PERCEPTUAL LEARNING AND REASONS-RESPONSIVENESS

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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). Reasons-responsiveness also plays a major role in determining which mental states are rationally evaluable, in both the moral and epistemic domains (Fischer & Ravizza, 1998; Railton, 2014; Nolfi, 2015; McHugh, 2017). States that cannot respond to reasons, such as 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 link 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 call your experience rational given that it is formed without consulting reasons at all. Due to this

apparent isolation from reasons, perception is traditionally considered outside the scope of rational evaluability.

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 perception's rational evaluability 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 in fact she was 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 a semantic connection is required, how perceptual and cognitive states are differentiated, and how stages of processing are carved up.[1] Some theorists hold that cognitive penetration is rife (Prinz, 2006; Lupyan, 2015; Block, forthcoming), while others argue that all purported instances of cognitive penetration can be explained away (Fodor, 1983; Pylyshyn, 1999; Firestone & Scholl, 2016). The psychological terrain of cognitive penetration is a rocky one.[2]

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 are thereby epistemically evaluable as justified or unjustified.[3] While the role of perceptual learning in the epistemology of perception has received some recent attention (Brogaard & Gatzia, 2017; Chudnoff, 2017, 2021; Chudnoff & Chomanski, 2017), the idea that the outputs of perceptual learning are based on reasons is as yet unexplored.

The flexibility of perceptual learning makes it especially plausible that perceptual states are based on reasons. Not only are individual perceptual states formed in response to new 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. In §3, I describe my focal example of perceptual learning in chess masters. Drawing on experimental evidence, I argue that this learning process occurs in perception, rather than in judgment or memory. In §4, I argue that the chess masters' perceptual experiences are based on reasons and thereby epistemically evaluable. In §5, I consider an objection: perceptual systems are not sufficiently responsive to new epistemic reasons to involve the basing relation. I reply by illustrating how perceptual learning demonstrates sufficient reasons-responsiveness for basing. In §6, I consider whether chess players' perceptions are justified or unjustified.

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; Bengson, 2015). On some such views, conscious access to one's reasons is a necessary condition on epistemic evaluability. On other such views, the 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 (Boghossian, 2018). Purely physical pains and pleasures operate largely independently from reason and so elude rational assessment (Parfit, 1984). Desires and emotions are often exempt from epistemic evaluation because they are not sufficiently responsive to reasons.[4] 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).[5] In general, whether mental states are within the scope of epistemic evaluability hinges on how they interact with reasons.

Not just any old relation to reasons ensures a state's epistemic evaluability. A headache induced by perseverating over reasons bearing on an important career decision is nonetheless epistemically unevaluable. But when a mental state is not only caused by reasons but also epistemically based on those reasons, it is rendered epistemically evaluable. Unlike the headache, the belief you form based on those same reasons—e.g., that you should take job A over job B—is epistemically evaluable as justified or unjustified.

When a mental state is epistemically based on epistemic reasons, it is formed in virtue of the epistemic support those reasons provide (or are taken to provide).[6] States based on reasons can be evaluated for whether they are good or bad responses to epistemic support. When mental states are properly based on good and sufficient epistemic reasons, they are justified. When they are badly based or based on bad or insufficient epistemic reasons, they are unjustified. This key relation between basing on epistemic reasons and

epistemic evaluation is captured by the following condition:

> **Reasons-then-Status:** If a mental state is based on an epistemic reason, then that state has an epistemic status as justified or unjustified.

Reasons-then-Status proposes a sufficient condition on epistemic evaluability. This condition allows us to learn which states are epistemically evaluable by examining how they are formed.[7] When the basing relation is present, we have the raw material needed to perform epistemic evaluations. Reasons-then-Status 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. If all goes well, motivating reasons are (or represent) normative reasons for forming the mental state in question.[8]

Epistemic status is a property of mental states that also impacts an individual's overall 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. Thus, epistemic status is not only a measure of how well a state functions within a causal system but is tightly tied to agent-level assessment.

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). 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.

3. Perceptual learning

Perceptual learning gives us reason to question the role of perception as an unjustified justifier. In this section, I set the stage for my arguments to this effect by describing some crucial details of the psychology of perceptual learning. In §3.1, I introduce the idea of perceptual learning. I focus on perceptual unitization in chess, which is my central example of perceptual basing in §4. I describe how this learning process unfolds and the nature of the mental representations it generates. In §3.2 I argue perceptual learning in chess is a genuinely perceptual process.

3.1 Perceptual Unitization

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).[9] Perceptual learning comes in many forms, including improvements in sensory discrimination (Goldstone, 1994), changes in attentional allocation (Goldstone, Landy, & Brunel, 2011), and crossmodal information integration (Shams & Kim, 2010).[10] One central function of perceptual learning is creating new perceptual units. This takes two major forms. In perceptual differentiation, more fine-grained units are created, which allow for subtler discrimination among stimuli (Goldstone, 2000). In perceptual unitization, more complex units are created, which organize multiple stimulus properties into a discrete chunk (Gauthier & Tarr, 1997; Goldstone, 2000; Goldstone & Byrge, 2015; Connolly, 2019).

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Unitization is the perceptual analog of memory chunking. In memory chunking, we organize information into chunks and thereby exceed our typical working memory capacity. Each chunk functions as an item for the purposes of capacity limits, enabling more total information to be stored. Language illustrates this point well. Consider a speaker of only English and a speaker of only Croatian who are each asked to remember the following string of letters:

RAZMIJENTIMUKTRPANMEDVJED

The English-speaker will struggle to remember more than nine items, whereas the Croatian-speaker will easily remember the entire string because they can chunk it into three Croatian words: 'razmijenti' (exchanges), 'muktrpan' (arduous), and 'medvjed' (bear). These words function as readily available organizational structures. The three chunks occupy far less space in working memory than the 25 letters individually. Similarly, in perceptual unitization, perceptual units are developed that organize representations of stimulus features into discrete chunks that occupy far less space in working memory than the stimulus features do individually. While these chunks are the product of perception rather than memory, they also aid memory by decreasing the memory capacity needed to remember the perception.

