes a tone, the length of the gesture is proportional to the length of

the tone.<sup>91</sup> The result is an auditory experience as of an elongated tone, persisting past when the tone actually end.

I claim that this perceptual process is an instance of epistemic basing. The auditory perception of the long tone is based on the visual representation of the long gesture, the crossmodal causal representation, and the stored information about proportional lengths. A perceptual representation from one modality can serve as a reason on which another perceptual representation is based.

At first glance, one might think this is a merely causal transition between mental states rather than basing on reasons. It is true that some crossmodal interactions are more minimal neural or associative processes. For example, when you press on your eyeball with your eyelid shut, you see spots. This interaction between touch and vision is merely physical. The spots, called ‘phosphenes’, are generated by the mechanical stimulation of the cells on the retina. There is no response to mental states, so it is not an instance of the basing relation. The production of phosphenes is entirely explained by physical interactions without need to appeal to reasons or transmission of epistemic support.

Similarly, some forms of synesthesia involve associative links across sensory modalities, without mediation by the basing relation. For people with chromesthesia, hearing certain sounds makes them see certain colors. Hearing an “ah” sound might cause a chromesthete to see green. While the auditory experience of “ah” causally triggers a visual experience of green, “ah” does not provide

---

<sup>91</sup> This stored information is specific to direct impact causation, and so does not dictate that e.g., the lengths of a gesture and tone are proportional when pressing the play button in iTunes. Additionally, this stored information may be an instance of a more general perceptual principle connecting the proportions of impact causes and effects, that covers a wider range of cases than just gestures and tones. The details of such a general principle are dependent on empirical data.

epistemic support for the visual experience. It is a brute causal relation between mental states rather than epistemic basing.<sup>92</sup>

The Marimba Illusion differs from phosphenes and chromesthesia in several key respects, making it a much more plausible instance of epistemic basing. In the rest of this section, I argue that the Marimba Illusion displays all four key markers of basing: bases with causal contents (III.i), widely available bases (III.ii), propositionally justified based states (III.iii), and epistemically sensitive transition rules (III.iv). Along the way, I return to the contrast cases of phosphenes and chromesthesia to illustrate how the Marimba Illusion differs significantly, and so is within the realm of epistemic evaluability.

### **III.i Bases with Causal Contents**

In the Marimba Illusion, two of the states that serve as bases have causal contents: the crossmodal causal representation (the gesture causes the tone) and the stored crossmodal information (when a gesture causes a tone, the length of the gesture is proportional to the length of the tone). These causal representations enable the illusion to obtain. The inputs from vision and audition and the output all only represent spatiotemporal properties. Without appeal to any additional stored information, the crossmodal transition is left unexplained. Positing mediating states with causal contents not only explains the Marimba Illusion, but also contributes to a broader explanation of the wide range of crossmodal interactions governed by the Unity Assumption. These causal representations connect inputs and output, both psychologically driving the process and lending it structure.

---

<sup>92</sup> I leave open whether other forms of synesthesia involve the basing relation. Chromesthesia's simple structure may not be shared across all types.

Additional evidence that the Marimba Illusion involves states with causal contents comes from a version of the experiment in which the causal connection between the gesture and the tone was made implausible (Schutz and Kubovy 2009). In this experiment, the marimba player's gestures were paired with sustained tones (such as clarinet tones) rather than percussive marimba tones. The previously observed effect disappeared. Subjects did not experience illusory tone elongation in the long gesture condition. Without the characteristic spatiotemporal properties of percussive tones, the mediating causal representation is not generated. The perceptual system knows that marimba-striking gestures could not cause clarinet tones. This data indicates that the Marimba Illusion is dependent on causal representations.

The presence of states with causal contents differentiates the Marimba Illusion from phosphenes and chromesthesia. The production of phosphenes does not involve a response to mental states at all, and so does not involve states with causal contents. While causation is involved in the sense that retinal pressure causes an experience as of spots, there representation of this causation in the mind. Instead, mere physical stimulation generates phosphenes.

Chromesthesia, on the other hand, does involve a response to mental representations rather than to mere physical stimulation. But the representations involved do not have causal contents. The inputs are auditory experiences of phonemes or musical tones. The outputs are visual experiences of colors.<sup>93</sup> The transition from auditory to visual experience is well-explained by a simple associative structure linking the inputs and outputs, with no other intervening psychological states.

---

<sup>93</sup> Other types of synesthesia involve states with richer, more abstract contents. Some synesthetes associate numerical magnitudes and colors. These synesthetes have the same visual color experience in response to Arabic numerals, Roman numerals, or clusters of dots (Ramachandran and Hubbard 2001). These states nonetheless lack both causal contents and propositional justification, due to the arbitrary nature of the linkages.

Unlike the more minimal processes of phosphenes and chromesthesia, the Marimba Illusion features causal contents, which are paradigmatic of epistemic basing. The representations that 1) the gesture causes the tone and that 2) when a gesture causes a tone the length of the gesture is proportional to the length of the tone, are prime for providing reasons.

### **III.ii Widely Available Bases**

When considering whether basing occurs in perception, one might worry that states in perceptual systems are too task-specific to be reasons. For example, luminance maps and edge representations are used for the particular task of computing shape representations in early vision. These states lack the paradigmatic wide availability of reasons. If a process does not involve reasons, it cannot be an instance of basing on reasons. This worry is particularly pressing if one has a modular view of perception, according to which sensory input systems are domain specific, informationally encapsulated subsystems with proprietary information databases and processing rules.<sup>94</sup> One might worry that states within modules can only fulfill their module-specific task and so are not widely available enough to count as reasons.

Crossmodal interactions avoid this worry. In the Marimba Illusion, the inputs from vision and audition are the outputs of modules, not states embedded within modules. The combinatory process operates across both modules and sensory modalities.<sup>95</sup> Wide availability is a typical property of

---

<sup>94</sup> For arguments for modularity, see Fodor 1983 and Pylyshyn (1999). I do not assume a modular perceptual architecture. I consider this worry from a modularist perspective because it presents the greatest challenge. On non-modular perceptual architectures, according to which the mind is a wholly interconnected network, the worry that perceptual states are too circumscribed to be reasons is far less pressing. For arguments against modularity, see Churchland (1988), Prinz (2006), and Lupyan (2015).

<sup>95</sup> Modules are not equivalent to sensory modalities. Sensory modalities may consist of multiple distinct modules. For example, separate shape and color processing modules might both be housed within vision. On the flipside, modules may also span multiple sensory modalities. For example,

outputs of perceptual modules. When these outputs feed into conscious perceptual experience, they can be used for countless types of cognition and action. In response to a visual experience as of a saltshaker, you might reach for the salt and add it to the saucepot or form the belief that you need to put salt on your grocery list. Just as such widely available perceptual experiences provide reasons for belief or action, the outputs of vision and audition also provide reasons when they participate in crossmodal interactions.