Here, I focus on perceptual unitization in chess masters.[11] The research program on the cognitive science of chess was launched in the 1940's by Adriaan de Groot and has thrived over the last 80 years (de Groot, 1965; Milojkovic, 1982; Holding, 1985; Calderwood, Klein, & Crandall, 1988; Charness, 1992; Gobet & 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 novices at reconstructing chessboards after viewing them for only five seconds (Chase & Simon, 1973). This result indicates that chess masters have visually unitized the pieces into chunks of available moves, such as castlings, checks, and double

attacks, allowing for efficient memory storage. Novices have not unitized the pieces, and so only see each individual piece at its location. The number of individual pieces on the board far outstrips our working memory capacity of about seven items, whereas the number of chunks is closer to this limit, lending chess masters a distinct advantage. This unitization model has been further supported by eye movement analyses of chess players indicating they linger over crucial pieces rather than sweeping the board (Charness et al., 2001; Reingold et al., 2001; Bilalic et al., 2010) and neural data indicating that only expert chess players recruit brain areas that are typically used for chunking (Amidzic et al., 2001; Campitelli et al., 2007).

Chess masters learn to chunk through extensive experience seeing chessboards and considering moves. In the first stage of this process, which I will call 'storage,' chess masters' perceptual systems combine experiences with their beliefs about available moves to store rules dictating the conditions for new visual units. This occurs gradually during gameplay. In the second stage of the process, which I will call 'unitization,' the stored rules are used to generate subsequent visual experiences.[12] The key aspects of the first stage of the process are as follows:

Stage 1: Storage

<u>Visual Experience</u>
Content: Chess pieces a, b, and c, are at locations x, y, and z.[13]

<u>Chess Belief</u>
Content: Move m is available (involving chess pieces a, b, and c, at locations x, y, and z).

<u>Unitization Rule</u>
When chess pieces x, y, and z are at realistic locations a, b, and c, this makes up chunk m.

The visual experience is an ordinary visual experience of a segment of the chessboard that a player at any level of expertise might have. The chess belief is a belief that a particular move is available, derived from the player's knowledge of the rules of chess. Repeated tokens of

this type of experience and belief combine to prompt the visual system to store a unitization rule. This rule says that when this realistic configuration of pieces-at-location is present, chunk m is present.

What exactly is the psychological nature of this rule? The experimental data does not determine whether it is explicitly represented as the content of a mental state or whether it is only an implicit rule that guides mental transitions from inputs to outputs. I take both to be live possibilities. I return to this issue in §4, where I discuss how these two possibilities impact my arguments for perceptual basing.

Once a chess player has thoroughly learned this rule, they can use it to unitize their visual experience of the chessboard. The key aspects of this second stage of the process are as follows:

Stage 2: Unitization

<u>Visual Input</u>
Content: Chess pieces x, y, and z are at realistic locations a, b, and c.[14]

<u>Unitization Rule</u>
When chess pieces x, y, and z are at realistic locations a, b, and c, this makes up chunk m.

<u>Output (Visual Experience)</u>
Content: Chunk m is present.

The visual input is a mental representation within the visual system that specifies the configuration of a set of pieces. 'Input' here indicates that the state is an input to the unitization process, but it is also the output of prior visual processing. The visual input is a state that occurs within both the visual system of a chess master and that of novice player. In a novice player, this is where visual processing would end, because the novice does not have any stored unitization rules. In contrast the chess master does have a stored unitization rule. This rule is applied to the visual input to produce a visual experience of a chunk.

As stated earlier, I remain neutral as to whether the rule is implicitly or explicitly represented. If the rule is explicitly represented, what is the representation's format? The experimental data does not answer this question either, but the rule's nature may constrain the format in which it is represented. The rule is roughly a conditional, so a representation of it must involve an if-then operator. The presence of a logical operator indicates that the representational content is propositional rather than pictorial.[15] While propositional contents may be represented in a variety of formats, the presence of a logical operator lends itself toward a propositional or language-like format.[16] But other options are available. For example, the unitization rule may be represented in a map-like format. Maps can accommodate both logical and causal relations (Camp, 2007). A third possibility is a hybrid format in which pictorial representations of the pieces-at-locations and of chunk m are conjoined by a logical operator. I return to this topic in §4, where I illustrate how these three possibilities for the format of the representation of the rule are equally congenial to my arguments for perceptual basing.

3.2 Perceptual or Cognitive?

It is important to my arguments that unitization in chess is a perceptual processes resulting in perceptual states because my goal is to argue that epistemic basing can occur within perception. I will consider here some worries one might have with regards to the perceptual nature of unitization in chess. I argue that 1) unitization is not a form of cognitive penetration, and 2) unitized experiences of chessboards are perceptions rather than judgments.

First, one might worry that the storage process (stage 1) is cognitive penetration rather than perceptual learning.[17] While it is true that the storage of the unitization rule is

partially driven by beliefs, this process differs from paradigmatic cognitive penetration.

Classic cases of cognitive penetration are synchronic: an occurrent cognitive state influences occurrent perceptual processing or experience. Synchronic cognitive penetration provides the strongest challenge to modular views of perception, according to which perception is composed of dedicated input analyzers that consult only their own database of information in their processing (Fodor, 1983; Pylyshyn, 1999). Synchronic cognitive penetration would show that perceptual input analyzers reach beyond their own database of information and consult cognitive states in their processing.

In contrast, perceptual learning in chess involves diachronic cognitive influence rather than synchronic cognitive penetration.[18] Diachronic cognitive influence differs from synchronic cognitive penetration in two key respects: 1) diachronic cognitive influence requires repeated exposure to cognitive states over time, and 2) the changes these cognitive states induce in perception are long-lasting. In perceptual learning in chess, repeated beliefs about available moves (along with repeated experiences of the board) gradually induce long-lasting changes in perceptual processing by building up the unitization rules in the visual system. The diachronic changes to perception may be directly caused when the beliefs and experiences are simultaneously tokened, or indirectly caused when the beliefs direct the player's attention to the relevant configurations of pieces. In either case, synchronous beliefs do not cause players to see chunks. Chess masters can see chunks without having any beliefs about available moves, and novices can have beliefs about available moves without seeing chunks. The existence of diachronic cognitively driven perceptual learning is far less controversial than the existence of synchronic cognitive penetration and is admitted by even the staunchest proponents of modularity (e.g., Fodor, 1983, 1984). Diachronic cognitive influence allows modularists to maintain their central tenet that in any individual instance of

visual processing, input analyzers only consult their dedicated perceptual database—although this database can be gradually expanded over time.