The contrast cases of phosphenes and chromesthesia also involve multiple sensory modalities, so the underlying states are widely available to a degree. In phosphenes, the pressure on the eyeball kicks off processing in both tactition and vision, indicating that it can be used in two ways. However, these two uses are far fewer than the numerous ways the output of a perceptual system might be used for belief and action. Moreover, the physical pressure that produces phosphenes is not a mental state. Only mental states can serve as reasons or epistemic bases, so phosphenes remains an implausible case of basing.

Chromesthesia, on the other hand, starts from a perceptual experience, which is a genuine mental state. The auditory experience of “ah” that leads to a synesthetic experience of green is available for a variety of uses in reasoning. It might be used to form the belief that someone nearby is relaxing, or the belief that someone is about to sneeze (anticipating an impending “-choo”). Yet while chromesthesia may bear the wide availability marker of basing, it lacks the other three, as discussed in sections III.i, III.iii, and III.iv. Wide availability alone is insufficient evidence of basing.

---

speech perception takes inputs from both vision and audition. However, the intricacies of the relationship between modules and modalities does not confound the example of the Marimba Illusion. The systems that generate the auditory and visual inputs are both distinct sensory modalities and distinct modules. These inputs are combined in a process that is both crossmodal and cross-modular.

When all four key markers appear, as in the Marimba Illusion, we then have good reason to think it is an instance of epistemic basing.

### **III.iii Propositionally Justified Based States**

Mental states that are based on reasons are typically propositionally justified, at least when basing goes well. The outputs of the Marimba Illusion are propositionally justified by the inputs, crossmodal representation, and stored crossmodal information. One way to see this justification relation is by considering an analogous inference with beliefs:

**P1:** There is a long gesture.

**P2:** There is a tone.

**P3:** The gesture causes the tone.

**P4:** When a gesture causes a tone, the length of the gesture is proportional to the length of the tone.

**C:** The tone is long.

This is a valid inference. Although the contents of the states in the Marimba Illusion are more complex, they have the same general form and manifest similar epistemic support relations. Just as premises 1-4 in the inference above propositionally justify its conclusion, the inputs, causal representation, and stored information in the Marimba illusion propositionally justify its output. Thinking through this parallel case of inference makes the crossmodal epistemic support relation vivid.

In contrast, in phosphenes the pressure on your eye does not propositionally justify the visual experience of spots. There is no way to naturally reconstruct the states involved as an inference. Similarly, in chromesthesia, while there are systematic mental mappings between sounds and colors, these mappings do not correspond to justificatory relations. An auditory representation of the sound “ah” is not a consideration in favor of having a visual experience as of green. Unlike



phosphenes and chromesthesia, the outputs of the Marimba Illusion are propositionally justified, as is characteristic of states that are based on reasons.

### **III.iv Epistemically Sensitive Transition Rules**

Basing on reasons requires not only propositional justification but also the transmission of justification from the bases to the based state. The justification that epistemic bases provide drives the transition to the conclusion. There is good reason to think that the Marimba Illusion also such a transmission of epistemic support from the inputs, causal representation, and stored crossmodal information to the output, due to the epistemic sensitivity of its transition rules.

The Marimba Illusion is produced by well-ingrained principles in the mind that consistently govern transitions respecting epistemic support relations. The kind of causal principles that guide this transition drive many other crossmodal interactions, including the Ventriloquist Effect (Alais and Burr 2004), perception of synchronicity in drumming (Arrighi, Alais, and Burr 2006), and the perception of objects as bouncing or streaming (Sekuler, Sekuler, and Lau 2001). These principles are robust and stable, much like the rules that govern inference in cognition. The related Unity Assumption guides a wide range of perceptual processes, including the McGurk Effect (McGurk and MacDonald 1980), the Rubber Hand Illusion (Botvinick and Cohen 1998), and the Tone-Flash Illusion (Shams, Kamitani, and Shimojo 2002). The Marimba Illusion has a common form and is not merely incidental. The pervasive nature of similar processes is well-explained by the idea that they are all driven by epistemic reasons.

The Marimba Illusion is also sensitive to changes in epistemic support, like basing relations are. The effect is not a brute on/off connection between long gestures and long tones, and short gestures and short tones. The degree of influence varies proportionally with the plausibility of the causal connection. When the gesture and tone are slightly out of sync, the illusion becomes weaker

(Schutz and Kubovy 2009). The tone is still heard as elongated, but not to the same extent as when the spatiotemporal cues are aligned.

Additional evidence for the epistemic sensitivity of the transition rule comes from the fact that the illusion does not obtain when marimba-striking gestures are paired with sustained clarinet tones (Schutz and Kubovy 2009). The perceptual system knows that impact gestures produce percussive tones and not sustained tones, making the causal connection between the striking gesture and the clarinet tone implausible. When the evidence presented by the sensory modalities does not support the presence of a causal connection, the crossmodal causal representation is not produced. The process is governed by transition rules that operate over epistemic reasons.

In contrast, the transition rules governing phosphenes and chromesthesia are not epistemically sensitive. In phosphenes, an increase in optic pressure will correlate with an increase in the amount or intensity of spots seen, but the pressure increase is not more (or any) reason in favor of seeing spots. These systematic changes do not track justification. Chromesthesia is not modulated by changes in epistemic support either. As sounds become closer to the word ‘green’ or more statistically likely to indicate the presence of green, a chromesthete’s visual experience of green does not become stronger. Unlike these cases, the Marimba Illusion displays the sensitivity to changes in epistemic support that is characteristic of basing.

#### **IV. Conclusion**

The presence of all four key markers in the Marimba Illusion indicates that crossmodal interactions can be based on epistemic reasons. Is this good epistemic basing, leading to a justified perceptual experience, or poor epistemic basing, leading to an unjustified perceptual experience?

Upon first inspection, it looks like good basing. The inputs, causal representation, and stored information together provide epistemic support for the auditory experience of the tone as long. It

seems reasonable for the mind to move from representations of the gesture as long, of the gesture as causing the tone, and of such gestures and tones being proportional, to the conclusion that the tone is long. However, the process also ignores a crucial piece of information: the auditory input that says the tone is short. The auditory system has perfectly good access to information about tone duration. The subject's ears are not blocked, and the sound quality is not degraded. Auditory information that could be used to directly calculate tone duration is registered but is overlooked or overridden due to the visual domination. This auditory neglect is structurally similar to ignoring evidence, which typically renders an experience unjustified.

Whether this neglect impugns the epistemic status of the experience depends on what constitutes relevant and available evidence. The information ignored is likely sensory data rather than a fully-fledged mental state. The sensory data has the potential to become a representation of tone duration if it were further processed. The system ignores something that could become a reason if properly pursued, akin to a detective failing to follow up on a promising lead. The questions of whether and when we are rationally required to pursue potential reasons cuts across the domains of perception and belief.<sup>%</sup> While answers to these questions are beyond the scope of this paper, the fact that they surface at this juncture demonstrates that crossmodal interactions fit congruously into the broader epistemic landscape.