One might also worry that when chess masters unitize the board, they do not visually experience chunks but instead judge that there are chunks on the basis of visual experiences of individual pieces. This worry is assuaged by a range of both experiential and experimental evidence that unitization in chess occurs within perception and results in a perceptual experience. First, chess masters describe their experience as highly visual. Chess memoirs and instructional manuals are written through with visual language. Irving Chernev, a U.S. national master, writes, "To acquire this [chess] instinct it is not necessary to memorize countless opening variations or to burden your brain with lists of formulas and principle…You will familiarize yourself with them painlessly—not by rote but by seeing their effect in the progress of a game…*decisive combinations will appear on the board*" (Chernev, 1957, p. 5). Chess magazines have long cited the classic rule, "When you see a good move look out for a better" (Wayte, 1878, p. 31). These descriptions reflect that from a subjective point of view, moves are visually apparent to chess masters. These chunks are described as visually popping out rather than as resulting from deliberate inference.

One might worry, though, that subjective reports alone are compatible with an explanation in terms of learning effects on judgment or memory rather than on perception itself. While representations of available moves may seem visual, introspection is not always reliable. For example, one might think that chess masters perceive the board exactly as novices do but are better able to judge when available moves are present. Or one might think that chess masters perceive *and* judge the board exactly as novices do but are better able to remember which moves they judged to be available.

While subjective reports may be compatible with these alternative hypotheses, an array of empirical data strongly supports the claim that chunking in chess is truly a form of perceptual learning rather than an effect on judgment or memory.[19] First, neuroscientific data shows that chess masters display greater neural activity in the fusiform face area (FFA) than novices when looking at chessboards (Bilalic et al., 2011). The FFA is standardly taken to be a brain area for not only facial recognition but also other forms of visual expertise, such as recognizing birds and cars (Gauthier et al., 2000). It is a locus of holistic visual processing, such as recognition and unitization. Enhanced FFA activation in chess masters indicates that their learning is both truly perceptual and a form of chunking.

Unique looking patterns further support the perceptual nature of chunking. Eye movement recordings show that chess masters visually scan the board differently from novices, fixating on fewer locations and saccading with greater amplitude (Charness et al., 2001). Chess masters have a larger visual span than novices, enabling them to detect available moves with a single glance (Reingold et al., 2001). These expert patterns of visual attention help enable perceptions of chunks.

Further support for the perceptual nature of unitization in chess comes from data showing that there are no relevant differences between the memory capacities of chess masters and novices outside the context of realistic, visually perceived chess games. Early data from de Groot shows that when pieces are placed randomly on the board rather than as if stopped mid-game, chess masters perform just as poorly as novices (de Groot, 1965). Chess masters' success at board replication cannot be due to enhanced domain-general memory, or even enhanced memory for the locations of chess pieces. Visual input of realistic moves enables the chess masters' skill.

When this crucial visual input is absent, as in blindfold chess in which the game is played only through spoken cues, players recruit visual working memory to represent their opponents' boards and plan their moves. Using the same board replication paradigm as Chase and Simon (1973), Saariluoma found interference effects for mental imagery tasks but not for verbal memory tasks, indicating that mental imagery resources are used for blindfolded board replication (Saariluoma, 1991, 1992). When visual perception of the board is removed, visual mental imagery is the default substitution even when information is verbally presented. This default to mental imagery highlights the visual nature of chess masters' skills.[20] We would expect verbal interference to disrupt processes in judgment or (non-visual) memory. Taken together, the data from chess masters' subjective reports, neural localization in the FFA, differences in looking patterns, lack of differences in memory capacity, and visual interference in blindfolded chess strongly support the view that unitization in chess occurs in perception rather than in judgment or memory.[21]

4. Epistemic basing in perceptual learning

While chunking is distinctly perceptual, it also bears the key markers of the epistemic basing relation. In this section, I argue that the chess masters' unitized perceptions of the chessboard are based on a reason and thereby epistemically evaluable. I first argue that unitization features the key components of the basing relation: 1) states that provide a reason, 2) a reason that epistemically supports the based state, and 3) formation (or maintenance) of the based state in virtue of the reason the states provide. I then respond to several concerns one might have about this perceptual basing.

The storage stage of perceptual learning equips the perceptual system with the unitization rule that enables basing, but the basing relation itself is instantiated in the unitization stage. Consider again the unitization process described in §3.1:

Stage 2: Unitization

<u>Visual Input</u>
Content: Chess pieces x, y, and z are at realistic locations a, b, and c.

<u>Unitization Rule</u>
When chess pieces x, y, and z are at realistic locations a, b, and c, this makes up chunk m.

<u>Output (Visual Experience)</u>
Content: Chunk m is present.

My claim here is that the output is based on the reason provided by the visual input and the unitization rule.[22] On the view that reasons are mental states, the reason is simply the input and implicit or explicit representation of the unitization rule taken together.[23] On the view that reasons are propositions, the reason is the proposition that chess pieces x, y, and z are at realistic locations a, b, and c, and the proposition that when chess pieces x, y, and z are at realistic locations a, b, and c, this makes up chunk m. On the view that reasons are facts, the reason is the fact that chess pieces x, y, and z are at realistic locations a, b, and c, and the fact that when chess pieces x, y, and z are at realistic locations a, b, and c, this makes up chunk m. On the view that reasons are states of affairs, the reason is the state of affairs in which chess pieces a, b, and c, are at realistic locations x, y, and z, and in which when chess pieces x, y, and z are at realistic locations a, b, and c, this makes up chunk m. On either of these three externalist accounts of reasons, while the reason itself is situated outside the chess player's mind, the input and unitization rule epistemically relate her to this reason such that it can serve as her epistemic basis.

Why do these states provide a reason, either by constituting a reason themselves or by epistemically relating the agent to an external reason? First, the input is the type of

perceptual representation that provides a reason for belief in other contexts. It is not an early state of sensory registration but instead a representations of pieces-at-locations that results from significant prior processing. In an agent who has not undergone perceptual learning, perceptual processing would end at this state, and it would become a conscious perceptual experience. This experience might provide reason for the agent to believe e.g., that there is a rook on square C4, or that her opponent's queen has not yet been captured. The mere fact that the state occurs unconsciously in unitization does not preclude it from providing a reason because we commonly grant that unconscious beliefs provide reasons. For example, a person who unconsciously believes she is good and generous at heart might be too humble to consciously admit this to herself, yet she would be justified in believing that she would help her friends if they were in need. This is because her unconscious belief that she is good and generous provides a reason for her belief that she would help her friends. Given that the input is a state of the same type as a perceptual experience that provides reasons, and given that consciousness does not make a relevant difference, the input seems apt to provide a reason.

As mentioned earlier, there are two psychological possibilities for the mental instantiation of the unitization rule: 1) the rule may be explicitly represented in the content of a mental state, or 2) the rule may only implicitly guide the transition from input to output. On both possibilities, the chess master's connection to the rule provides a reason for her experience of the chessboard.

If the unitization rule is an explicitly represented mental state, it provides a reason in the same way the input does. On an internalist conception of reasons, this means that the input and the representation of the unitization rule are together a reason for the output. On an externalist conception of reasons, this means that the input and representation of the

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unitization rule together epistemically relate the agent to the set of propositions, facts, or states of affairs that is the reason for the output.

As mentioned in §3, if the unitization rule is explicitly represented, the representation may have a propositional, map-like, or hybrid format. The input may also have a propositional, map-like, or even entirely pictorial format. I do not attempt to adjudicate between these options here, because all these possibilities are compatible with the states' providing a reason. States ranging from entirely propositional to entirely pictorial provide reasons in other contexts. Beliefs are standardly taken to have a propositional format (Quilty-Dunn, 2020b, Block, forthcoming) and provide reasons for subsequent beliefs formed on their basis. Perceptual experiences are often taken to have a pictorial/iconic format (Carey, 2009; Block, forthcoming) and provide reasons for beliefs endorsing their content. So, the input and representation of the unitization rule's ability to provide reasons does not turn on their format.

If the unitization rule is an implicit rule rather than an explicit representation, one might worry that this undermines its ability to provide a reason.[24] Implicit storage is a live psychological possibility given the experimental evidence and so should be taken seriously. A first point of reply is that there are other cases in which implicit rules plausibly provide reasons. A first example is implicit grammar. Consider a fluent English speaker who has an internalized grammatical rule that when the object of a sentence is a disjunction with singular disjuncts it agrees with a singular verb. This implicit rule provides a reason for her belief that the sentence "Eve or Oksana are in Barcelona" is grammatically incorrect, even if she cannot articulate the rule. Another example is implicit knowledge of scientific laws. Consider an experienced cyclist who has implicitly learned Boyle's Law through regularly pumping air into her bike tires. Boyle's Law says that the pressure exerted by a gas is inversely

proportional to its volume. When the cyclist opens a new soda bottle, her implicit knowledge of Boyle's Law provides her reason for opening it slowly (and for believing she ought to open it slowly), because the low volume has created high pressure that will release on opening. In both these examples, rules provide reasons even if they are implicitly represented.

More importantly, we can set aside the question of whether implicit rules can provide reasons on their own because the unitization rule provides a reason in conjunction with the input, which is an explicit representation. We can think of the implicitly followed unitization rule as enabling the input to provide a reason for the output. This enabling role is commonly granted to internalized rules. Consider a young child who does not yet have any explicit beliefs about modus ponens yet uses it to guide her reasoning. Her internalization of the modus ponens rule (that if p implies q, and p is true, then q must be true) enables her belief that it is 8 pm and her belief that if it is 8 pm, then it is bedtime to provide a reason for her belief that it is bedtime. The same can be true of rules corresponding to the conditional premise in various modus ponens inferences. An experienced fisherman's visual experience of the tip of a seal's nose provides a reason for him to believe it is a Harbor Seal because the experience is enabled by his internalized rule that if a seal's nostrils form a heart shape, it is a Harbor Seal. The unitization rule plays at least this kind of enabling role, allowing the input to provide a reason for the output.

Returning to why unitization in chess instantiates epistemic basing, this process bears a second key characteristic of basing: the reason provided by the input and unitization rule epistemically supports the output. To see this support relation, consider a scenario in which you are tasked with determining which moves are available in a chess game while looking away from the board. A friend who is looking at the board tells you where each piece is

located, and you consult a rulebook that details which configurations of pieces make up available moves. Eventually, by combining your sources of information and deliberating, you draw an epistemically justified conclusion about which moves are available (i.e., which chunks are present), based on the available reason. This scenario parallels the perceptual processing a chess master undergoes when looking at a chessboard. Just as your belief is epistemically supported by the reason provided by your friend and the rulebook, the chess master's visual experience is epistemically supported by the reason provided by the input and unitization rule.

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 a rule that consistently and reliably guides visual processing across a range of cases. The epistemic support relation between inputs and outputs are consistently tracked whenever these learned perceptual principles are used.

We can see the epistemic nature of this transition by considering counterfactuals that vary the epistemic support provided. If different unitization rules were stored such that the input supported a different output, the output would shift accordingly. For example, if a chess player were taught non-standard chess rules according to which bishops only move sideways, she would store different unitization rules and thus perceive pieces at the same locations as constituting different chunks. The output depends on the epistemic support provided by the input and unitization rule, indicating these states stand in an epistemic basing relation.

The basing relations that lead to perceptions of chunks are not conscious or voluntary, making them unlike standard exemplars of basing on reasons. One may worry that basing requires conscious access to one's reasons and/or voluntary control over them,

which perceptual systems lack. 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 train, but this would be only post-hoc speculation. Despite lack of consciousness and voluntary control, her belief is based on reasons, 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.[25]

Even if one grants that epistemic basing can be unconscious and involuntary, one might still worry that epistemic basing must be person-level, while perceptual learning is subpersonal.[26] The idea of the person-level was introduced by Dennett (1969) as a kind of psychological explanation. Person-level explanations attribute mental states and processes to agents, whereas subpersonal explanations attribute mental states and processes only to subsystems. States and processes that figure in person-level explanations are themselves person-level, whereas states and processes that only figure in subpersonal explanations are subpersonal. While the term 'person-level' has taken on a variety of meanings ranging from 'conscious' to 'rationally evaluable' (Drayson, 2012, 2014), I will focus here on the classic meaning of attributability to the individual via its role in a psychological explanation because this meaning presents the clearest potential condition on epistemic basing.[27]

Is the perceptual learning process attributed to the chess player, or only to her visual subsystem? In approaching this question, a first point to note is that the process is bookended by uncontroversially person-level states. The process begins with conscious perceptual experiences of available moves and beliefs about the rules of chess, which drive the storage of unitization rules. The process ends with a conscious perceptual experience of a chunk. Conscious experiences and beliefs are paradigm person-level states (McDowell, 1994; Burge, 2010).

The middle of the process, in which the input and unitization rule are combined, dips below the surface of consciousness into the inner workings of perception and so is less paradigmatically person-level. Are the input and unitization rule attributable to the individual, or only to a visual subsystem? That is, does it make sense to say that the chess master represents that pieces x, y, and z are at locations a, b, and c, and that the chess master applies the rule that when chess pieces x, y, and z are at realistic locations a, b, and c, this makes up available move m?