The view that crossmodal experiences can be based on reasons extends beyond the Marimba Illusion. Other crossmodal interactions that exploit the Unity Assumption (or similar principles linking spatiotemporal properties and causation) are good candidates for involving epistemic basing.

---

<sup>%</sup> For more on what it means for reasons or evidence to be available, and on the corresponding norms, see Parfit (1997, 2001), Williamson (2000), Kelly (2008), and Schroeder (2008). For discussion of the norms of attention and inquiry, see Foley and Fumerton (1982), Friedman (2017) and Siegel (2017).

Promising examples include the McGurk Illusion, the Tone-Flash Illusion (Shams et al. 2002), the Ventriloquist Effect (Alais and Burr 2004) and the Rubber Hand Illusion (Botivnick and Cohen 1998). Crossmodal interactions that are more like phosphenes and chromesthesia will not be based on reasons, due to their associative or brute-physical mechanisms.

My arguments here destabilize the traditional view on which epistemic basing is restricted to the realm of belief. While the key markers of basing may be most obvious in conscious, deliberate inference, the Marimba Illusion illustrates that basing can also occur in unconscious, automatic, and perceptual parts of the mind. The rich interactions across sensory modalities are much more like reasoning than is commonly granted. While crossmodal illusions give us distorted reflections of reality, they are often reasoned distortions rather than arational ones.

## Conclusion

The three chapters of this dissertation together furnish an argument that perceptual states can be based on reasons and thereby epistemically evaluable. None of these focal cases involves direct influence from cognition, demonstrating that reasons can be housed within perceptual systems themselves. The scope of epistemic evaluability extends beyond belief, to include even unconsciously and automatically formed perceptions.

The examples discussed in this dissertation are all later-stage perceptual processes. They have mental representations as their starting points, taking the outputs of more primitive perceptual systems as inputs. These cases are dialectically advantageous because mental representations are widely acknowledged to provide reasons in other contexts, such as in belief formation. Does epistemic evaluability reach even farther down into earlier stages of perception, such as sensory transduction? It is far less clear that the merely physical states that underlie earlier processing provide reasons rather than merely serving as information conduits. The accounts of basing, reasons, and justification offered here are not meant to be deflationary. In order to manifest these properties, mental processes must still bear certain epistemic signatures. While nothing in my arguments strictly precludes the idea that epistemic evaluability extends farther into perception, the first stages of mental representation may be the lower bounds of the basing relation.

While these arguments may have vertical limits, they have significant horizontal potential. The Reasons then Status condition can be used to assess the rational evaluability of other types of mental states beyond perception, such as emotions, intuitions, the language faculty, and mental states of non-human animals. Close examination of psychological data in each of these domains will help further delineate the scope of epistemic evaluability.

Another promising continuation of this project is an exploration of how the epistemic norms of perception differ from those of belief. A central difference between perception and

cognition is that perception is far more informationally encapsulated. While information flows freely in central cognition, perceptual systems have proprietary information database. Informational encapsulation renders a large swathe of reasons inaccessible, preventing perception from responding to reasons housed in belief. When perception fail to respond to reasons due to information encapsulation, are the states it produces unjustified? On the one hand, when beliefs fail to respond to reasons they are typically rendered unjustified. On the other hand, informational encapsulation is a very different sort of factor from the agent-level features like stubbornness or wishful thinking that often prevent beliefs from responding to reasons. Informational encapsulation is a general constraint of cognitive architecture, built into our minds from the get-go. In subsequent work, I plan to argue that the norms of perception are sensitive to the fixed constraints of cognitive architecture, but in some cases perceptual failures to respond to reasons can nonetheless render individuals irrational.

This dissertation helps clear the ground for many such new projects in the epistemology of perception. Accepting perception into the scope of epistemic evaluability not only enlarges the territory of our familiar epistemic debates, but also broadens epistemology's horizons in new and exciting ways.

## Bibliography

- Adams, Robert. 1985. "Involuntary Sins." *The Philosophical Review* 94(1): 3-31.
- Arpaly, Nomy. 2006. *Merit, Meaning, and Human Bondage: An Essay on Free Will*. Princeton, NJ: Princeton University Press.
- Audi, Robert. 1998. *Epistemology*. London: Routledge.
- Audi, Robert. 2001. *The Architecture of Reason: The Structure and Substance of Rationality*. New York: Oxford University Press.
- Austen, Jane. 2003 [1815]. *Emma*. London: Penguin Classics.
- Aguilar, Andréa, and Renée Baillargeon. 1999. "2.5-Month-Old Infants' Reasoning about When Objects Should and Should Not Be Occluded." *Cognitive Psychology* 39(2): 116–157.
- Alais, David, and David Burr. 2004. "The Ventriloquist Effect Results from Near-Optimal Bimodal Integration." *Current Biology* 14: 257-262.
- Alston, William. 1988. "An Internalist Externalism". *Synthese* 74(3): 265-283.
- Alston, William. 1989. *Epistemic Justification: Essays in the Theory of Knowledge*. Ithaca, NY: Cornell University Press.
- Armstrong, David. 1973. *Belief, Truth, and Knowledge*. Cambridge, UK: Cambridge University Press.
- Arrighi, Roberto, David Alais, and David Burr. 2006. "Perceptual Synchrony of Audio-Visual Streams for Natural and Artificial Motion Sequences." *Journal of Vision* 6: 260-268.
- Aslin, Richard, and Scott Johnson. 1996. "Perceptions of Object Unity in Young Infants: The Rules of Motion, Depth and Orientation." *Cognitive Development* 11(2): 161–180.
- Audi, Robert. 1993. "Contemporary Foundationalism." In *The Theory of Knowledge: Classical and Contemporary Readings*, ed. Louis Pojman, 206-213. Belmont, CA: Wadsworth.
- Audi, Robert. 2001. *The Architecture of Reason: The Structure and Substance of Rationality*. New York: Oxford University Press.
- Audi, Robert. 2008. "Intuition, Inference, and Rational Disagreement in Ethics." *Ethical Theory and Moral Practice* 11 (5): 475-492.
- Audi, Robert. 2015. "The Grounds and Structure of Reasons for Action." In *Reasons, Rights, and Values*, Robert Audi, 71-96. Cambridge, UK: Cambridge University press.
- Baillargeon, Renée. 1998. "Infants' Understanding of the Physical World." In *Advances in Psychological Science, Vol. 2: Biological and Cognitive Aspects*, ed. Michel Sabourin, Fergus Craik, and Michèle Robert, 503–529. Hove, England: Psychology Press.