The idea of the person-level is in an important sense holistic, in that it anchored in the idea of a person-level explanation. Explanations typically involve multiple states and mental transitions, which are jointly classified as person-level or subpersonal. Person-level states and processes interface with other person-level states and processes, while subpersonal states and processes interface at the subpersonal level. Considered in this holistic manner, given that the perceptual learning process starts and ends with uncontroversially person-level states, and that perceptual learning motivates person-level action (e.g., making moves in the chess game or attending to relevant configurations of pieces with the goal of storing additional unitization rules), the process seems holistically person-level.

Furthermore, explanations that attribute all aspects of the perceptual learning process to individuals sound very natural. For example, in Irving Chernev's classic chess instruction manual he credits expert players with several layers of the perceptual "instinct" for recognizing moves (i.e., unitization): "To acquire this instinct, it is not necessary to memorize countless opening variations, or to burden your brain with lists of formulae and principles. True, there are principles that govern proper procedure, and applying them will help you build up strong, sound, winning positions. But you will familiarize yourself with them painlessly—not by rote but by seeing their effects in the progress of a game" (Chernev, 1957, p. 5). Chernev emphasizes not only that the "instinct" for recognizing moves belongs to the player, but also that the player ("you") becomes "painlessly" (i.e., automatically) familiar with the relevant principles (such as unitization rules) through perceptual experience. This attribution of learning to the player fits naturally into our folk psychology, its unconscious perceptual nature notwithstanding.

Chernev's attribution of learning to the player is not merely for literary effect. It is part of a psychological explanation that illuminates how the rules embedded within perceptual processing are integrated with other aspects of the player's person-level psychology, such as her perceptual experiences and her decisions to make moves. The chess player sees the chunk because she has stored rules about which configurations make up available moves and applies these rules to her representation of the chessboard. Unlike subpersonal explanations, such as that a ganglion cell decreases its firing rate because it receives inhibitory input, the perceptual learning explanation bears on how the agent interacts with her environment and engages in further reasoning.

One might still worry, though, that the perceptual learning process cannot be person-level simply because it occurs within a visual subsystem rather than within central

cognition.[28] What is it about occurring within a subsystem that precludes attribution to the agent? One possibility is that subsystems are typically unconscious and involuntary, and so are disconnected from an agent's experiences and control. However, the examples discussed in the preceding pages show that there can be involuntary basing on unconscious reasons. Another possibility is that subsystems are typically informationally encapsulated (Fodor, 1983; Pylyshyn, 1999). They rely on a proprietary informational database that is not accessible to central cognition and so are cut off from the person. However, there are also informationally encapsulated systems within central cognition, such as belief fragments (Lewis, 1982; Egan, 2008; Bendana & Mandelbaum, 2021) and central modules (Cosmides & Tooby, 1992), that are nonetheless attributable to the agent. Consider a scholar who defends feminism it in his work. When he is in his academic mode, he fully believes in the intellectual, social, and political equality of women. Yet in social contexts his behavior reveals an unconscious belief that women are inferior—he condescends to women, suggests they are better suited for domestic roles, and never votes for female candidates. His feminist beliefs are encapsulated in his academic fragment, and so fail to influence the sexist beliefs that drive his behavior, and vice versa. While his feminist and sexist beliefs are mutually informationally encapsulated, both sets of beliefs nonetheless are attributable to the scholar. He, as an individual, harbors both feminist and sexist beliefs. Attributing both sets of beliefs to the scholar explains the felt irrationality of his pattern of belief—he is incoherent across belief fragments. As this case illustrates, informational encapsulation does not preclude attribution to the person.

Given that the prototypical features of subsystems (unconsciousness, involuntariness, and informational encapsulation) are compatible with person-level attribution, we are left without positive reason to think that states and processes of

subsystems must be subpersonal. So, it is reasonable to conclude that contra the common assumption that states and processes of subsystems are necessarily subpersonal, states and processes of subsystems can be person-level. Whether a state or process is person-level depends not on its location relative to subsystems but on whether it figures in whole-individual explanations and whether it reflects something about the individual herself. Just as a faculty member can be a member of the philosophy department and a member of the university, a state or process can be attributed to both a subsystem and an individual.[29] Perceptual unitization in chess is one such process.

As a final point, classifying perceptual learning as person-level allows us to properly credit chess masters for their expertise. If the input and unitization rule are attributed to the player, we can say that she perceives the available moves because she has learned which configurations of pieces make up salient chunks. The expertise is hers, and figures in her overall epistemic character. In contrast, if the input and unitization rule are attributed only to her visual system, the player deserves no more credit for her perceptual expertise than a novice who sees an available move through sheer luck. This is unsatisfying. Perceptual expertise intuitively seems like an epistemic accomplishment for which the expert should be credited.

Even if one is convinced that basing on reasons can hypothetically occur within perception, one might worry that any reasons involved at early stages of the learning process drop out of the picture by the time a player becomes a chess master and her habits of recognition and action become ingrained. Dreyfus makes this kind of argument with respect to chess masters' actions in speed chess, claiming that when making a move they respond directly to the board rather than to any prior mental states (Dreyfus, 2005, 2013).[30] While Dreyfus is focused on action whereas I am focused perception, his claim that reasons are not

involved nonetheless threatens my claim that chess masters' perceptual experiences are based on reasons.

However, Dreyfus's argument that speed chess is reasons-free rests on the idea that players lack the phenomenology of responding to reasons (Dreyfus, 2005) and are unable to give a complete rational explanation of their choice of move (Dreyfus, 2013). Yet neither phenomenology nor the ability to offer rational explanations is necessary for responding to reasons, as exemplified by the literary trope of the detective's hunch. The great fictional detectives, such as Miss Marple, Father Brown, Philip Marlowe, Hercule Poirot, and Nancy Drew, often solve mysteries by relying on ideas that come to them unbidden yet are nonetheless manifestations of their reasoning abilities.[31] For example, in the opening scene of Raymond Chandler's *Farewell, My Lovely*, Marlowe witnesses a man demand information about a woman named Velma, commit a murder, and flee. In the aftermath, Marlowe has a hunch that to unravel the mystery he should track down Velma rather than the murderer himself. It is clear from Marlowe's earlier observations that the reason for his hunch is that the murderer was strangely fixated on Velma, yet Marlowe himself cannot articulate this reason: "The hunch I had was as vague as the heat waves that danced above the sidewalk" (Chandler, 1940, p. 20). Elsewhere, Marlowe describes his strikingly reliable hunches as "psychic" (Chandler, 1949, p. 365), indicating his complete lack of reasoning phenomenology. Nonetheless, the murderer's strange fixation on Velma (or Marlowe's observation thereof) is best understood as a motivating reason rather than a mere cause because it justifies Marlowe's beliefs and behavior. Marlowe seems rational in thinking he should pursue this lead precisely because he has picked up on the murderer's strange fixation, reflecting that his hunch is a response to a reason despite its subjective opacity.[32]

The chess player's reasons operate below the surface, just as Marlowe's do.[33] Furthermore, from a psychological point of view, there is no reason to think that the cognitive states that provide reasons disappear with experience. As I argue in the next section, the best model of the perceptual learning process indicates that reasons are transferred from experience and belief to the perceptual system, so that they can be drawn on in subsequent perceptual processing.

Putting together my arguments from §3 and §4, I have argued that in chunking in chess, perceptual states are based on an epistemic reason. Reasons-then-Status says that if a mental state is based on an epistemic reason, then that state has an epistemic status as justified or unjustified. By this condition, chess masters' perceptual states are epistemically evaluable. They not only provide justification but also have epistemic statuses as justified or unjustified.

5. Reasons-responsiveness in perceptual learning

Despite perception's reasoning-like computational structure, the conclusion that perception is based on reasons is rarely granted (c.f. Siegel, 2017; McGrath, 2013). While there are multiple ways one might object to the idea that perception involves basing, here I will focus on an objection that stems from perception's reluctance to respond to new reasons.[34]

Perceptual systems are largely modular, meaning they are comprised of distinct functional units that respond rapidly and 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 cannot access information stored in other parts of the mind. Due to information encapsulation, perceptual states are

not revised in light of newly acquired beliefs. If you learn that the spots you are seeing are caused by an afterimage, you will nonetheless continue to see spots despite your good reason for disbelieving the spots are there. Mental systems that respond uniformly to inputs irrespective of reasons do not display an appreciation of epistemic support. Such automatic, inflexible responses look more like brute causal transitions than like basing. A necessary condition on basing that I will call 'Reasons-Responsiveness' sums up this thought:

> **Reasons-Responsiveness**: A mental state can be based on epistemic reasons only if it is formed or sustained by a mechanism that is responsive to the agent's epistemic reasons.

While I will not defend Reasons-Responsiveness here, given its intuitive appeal and 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.[35] Those who antecedently reject Reasons-Responsiveness are already one step closer to accepting my conclusion that perceptual states are epistemically evaluable.

Reasons-Responsiveness employs the idea of a cognitive mechanism. Examples of mechanisms include perceptual modalities (e.g., vision, audition), circumscribed belief formation systems such as cheater detection (Cosmides & 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 mechanisms in the sense relevant to Reasons-Responsiveness.

Reasons-Responsiveness applies to mechanisms rather than to individual states to allow for epistemic critique of states that should have responded to reasons but failed to do so. For example, consider a competent reasoner who supports a certain politician. She believes the politician is honest and a force for good, based on extensive research. The supporter devotes many hours to canvasing for the politician's campaign. She then receives

news that the politician is corrupt. Instead of revising her belief in the candidate's honesty in light of this news, she maintains it, perhaps due to an unconscious desire to preserve her self-image as a good character judge.[36] The supporter's persistent belief that the politician is honest is unjustified precisely because it did not respond to her reasons when it could and should have. While the belief itself is not responsive to reasons, it is formed by a belief-formation mechanism that is in general responsive to reasons and so the belief can count as badly based.

Reasons-Responsiveness requires that a mechanism be responsive to the *agent's* reasons for its outputs to be based on reasons. If one holds that reasons are mental states, then all reasons are by default the agent's reasons. However, if one holds that reasons are external to an agent's mind (e.g., facts, propositions, or states of affairs), then only some reasons are the agents' (in virtue of an epistemic relation obtaining between the agent and the reason), while other are not. Responsiveness to external reasons is easy to come by and does not on its own indicate aptness for basing. Digestion is at least causally responsive to external reasons such as the fact (or proposition, or state of affairs) that celery is fibrous. Independent of perceptual learning, visual perception is responsive to external reasons such as the lighting conditions or the angle of one's head.[37] Responsiveness to the agent's reasons is rarer and indicates that a mechanism is sensitive not only to the external world but also to the agent's internal representations and the rational support they provide.

Reasons-Responsiveness specifies responsiveness to *epistemic* reasons because responsiveness to moral or pragmatic reasons is not necessary for epistemic basing. For example, a psychopath who responds to epistemic but never moral reasons still has beliefs that are based on reasons and epistemically evaluable, even though on some views those beliefs are exempt from moral evaluation (e.g., Watson, 2011).[38]

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 reasons provide. A mechanism that is responsive to reasons must respond to reasons regularly, but it need not respond to reasons in every instance of its operation. Responding to reasons is a broad genus that includes the species of basing on reasons, inference, and reasoning, among others.[39]

Reasons-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 Reasons-Responsiveness also requires differential responses when new reasons are encountered. For example, if the baker discovers that 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 Reasons-Responsiveness. Put simply, a mechanism is responsive to reasons if and only if the way it forms outputs in response to inputs can change due to new reasons.

It is often thought that a failure of reasons-responsiveness precludes perceptual states from being a locus of the basing relation because they operate according to fixed principles of causal response. However, perceptual mechanisms are in fact responsive to reasons through perceptual learning. For example, as chess players learn to perceive chunks their visual systems store information in response to reasons provided by their experiences of chess boards and their beliefs about available moves. The key aspects of this learning process are as described in §3.1:

Stage 1: Storage

<u>Visual Experience</u>
Content: Chess pieces a, b, and c, are at locations x, y, and z.

<u>Chess Belief</u>
Content: Move m is available (involving chess pieces a, b, and c, at locations x, y, and z).

<u>Unitization Rule</u>
When chess pieces x, y, and z are at realistic locations a, b, and c, this makes up chunk m.

This learning process is a response to a reason. On an internalist conception of reasons, the reason is two mental states taken together: the visual experience of chess pieces a, b, and c at locations x, y, and z and the belief that move m is available. On an externalist conception of reasons, the reason is two facts taken together; 1) the fact (or proposition, or state of affairs) that pieces a, b, and c, are at locations x, y, and z, to which the agent is epistemically related by her visual experience, and 2) the fact (or proposition, or state of affairs) that move m is available, to which the agent is epistemically related by her belief. This reason supports representing and/or following the rule that when chess pieces a, b, and c, are at realistic locations a, b, and c, this makes up chunk m.[40] Over time, this epistemic support relation has an induction-like structure. Support for representing and/or following the unitization rule accrues with each recurrence of the experience and belief pair. While a chess player could in principle continue to painstakingly infer available moves by examining each aspect of her visual experiences and consulting her beliefs about the rules of chess, vision learns to do the work instead. Perception is not fixed and insulated as it is often thought to be but changes in light of reasons.