- Baillargeon, Renée, Amy Needham, and Julie DeVos. 1992. "The Development of Young Infants' Intuitions about Support." *Early Development and Parenting* 1(2): 69–78.
- Bannert, Michael, and Andreas Bartels. 2013. "Decoding the Yellow of a Grey Banana." *Current Biology* 23: 2268–2272.
- Beck, Jacob. 2018. "Marking the Perception-Cognition Boundary: The Criterion of Stimulus Dependence." *Australasian Journal of Philosophy* 96(2): 319–334.
- Bengson, John. 2015. "The Intellectual Given." *Mind* 124(495): 707–760.
- Block, Ned. Forthcoming. *The Border Between Seeing and Thinking*.
- Bogartz, Richard, Jean Shinksey, and Cindy Speaker. 1997. "Interpreting Infant Looking: The Event Set  $\times$  Event Set Design." *Developmental Psychology* 33: 408–422.
- Boghossian, Paul. 2014. "What is Inference?" *Philosophical Studies* 169: 1–18.
- Bonjour, Laurence. 1985. *The Structure of Empirical Knowledge*. Cambridge, MA: Harvard University Press.
- Bonjour, Laurence. 2003. "A Version of Internalist Foundationalism." In *Epistemic Justification: Internalism vs. Externalism, Foundationalism vs. Virtues*, ed. Laurence Bonjour and Ernest Sosa, 3–96. Malden, MA: Blackwell.
- Botvinick, Matthew, and Johnathan Cohen. 1998. "Rubber Hands 'Feel' Touch that Eyes See." *Nature* 391: 756.
- Brady, Michael. 2009. "The Irrationality of Recalcitrant Emotions." *Philosophical Studies* 145(3): 413–430.
- Bronte, Emily. 1995 [1847]. *Wuthering Heights*. London: Penguin Books.
- Brainard, David. 2009. "Bayesian Approaches to Color Vision." In *The Visual Neurosciences*, ed. Michael Gazzaniga, ed., 4th Edition, 395–408. Cambridge, MA: MIT Press.
- Braine, Martin D. S., and David P. O'Brien, ed. 1998. *Mental Logic*. Mahwah, NJ: Erlbaum.
- Brewer, Bill. 1999. *Perception and Reason*. Oxford: Oxford University Press.
- Brogaard, Berit and Dimitria Gatzia. 2017. "The Real Epistemic Significance of Perceptual Learning." *Inquiry* 61(5–6): 543–558.
- Brogaard, Berit and Dimitria Gatzia. 2016. "Is Color Experience Cognitively Penetrable?" *Topics in Cognitive Science* 9(1): 193–213.
- Broome, John. 2007. "Does Rationality Consist in Responding Correctly to Reasons?" *Journal of*



- Moral Philosophy* 4(3): 349-374.
- Broome, John. 2013. *Rationality Through Reasoning*. Chichester: Wiley-Blackwell.
- Burge, Tyler. 2010a. *Origins of Objectivity*. Oxford: Oxford University Press.
- Burge, Tyler. 2010b. "Steps Toward Origins of Propositional Thought." *Disputatio* 4(29): 39–67.
- Byrne, Ruth. 2005. *The Rational Imagination: How People Create Alternatives to Reality*. Cambridge, MA: MIT Press.
- Calderwood, Roberta, Gary A. Klein, and Beth W. Crandall. 1988. "Time Pressure, Skill, and Move Quality in Chess", *American Journal of Psychology* 101: 481-493.
- Carey, Susan. 2009. *The Origin of Concepts*. New York: Oxford University Press.
- Carey, Susan. 2011. "Précis of *The Origin of Concepts*." *Behavioral and Brain Sciences* 34(3): 113–124.
- Carey, Susan, and Fei Xu. 2001. "Infants' Knowledge of Objects: Beyond Object Files and Object Tracking." *Cognition* 80: 179–213.
- Casati, Roberto. 2004. "Is the Object Concept Formal?" *Dialectica* 58(3): 383–394.
- Charness, Neil. 1992. "The Impact of Chess Research on Cognitive Science." *Psychological Research* 54: 4-9.
- Charness, Neil, Eyal M. Reingold, Marc Pomplun, and Dave M. Stampe. 2001. "The Perceptual Aspect of Skilled Performance in Chess: Evidence from Eye Movements." *Memory and Cognition* 28(8): 1146-1152.
- Chase, William, and Herbert Simon. 1973. "Perception in Chess." *Cognitive Psychology* 4: 55-81.
- Chiandetti, Cinzia, and Giorgio Vallortigara. 2011. "Intuitive Physical Reasoning about Occluded Objects by Inexperienced Chicks." *Proceedings of the Royal Society B: Biological Sciences* 278(1718): 2621–2627.
- Chisholm, Roderick. 1977. *Theory of Knowledge*. Englewood Cliffs, NJ: Prentice Hall.
- Chomsky, Noam. 1957. *Syntactic Structure*. The Hague/Paris: Mouton.
- Chomsky, Noam. 1965. *Aspects of the Theory of Syntax*. Cambridge, MA: MIT Press.
- Chomsky, Noam. 1986. *Knowledge of Language: Its Nature, Origin, and Use*. New York: Praeger.
- Chudnoff, Elijah. 2011. "The Nature of Intuitive Justification." *Philosophical Studies* 153(2): 313–33.
- Chudnoff, Elijah. 2017. "The Epistemic Significance of Perceptual Learning." *Inquiry* 61(5-6): 520-542.

- Chudnoff, Elijah and Bartek Chomanski. 2017. "How Perception Generates, Mediates, and Preserves Perceptual Learning." *Inquiry* 61(5-6): 559-568.
- Churchland, Paul. 1988. "Perceptual Plasticity and Theoretical Neutrality: A Reply to Jerry Fodor." *Philosophy of Science* 55(2): 167-187.
- Cohen, Stewart. 2016a. "Replies to My Commentators." *Inquiry* 59(7-8): 906-922.
- Cohen, Stewart. 2016b. "Theorizing about the Epistemic". *Inquiry* 59(7-8): 839-857.
- Conan Doyle, Arthur. 1993 [1893]. *The Memoirs of Sherlock Holmes*. New York: Oxford University Press.
- Conee, Earl. 2016. "The Epistemic." *Inquiry* 59(7-8): 858-866.
- Connolly, Kevin. 2019. *Perceptual Learning: The Flexibility of the Senses*. New York: Oxford University Press.
- Cosmides, Leda, and John Tooby. 1992. "Cognitive Adaptations for Social Exchange." In *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*, ed. Jerome Barkow, Leda Cosmides, and John Tooby, 163-228. New York: Oxford University Press.
- Cowan, Robert. 2018. "Epistemic Sentimentalism and Epistemic Reasons-Responsiveness." In *Evaluative Perception*, ed. Anna Bergqvist and Robert Cowan. Oxford: Oxford University Press.
- Dancy, Jonathan. 2000. *Practical Reality*. Oxford: Oxford University Press.
- Davidson, Donald. 1963. "Actions, Reasons, and Causes." *Journal of Philosophy* 60(23): 685- 700.
- de Groot, Adriaan. 1965. *Thought and Choice in Chess*. The Hague: Mouton.
- de Sousa, Ronald. 1987. *The Rationality of Emotion*. Cambridge, MA: MIT Press.
- Delk, John, and Samuel Fillenbaum. 1965. "Differences in Perceived Color as a Function of Characteristic Color." *The American Journal of Psychology* 78(2): 290-293.
- Deroy, Ophelia. 2013. "Object-Sensitivity Versus Cognitive Penetrability of Perception." *Philosophical Studies* 162(1): 87-107.
- Dietz, Christina. 2018. "Reasons and Factive Emotions." *Philosophical Studies*, 175(7): 1681-1691.
- Dreyfus, Stuart, and Hubert Dreyfus, 1980. "A Five-Stage Model of the Mental Activities Involved in Direct Skill Acquisition." Washington, D.C.: Storming Media.
- Egan, Andy. 2008. "Seeing and Believing: Perception, Belief Formation, and the Divided Mind." *Philosophical Studies* 140: 47-63;

- Evans, Gareth. 1982. *Varieties of Reference*. Oxford: Oxford University Press.
- Evans, Ian. 2012. "The Problem of the Basing Relation." *Synthese* 190: 2943-2957.
- Evans, Johnathan, and Keith E. Stanovich. 2013. "Dual-Process Theories of Higher Cognition: Advancing the Debate." *Perspectives on Psychological Science* 8(3): 223–241.
- Feldman, Richard. 2002. *Epistemology*. Upper Saddle River, NJ: Prentice Hall.
- Feldman, Richard, and Earl Conee. 1985. "Evidentialism." *Philosophical Studies* 48(1): 15-34.
- Festinger, Leon. 1957. *A Theory of Cognitive Dissonance*. Stanford: Stanford University Press.
- Firestone, Chaz and Brian Scholl. 2016. "Cognition Does Not Affect Perception: Evaluating the Evidence for "Top-Down" Effects." *Behavioral and Brain Sciences* 39: 1–72.
- Fischer, John Martin, and Marc Ravizza. 2012. *Responsibility and Control: A Theory of Moral Responsibility*. Cambridge, UK: Cambridge University Press.
- Fish, William. 2010. *Philosophy of Perception: A Contemporary Introduction*. New York: Routledge.
- Fodor, Jerry. 1975. *The Language of Thought*. Cambridge, MA: Harvard University Press.
- Fodor, Jerry. 1983. *The Modularity of Mind*. Cambridge, MA: MIT Press.
- Foley, Richard, and Richard Fumerton. 1982. "Epistemic Indolence" *Mind* 91(361): 38-56.
- Frank, Robert, and Jennifer Byram. 1998. "Taste-Smell Interactions are Tastant and Odor Dependent." *Chemical Senses* 12(3): 445-455.
- Friedman, Jane. 2017. "Inquiry and Belief." *Noûs* 53(2): 296-315.
- Fumerton, Richard. 1985. *Metaphysical and Epistemological Problems of Perception*. Lincoln and London: University of Nebraska Press.
- Gao, Tao, and Brian Scholl. 2010. "Are Objects Required for Object Files? Roles of Segmentation and Spatiotemporal Continuity in Computing Object Persistence." *Visual Cognition* 18(1): 82–109.
- Gauthier, Isabel, and Michael J. Tarr. 1997. "Becoming a "Greeble" Expert: Exploring Mechanisms for Face Recognition." *Vision Research* 37(12): 1673-1682.
- Gelman, Susan. 2003. *The Essentialist Child: Origins of Essentialism in Everyday Thought*. New York: Oxford University Press.
- Gelman, Susan and Henry Wellman. 1991. "Insides and Essences: Early Understandings of the Non-Obvious." *Cognition* 38(3): 213-244.

- Gibbard, Alan. 1990. *Wise Choices, Apt Feelings: A Theory of Normative Judgment*. Oxford: Oxford University Press.
- Gibson, Eleanor. 1963. "Perceptual Learning." *Annual Review of Psychology* 14: 29-56.
- Gobet, Fernand and Herbert Simon. 1998. "Expert Chess Memory: Revisiting the Chunking Hypothesis." *Memory* 6(3): 225-255.
- Goldman, Alvin. 1979 [2012]. "What is Justified Belief?" In *Reliabilism and Contemporary Epistemology: Essays*, Alvin Goldman, 29-49. Oxford: Oxford University Press.
- Goldman, Alvin. 2006. *Simulating Minds: The Philosophy, Psychology, and Neuroscience of Mindreading*. New York: Oxford University Press.
- Goldman, Alvin. 2008. "Immediate Justification and Process Reliabilism." In *Epistemology: New Essays*, ed. Quentin Smith, 63-82. Oxford: Oxford University Press.
- Goldstone, Robert L. 1994. "Influences of Categorization on Perceptual Discrimination." *Journal of Experimental Psychology: General* 123(2): 178-200
- Goldstone, Robert L., David Landy, and Lionel C. Brunel 2011. "Improving Perception to Make Distant Connections Closer." *Frontiers in Psychology* 2: 385.
- Green, E.J. 2017. "What Do Object Files Pick Out?" *Philosophy of Science* 85(2): 177–200.
- Hansen, Thorsten, Maria Olkkonen, Sebastian Walter, and Karl R. Gegenfurtner. 2006. "Memory Modulates Color Appearance." *Nature Neuroscience* 9: 1367-1368.
- Hauser, Marc and Susan Carey. 1998. "Building a Cognitive Creature from a Set of Primitives: Evolutionary and Developmental Insights." In *The Evolution of Mind*, ed. Denise Dellarosa Cummins and Colin Allen, 51–106. Oxford: Oxford University Press.
- Hauser, Marc and Susan Carey. 2003. "Spontaneous Representations of Small Numbers of Objects by Rhesus Macaques: Examinations of Content and Format." *Cognitive Psychology* 47(4): 367–401.
- Helmholtz, Hermann von. 1867 [1910]. *Handbuch der Physiologischen Optik* [Handbook of Psychological Vision]. Leipzig: L. Voss. Reprinted with extensive commentary in *Handbuch der physiologischen Optik*, 3rd ed., ed. Allvar Gullstrand, Johannes von Kries, and Willibald Nagel. Hamburg and Leipzig: L. Voss.
- Herz, Rachel. 2016. "The Role of Odor-Evoked Memory in Psychological and Physiological Health." *Brain Sciences* 6(3): 22.
- Hespos, Susan, and Renée Baillargeon. 2001. "Reasoning about Containment Events in Very Young Infants." *Cognition* 78: 207–245.