Not all changes to mental processing are responses to reasons. Optic nerve signals change depending on the pattern of light on the retina, but they are not responses to reasons. Associations are modulated through conditioning, but association is a paradigmatic antithesis of reasoning rather than an instance of it (Siegel, 2017; Quilty-Dunn &

Mandelbaum, 2018). Why is perceptual learning in chess a response to reasons while these cases are not?

The answer to this question lies in the type of states involved and the type of structure they stand in. Optic nerve transmission lacks the requisite type of states to provide reasons, whereas associations lack the requisite type of structure. Perceptual learning in chess has both. I will discuss these two features in turn.

Reasons are typically provided by mental states with truth-evaluable contents, such as beliefs and experiences.[41] In chunking in chess, reasons are provided by beliefs about available moves and visual experiences of chess boards. Beliefs are uncontroversially person-level states, so there is little question that beliefs about available moves can provide reasons to agents. In the context of belief formation, the belief that there is a checkmate available provides the agent with reason to believe she will win the game. Visual experiences of chessboards are also widely considered person-level (McDowell, 1994; Burge, 2010), and provide reasons to agents across a range of contexts. Seeing a queen on the board provides the agent with a reason for the belief that the queen has not yet been captured. In perceptual learning, visual experiences of chessboards and beliefs about available moves provide the agent with reason to perceptually represent and/or follow unitization rules. As more epistemic support from experience accrues over time, the body of stored rules is expanded and reinforced.

There is good reason to think that perceptual learning is truly a response to visual experiences rather than to prior unconscious states of the visual system. While perceptual learning sometimes occurs in the absence of attention (Gutnisky et al., 2009), there is evidence it does not readily occur without consciousness (Meuwese et al., 2013; cf. Carmel & Carrasco, 2013).[42] Attention and consciousness both significantly facilitate perceptual

learning (Meuwese et al., 2014; Szpiro & Carrasco, 2015; Donovan & Carrasco, 2018). While unconscious mental states may provide reasons in other contexts, given the chess master's ample supply of well-attended conscious experiences of the board, it is likely they provide the reason used in learning.

In contrast, optic nerve transmission is not a response to states that provide a reason. It is a response to sensory registration of a pattern of light on the retina, which is merely a physical state, not a mental state. Sensory registration is not truth-evaluable, so it is difficult to even conceptualize what reason it might provide. Such states are not widely accepted as providing reasons in other contexts. Unlike perceptual learning in chess, optic nerve transmission lacks a reason as its starting point.

Perceptual learning in chess not only involves states that provide a reason, but those states are also embedded in a structure of epistemic support between reason and response. The reason provided by the experiences of the board and beliefs about available moves epistemically supports representing and/or following the unitization rule. The visual system responds to this epistemic support by doing just that—explicitly representing and/or implicitly following the unitization rule. As the chess player experiences more perception-belief pairs of this type over time, her epistemic support for the unitization rule increases. If her experiences did not provide epistemic support for representing and/or following the rule (e.g., if she perceived different configurations of pieces), a different form of perceptual learning would occur. This counterfactual indicates an epistemic dependence relation between the stored rule and the reason provided by experience and belief.

This learning structure contrasts with associative learning. Associative learning involves simple causal connections between representations. These connections are typically formed and reinforced through repeated exposure to relatively contiguous stimuli

(Mandelbaum, 2017). If every time you take the ferry you treat yourself to an on-board donut, you will come to associate ferries and donuts, thinking of one whenever you think of the other. Associations are unlike reasoning in that they are brute causal processes rather than processes driven by the contents or formal properties of mental states.[43]

A basic associative model of perceptual learning in chess is implausible. According to such a model, chess masters' visual systems would encode certain chunks as salient due to concurrent visual representations of the board and chess beliefs, rather than due to the epistemic support provided by these states. But temporal contiguity does not fully explain the learning data. It does not explain why some configurations of pieces are stored as chunks while others are not, despite all the pieces being viewed simultaneously. It also does not explain why the unitization rule specifies that particular configurations of pieces make up particular chunks, rather than simply connecting the concepts of moves (checkmate, double attack, castling etc.) with individual pieces. It also does not explain why perceptual learning consistently tracks the amount of epistemic support provided by experiences and beliefs across skill levels and game contexts. There are more sophisticated models of associative learning that account for factors such as time intervals, regularity of reinforcement, attention, and past predictive success (e.g., Rescorla & Wagner, 1972) and so have more promise in explaining the data, but such models are also richly structured enough to plausibly involve responses to reasons.

In this section I have argued that perceptual learning mechanisms are responsive to epistemic reasons, undermining an objection to the epistemic evaluability of perception from the Reasons-Responsiveness condition. Perceptual systems are sufficiently flexible in light of reasons to instantiate epistemic basing. The idea that perceptual mechanisms are reasons-responsive and the idea that perceptual states are based on reasons are mutually supporting.

If one accepts that perceptual systems respond to reasons as they learn new information, then it is natural to think the learned rules carry those reasons forward to new perceptual states.

There is a diverse range of forms of perceptual learning, encompassing the models outlined here and others. While I have focused on perceptual learning in chess, my arguments do not hang on any one experiment or domain of learning. If the reader is skeptical that chunking in chess is truly perceptual or truly a form of learning, she can substitute an alternative form of perceptual unitization such as learning to perceive the novel category of 'Greebles' as members of different families (Gauthier & Tarr, 1997), learning to perceive dog breeds (Diamond & Carey, 1982), and learning to perceive words (O'Hara, 1980). Applied to the case of Greebles, my arguments would say that our visual experience of a Samar family Greeble is a response to the reason provided by the visual experience of the elongated and pointed shape of its appendages and a stored perceptual rule about which shaped features correspond to which Greeble family. Abstracting away from individual experiments, the discussion here illustrates that the perceptual nature of a processes does not preclude it from 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 reasons-responsiveness depends are not intrinsically cognitive.

6. 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 perception and belief, such as the modularity of perception compared to the inferential promiscuity of belief (Stitch, 1978), may engender corresponding normative differences.[44] If one thinks that normative requirements should be sensitive to psychological possibility, then cognition's immediate responses and wider informational integration will set a higher normative bar. In turn, the relatively slow-changing and encapsulated realm of perception may have less stringent requirements.