- Holding, Dennis H. 1985. *The Psychology of Chess Skill*. Hillsdale, NJ: Erlbaum.
- Huemer, Michael. 2007. "Compassionate Phenomenal Conservatism." *Philosophy and Phenomenological Research* 74(1): 30–55.
- Huntley-Fenner, Gavin, Susan Carey, and Andrea Solimando. 2003. "Objects Are Individuals but Stuff Doesn't Count: Perceived Rigidity and Cohesiveness Influence Infants' Representations of Small Groups of Discrete Entities." *Cognition* 85(3): 203–221.
- Kahneman, Daniel, Anne Treisman, and Brian Gibbs. 1992. "The Reviewing of Object Files: Object-Specific Integration of Information." *Cognitive Psychology* 24: 175–219.
- Johnson-Laird, Phillip. 1997. "Rules and Illusions: A Critical Study of Rips' The Psychology of Proof." *Minds and Machines* 7(3): 387–407.
- Kant, Immanuel. 1997 [1787]. *Critique of Practical Reason*. Cambridge, UK: Cambridge University Press.
- Keil, Frank. 1989. *Concepts, Kinds, and Cognitive Development*. Cambridge, MA: MIT Press.
- Kellman, Phillip, and Elizabeth Spelke. 1983. "Perception of Partly Occluded Objects in Infancy." *Cognitive Psychology* 15(4): 483–524.
- Kelly, Thomas. 2002. "The Rationality of Belief and Some Other Propositional Attitudes." *Philosophical Studies* 110: 163–196.
- Kelly, Thomas. 2008. "Evidence: Fundamental Concepts and the Phenomenal Conception." *Philosophy Compass* 3(5): 933–955.
- Kiesewetter, Benjamin. 2017. *The Normativity of Rationality*. Oxford: Oxford University Press.
- Kim, Jaegwon. 1988. "What is 'Naturalized Epistemology?'" *Philosophical Perspectives* 2: 381–405.
- Korcz, Keith. Forthcoming. "The Epistemic Basing Relation." In *The Stanford Encyclopedia of Philosophy* (Fall 2019 Edition), ed. Edward N. Zalta. [plato.stanford.edu/archives/fall2019/entries/basing-epistemic/](https://plato.stanford.edu/archives/fall2019/entries/basing-epistemic/).
- Kornblith, Hilary. 2012. *On Reflection*. Oxford: Oxford University Press.
- Kvanvig, John. 2003. "Propositionalism and the Perspectival Character of Justification." *American Philosophical Quarterly* 40(1): 3–18.
- Leone, Maria J., Diego F. Slezak, Guillermo A. Cecchi, and Mariano Sigman. 2014. "The Geometry of Expertise." *Frontiers in Psychology* 5(47): 1–9.
- Leslie, Alan M. 1988. "The Necessity of Illusion: Perception and Thought in Infancy." In *Thought Without Language*, ed. Lawrence Weiskrantz. Oxford: Oxford Science Publications: 185–210.

- Levy, Neil. "Consciousness, Implicit Attitudes, and Moral Responsibility." *Noûs* 16: 431-441
- Lewis, David. 1982. "Logic for Equivocators." *Noûs* 16: 431-441
- Logan, John S., Scott E. Lively, and David B. Pisoni. 1991. "Training Japanese Listeners to Identify English /r/ and /l/: A First Report." *Journal of the Acoustical Society of America* 89(2): 874-886.
- Lord, Errol. 2018. *The Importance of Being Rational*. Oxford: Oxford University Press.
- Lupyan, Gary. 2015. "Cognitive Penetrability of Perception in the Age of Prediction: Predictive Systems are Penetrable Systems." *Review of Philosophy and Psychology* 6(4): 547-569.
- Lyons, Jack. 2011. "Circularity, Reliability, and the Cognitive Penetration of Perception." *Philosophical Issues* 21: 289-311.
- Lyons, Jack. 2016a. "Inferentialism and the Cognitive Penetrability of Perception." *Episteme* 13(1): 1-28.
- Lyons, Jack. 2016b. "What We Talk about When We Talk about Epistemic Justification." *Inquiry* 59(7-8): 867-888.
- Macpherson, Fiona. 2009. "Perception, Philosophical Perspectives." In *The Oxford Companion to Consciousness*, ed. Tim Bayne, Axel Cleeremans, and Patrick Wilken, ed. Oxford: Oxford University Press.
- Macpherson, Fiona. 2012. "Cognitive Penetration of Colour Experience: Rethinking the Issue in Light of an Indirect Mechanism." *Philosophy and Phenomenological Research* 84(1): 24-62.
- Mandelbaum, Eric. 2017. "Associationist Theories of Thought." *The Stanford Encyclopedia of Philosophy*, Summer 2017 Edition, ed. Edward N. Zalta.
- Markie, Peter. 2005. "The Mystery of Direct Perceptual Justification." *Philosophical Studies* 126: 347-373.
- Markie, Peter. 2006. "Epistemically Appropriate Perceptual Belief." *Noûs* 40: 118-142.
- Markie, Peter. 2013. "Searching for True Dogmatism." In *Seemings and Justification: New Essays on Dogmatism and Phenomenal Conservatism*, ed. Chris Tucker, 248-268. Oxford: Oxford University Press.
- McGrath, Matthew. 2013. "Phenomenal Conservatism and Cognitive Penetration: The 'Bad Basis' Counterexamples." In *Seemings and Justification: New Essays on Dogmatism and Phenomenal Conservatism*, ed. Chris Tucker, 225-247. Oxford: Oxford University Press.
- McGrath, Matthew. 2016. "Cohen on 'Epistemic'." *Inquiry* 59(7-8): 889-905.
- McGurk, Harry, and John MacDonald. 1976. "Hearing Lips and Seeing Voices." *Nature* 264(5588):

746-748.

- McHugh, Conor. 2017. "Attitudinal Control." *Synthese* 194: 2745-2762.
- McHugh, Connor and Jonathan Way. 2018. "What is Reasoning?" *Mind* 127(505): 167-196.
- Medin, Douglas. 1989. "Concepts and Conceptual Structure." *American Psychologist* 44(12): 1469-1481.
- Melkman, Rachel, and Liora Rabinovitch. 1998. "Children's Perception of Continuous and Discontinuous Movement." *Developmental Psychology* 34: 258-263.
- Michotte, Albert. 1963. *The Perception of Causality*. Oxford: Basic Books.
- Milojkovic, James D. 1982. "Chess Imagery in Novice and Master." *Journal of Mental Imagery* 6: 125-144.
- Morton, John, and Mark Johnson. 1991. "CONSPEC and CONLEARN: a Two Process Theory of Infant Face Recognition." *Psychological Review* 98:164-181.
- Moser, Paul. 1989. *Knowledge and Evidence*. Cambridge, UK: Cambridge University Press.
- Muentener, Paul, and Susan Carey. 2010. "Infants' Causal Representations of State Change Events." *Cognitive Psychology* 61(2): 63-86.
- Munton, Jessie. "Perceptual Skill and Social Structure." *Philosophy and Phenomenological Research* 99(1): 131-161.
- Neta, Ram. 2019. "The Basing Relation." *The Philosophical Review* 128 (2):179-217.
- Nolfi, Kate. 2015. "Which Mental States are Rationally Evaluable and Why?" *Philosophical Issues* 25(1): 41-63.
- Oaksford, Mike, and Nick Chater. 2007. *Bayesian Rationality: The Probabilistic Approach to Human Reasoning*. Oxford: Oxford University Press.
- Palmieri, Thomas J. 1997. "Exemplar Similarity and the Development of Automaticity." *The Journal of Experimental Psychology: Learning, Memory, and Cognition* March 23(2): 324-354.
- Parfit, Derek. 1984. *Reasons and Persons*. Oxford: Oxford University Press.
- Parfit, Derek. 1997. "Reasons and Motivation." *Proceedings of the Aristotelian Society Supplementary Volume* 71: 99-130
- Parfit, Derek, 2001. *On What Matters* (Vol. 1). Oxford: Oxford University Press.
- Parfit, Derek. 2001. "Rationality and Reasons." In *Exploring Practical Philosophy: From Action to Values*, ed. Dan Egonsson, Jonas Josefsson, Bjoen Petersson, and Toni Rønnow-Rasmussen, 19-39.

- Alderhot: Ashgate.
- Peirce, Charles Sanders. 1905. "Issues of pragmatism." *The Monist* 15(4): 481-499.
- Pollock, John and Joseph Cruz. 1999. *Contemporary Theories of Knowledge*, 2<sup>nd</sup> ed. Lanham, MD: Rowman & Littlefield.
- Prinz, Jesse. 2006. "Is the Mind Really Modular?" In *Contemporary Debates in Cognitive Science*, ed. Robert J. Stainton, 22-36. Malden: Blackwell Publishing.
- Prettyman, Adrienne. 2019a. "Perceptual Learning." *WIREs Cognitive Science* 10(e1489), DOI: 10.1002/wcs.1489
- Prettyman, Adrienne. 2019b. "Perceptual Precision." *Philosophical Psychology* 32(6): 923-944.
- Pryor, James. 2000. "The Skeptic and the Dogmatist." *Noûs* 34(4), 517-549.
- Pryor, James. 2013. "Problems for Credulism." In *Seemings and Justification: New Essays on Dogmatism and Phenomenal Conservatism*, ed. Chris Tucker, 89-132. Oxford: Oxford University Press.
- Pylyshyn, Zenon. 1999. "Is Vision Continuous with Cognition? The Case for Cognitive Impenetrability of Visual Perception." *Behavioral and Brain Sciences* 22: 341-423.
- Pylyshyn, Zenon. 2001. "Visual Indexes, Preconceptual Objects, and Situated Vision." *Cognition* 80: 127-158.
- Pylyshyn, Zenon, and Ron Storm. 1988. "Tracking Multiple Independent Targets: Evidence for a Parallel Tracking Mechanism." *Spatial Vision* 3(3): 1-19.
- Quilty-Dunn, Jake. 2019. "Perceptual Pluralism." *Noûs*. doi: 10.1111/nous.12285.
- Quilty-Dunn, Jake. Forthcoming. "Attention and Encapsulation". *Mind and Language*.
- Quilty-Dunn, Jake, and Eric Mandelbaum. 2018. "Inferential Transitions." *Australasian Journal of Philosophy* 96(3): 532-547.
- Railton, Peter. 2012. "That Obscure Object, Desire." *Proceedings and Addresses of the American Philosophical Association* 86(2): 22-46.
- Railton, Peter. 2014a. "The Affective Dog and its Rational Tale: Intuition and Attunement." *Ethics* 124(4): 813-859.
- Railton, Peter. 2014b. "Reliance, Trust, and Belief." *Inquiry: An Interdisciplinary Journal of Philosophy*. 57(1): 122-150.
- Peter Railton. Forthcoming. "Comment on Susanna Siegel, 'Inference without Reckoning.'" *Philosophical and Phenomenological Research*.



- Ramachandran, Vilayanur S. 1988. "Perception of Shape from Shading." *Nature* 331: 163-166.
- Ramachandran, Vilayanur S., and Edward M. Hubbard. 2001. "Synesthesia—A Window into Perception, Thought, and Language." *Journal of Consciousness Studies* 8(12): 3-34.
- Regolin, Lucia, and Giorgio Vallortigara. 1995. "Perception of Partially Occluded Objects by Young Chicks." *Attention, Perception, & Psychophysics* 57(7): 971–976.
- Rescorla, Michael. 2013. "Bayesian Perceptual Psychology." In *The Oxford Handbook of Philosophy of Perception*, ed. Mohan Matthen. Oxford: Oxford University Press.
- Reverberi, Carlo, Doris Pischedda, Michele Burigo, and Paolo Cherubini. 2012. "Deduction Without Awareness." *Acta Psychologica* 139(1): 244–253.
- Rips, Lance. 2004. *The Psychology of Proof*. Cambridge, MA: MIT Press.
- Rinard, Susanna. 2018. "Believing for Practical Reasons." *Nous*. doi: 10.1111/nous.12253.
- Rolfs, Martin, Michael Dambacher, and Patrick Cavanagh. 2013. "Visual Adaptation of the Perception of Causation" *Current Biology* 23: 250-254.
- Scanlon, T.M. 1998. *What We Owe to Each Other*. Cambridge, MA: Harvard University Press.
- Scanlon, T.M. 2014. *Being Realistic About Reasons*. Oxford: Oxford University Press.
- Scholl, Brian. 2001. "Objects and Attention: The State of the Art." *Cognition* 80: 1–46.
- Scholl, Brian, and Alan Leslie. 1999. "Explaining the Infant's Object Concept: Beyond the Perception/Cognition Dichotomy." In *What is Cognitive Science?* ed. Ernest Lepore and Zenon Pylyshyn, 26-73. Oxford: Blackwell.
- Schutz, Michael, and Michael Kubovy. 2009. "Causality and Crossmodal Integration." *Journal of Experimental Psychology: Human Perception and Performance* 35(6): 1791-1810.
- Schutz, Michael, and Scott Lipscomb. 2007. "Hearing Gestures, Seeing Music: Vision Influences Perceived Tone Duration." *Perception* 36: 888-897.
- Sekuler, Robert, Alison B. Sekuler, and Renee Lau. 1997. "Sound Alters Visual Motion Perception." *Nature* 385:308
- Shams, Ladan, Yukiyasu Kamitani, and Shinsuke Shimojo. 2002. "Visual Illusion Induced by Sound." *Cognitive Brain Research* 14: 147-152.
- Shams, Ladan and Robyn Kim. 2010. "Crossmodal Influences on Visual Perception." *Physics of Life Reviews* 7(3): 269—284.

- Shea, Nicholas. 2015. "Distinguishing Top-Down from Bottom-Up Effects." In *Perception and Its Modalities*, ed. Dustin Stokes, Mohan Matthen, and Stephen Biggs, 73–91. Oxford: Oxford University Press.
- Shea, Nicholas. 2016. "Representational Development Need Not be Explicable-by-Content." In *Fundamental Issues of Artificial Intelligence*, ed. Vincent C. Müller, 221–238. Switzerland: Springer Synthese Library.
- Sher, George. 2006. "Out of Control." *Ethics* 116(2): 285–301.
- Siegel, Susanna. 2010. *The Contents of Visual Experience*. Oxford: Oxford University Press.
- Siegel, Susanna. 2011. "Cognitive Penetrability and Perceptual Justification." *Noûs* 46(2): 201–222.
- Siegel, Susanna. 2017. *The Rationality of Perception*. Oxford: Oxford University Press.
- Siegel, Susanna, and Nicholas Silins. 2015. "The Epistemology of Perception." In *The Oxford Handbook of the Philosophy of Perception*, ed. Mohan Matthen. Oxford: Oxford University Press.
- Smith, A.D. 2002. *The Problem of Perception*. Cambridge, MA: Harvard University Press.
- Smith, Angela. 2005. "Responsibility for Attitudes: Activity and Passivity in Mental Life." *Ethics* 115(2): 236–271.
- Smith, Linda. 2009. "From Fragments to Geometric Shape: Changes in Visual Object Recognition Between 18 and 24 Months." *Current Directions in Psychological Science* 18(5): 290–294.
- Smith, Michael. 1994. *The Moral Problem*. Oxford: Blackwell.
- Sosa, Ernest. "How to Defeat Opposition to Moore." *Noûs* (Supplement: Philosophical Perspectives, Epistemology) 13: 141–153.
- Spelke, Elizabeth. 1988. "Where Perceiving Ends and Thinking Begins: The Apprehension of Objects in Infancy." In *The Minnesota Symposia on Child Psychology, Vol. 20. Perceptual Development in Infancy*, ed. Albert Yonas, 197–234. Hillsdale, NJ: Erlbaum.
- Spelke, Elizabeth. Forthcoming. *Core Knowledge and Human Cognition*.
- Spelke, Elizabeth, Karen Breilinger, Janet Macomber, and Kristen Jacobsen. 1992. "Origins of Knowledge." *Psychological Review* 99: 605–632.
- Spence, Charles. 2015a. "Eating with Our Ears: Assessing the Importance of the Sounds of Consumption on Our Perception and Enjoyment of Multisensory Flavour Experiences." *Flavour* 4(3).
- Spence, Charles. 2015b. "Multisensory Flavor Perception." *Cell* 161(1): 24–35.

- Sperber, Dan, Francesco Cara, and Vittorio Girotto. 1995. "Relevance Theory Explains the Selection Task." *Cognition* 57: 31–95.
- Stahl, Aimee, and Lisa Feigenson. 2015. "Observing the Unexpected Enhances Infants' Learning and Exploration." *Science* 348(6230): 91–94.
- Stokes, Dustin. Forthcoming. "On Perceptual Expertise." *Mind and Language*.
- Streri, Arlette, and Elizabeth Spelke. 1988. "Haptic Perception of Objects in Infancy." *Cognitive Psychology* 20(1): 1–23.
- Streri, Arlette, and Elizabeth Spelke. 1989. "Effects of Motion and Figural Goodness on Haptic Object Perception in Infancy." *Child Development* 60(5): 1111–1125.
- Sylvan, Kurt. 2018. "Knowledge as a Non-Normative Property." *Philosophical and Phenomenological Research* 97(1): 190–222.
- Tanaka, James, and Marjorie Taylor. 1991. "Object Categories and Expertise: Is the Basic Level in the Eye of the Beholder?" *Cognitive Psychology* 23: 457–482.
- Tolliver, Joseph. 1982. "Basing Beliefs on Reasons." *Grazer Philosophische Studien* (15): 149–161.
- Tucker, Chris. 2013. "Introduction: Seemings and Justification." *Seemings and Justification: New Essays on Dogmatism and Phenomenal Conservatism*, ed. Chris Tucker, 1–29. New York: Oxford University Press.
- Turri, John. 2010. "On the Relationship Between Propositional and Doxastic Justification." *Philosophical and Phenomenological Research* 80(2): 312–326.
- Uller, Claudia, Marc Hauser, and Susan Carey. 2001. "Spontaneous Representation of Number in Cotton-Top Tamarins (*Saguinus Oedipus*)." *Journal of Comparative Psychology* 115(3): 248–257.
- Valenti, J.J. and Chaz Firestone. 2019. "Finding the 'Odd One Out': Memory Color Effects and the Logic of Appearance." *Cognition* 191: 103934.
- Vance, Jonna. 2014. "Emotion and the New Epistemic Challenge from Cognitive Penetrability." *Philosophical Studies*, 169(2): 257–283.
- vanMarle, Kristy, and Brian Scholl. 2003. "Attentive Tracking of Objects vs. Substances." *Psychological Sciences* 14(5): 498–504.
- Watanabe, Katsumi, and Shunsuke Shimojo. 2001. "When Sound Affects Vision: Effects of Auditory Grouping on Visual Motion Perception." *Psychological Science* 12: 109–116.
- Watson, Gary. 2011. "The Trouble with Psychopaths." In *Reasons and Recognition: Essays on the Philosophy of Tim Scanlon*, ed. R.J. Wallace, Rahul Kumar, and Samuel Freeman. New York: Oxford University Press.

- Wilson, John, and James Robinson. 1986. "The Impossibly Twisted Pulfrich Pendulum." *Perception* 15: 503–504.
- Wedgwood, Ralph. 2006. "The Normative Force of Reasoning." *Noûs* 40(4): 660–686.
- Welch, Robert B. and David H. D. Warren. 1980. "Immediate Perceptual Response to Intersensory Discrepancy." *Psychological Bulletin* 88(3): 638–667.
- Williamson, Timothy. 2000. *Knowledge and Its Limits*. Oxford: Oxford University Press.
- Witzel, Cristoph, Hanna Valkova, Thorsten Hansen, and Karl Gegenfurtner. 2011. "Object Knowledge Modulates Color Appearance." *i-Perception* 2: 13–49.
- Xu, Fei, and Susan Carey. 1996. "Infants' Metaphysics: The Case of Numerical Identity." *Cognitive Psychology* 30(2): 111–153.
- Zeimbekis, John. 2013. "Color and Cognitive Penetrability." *Philosophical Studies* 165(1): 167–175.