A complete treatment of the normative impact of information encapsulation is beyond the scope of this paper. My arguments address the question of whether perceptual states are epistemically evaluable independently from the question of how such epistemic evaluation should proceed. However, much of the argumentative force comes from the ways in which perceptual processing strikingly resembles belief formation. These similarities also support the idea that the epistemic norms of perception and belief have much in common. Perceptions and beliefs both meet Reasons-then-Status and so are epistemically evaluable because they are based on epistemic reasons. The quality of the basing relation that renders a state epistemically evaluable determines its epistemic status.

When chess masters see a board as segmenting into chunks, their visual experiences are properly based on a good reason and so are epistemically justified. The input <Pieces x, y, and z are at realistic locations a, b, and c> together with the unitization rule <When pieces x, y, and z, are at realistic locations a, b, and c this makes up chunk m> epistemically supports the experience <Chunk m is present>. The input, unitization rule, and experience

stand in roughly the structure of a modus ponens inference, which is a valid inference form. The premises are true, making the mental transition sound. The pieces are in fact at the represented locations, and representation of them arises from an unobstructed, close-up view of the chessboard. The unitization rule is itself well-supported by the chess masters' extensive experience. The chess masters lack defeaters for their experience. Thus, the reason provided by the input and unitization role is sufficient to justify the experience of chunk m.

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 experts perceive certain properties that amateurs cannot, such as structural chunks, but experts' experiences are also justified. Amateurs lack not only the capacity to perceive certain properties but also the robust justification endowed by expertise.[45]

While perceptual learning leads to justified experiences in chess masters, it can also lead to unjustified experiences. 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, but far less than a chess master's visual system has. When this player encounters a new chessboard, her visual system does not properly respond to the reason provided by her input and stored rule. Instead of seeing the chunk that correctly correspond to the configuration on the board, she sees the pieces as making up an alternate, incorrect chunk. Her visual experience is unjustified because the reason provided by her input and unitization rule does 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 & Fillenbaum, 1965; Hansen et al., 2006; Bannert & Bartels, 2013). In these experiments, objects appear closer to their canonical colors than they truly are. Grey bananas look yellow and grey Smurfs look blue. Vision draws on statistically accurate 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 their reliance on accurate priors. On the other hand, the visual system ignores occurrent color processing, which structurally resembles neglecting evidence. There is heated debate over whether memory color is perceptual learning, cognitive penetration, an effect on judgment, or not a true perceptual effect at all, so I do not assume memory color provides further evidence for the basing relation in perception.[46] Nonetheless, memory color's epistemically complex structure illustrates a hypothetical contrast to neatly justified perceptual expertise. The epistemic landscape of perception may be nearly as diverse as that of belief.

7. Conclusion

I have argued here that perceptual systems are governed not only by causal principles, but also by reasons. Chess masters' learned perceptual experiences are based on epistemic reasons and are thereby epistemically evaluable as justified or unjustified. My arguments for epistemic basing in perception extend to other forms of perceptual learning with similar structures. Candidates include learning to visually recognize bird species (Tanaka & Taylor, 1991), learning to see Greebles (Gauthier & Tarr, 1997), learning to hear new phonemes (Logan, Lively, & 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 basing. While perception widely relies on stored rules, beyond perceptual learning it is less clear that these stored rules combine with inputs to provides reasons. Two other strong candidates for basing on reasons in perception are perceptual representations of objects (Jenkin, 2020) and crossmodal interactions (Jenkin forthcoming).

Perceptual learning illustrates that even absent cognitive influence, perception exhibits the flexibility that is characteristic of reasons-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 to cognition.

[1] For definitions of cognitive penetration, see Fodor (1983), Pylyshyn (1999), Siegel (2011), Macpherson (2012), Firestone and Scholl (2016), and Quilty-Dunn (2020a).

[2] Siegel's arguments circumvent worries about the reality of cognitive penetration by focusing on perceptual experience, which need not be identical to the outputs of perceptual modules (Siegel 2011, 2017).

[3] 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 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 & Conee, 1985).

[4] 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).

[5] Memory is unusual in that the justification it provides is often taken to be preservative rather than generative, meaning that it transmits across mental states without modulation or addition (Audi, 1998). Thus, whether a given memory is rationally evaluable depends not only on the mode of retrieval but also on the etiology of the original state.

[6] 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.

[7] 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.

[8] My arguments are compatible with a conception of motivating reasons as mental states (Davidson, 1963; Audi, 2001; Turri, 2009), as facts (Williamson, 2000), or as abstract entities such as propositions or states of affairs (Dancy, 2000; Setiya, 2007, Hornsby, 2008; Schroeder, 2008, Fantl & McGrath, 2009, McDowell, 2013a, Comesaña & McGrath, 2014). On the view that reasons are mental states, my arguments show that states within the visual system are reasons on which perceptual experiences are based. On the view that motivating reasons are facts, propositions, or states of affairs, my arguments show that states within the visual system can epistemically relate us to the reasons on which our perceptual experiences are based. I use the locution "state x provides a reason" to neutrally express that a mental state either is itself a reason or epistemically relates us to a reason. For an explanation of how my focal example of perceptual learning in chess is best understood on each of these views of reasons, see §4.

[9] Some types of perceptual learning are also partly due to maturation (e.g., Smith, 2009).

[10] For recent philosophical discussions of perceptual learning, see Cecchi (2014), Arstila (2016), Connolly (2019), Prettyman (2019), Ransom (2020), Landers (2021), Chudnoff (2021), and Stokes (2021).

[11] I focus on chess because it is compelling and well-studied, not because it is a unique instance of reasons-responsiveness in perceptual learning. For discussion of additional examples, see §5 and §7.

[12] While storage (stage 1) must occur before unitization (stage 2), storage may also continue after unitization begins. This continued storage may take the form of strengthening the stored unitization rules and thereby making them more easily used, or it may take the form of storing new unitization rules.

[13] The visual experience and unitization rule may represent chess pieces as chess pieces (e.g., as knights, rooks, queens, etc.) or simply as particular shapes. I talk in terms of chess pieces for simplicity, but my arguments could be entirely recast in terms of shapes.

[14] Unitization only occurs when the input represents a realistic chessboard configuration rather than an arbitrary one (de Groot, 1965, Chase & Simon, 1973), because the visual system has only stored rules corresponding to past experiences.

[15] For discussion of the distinction between pictorial and propositional content, see Haugeland (1981), Lopes (1996), and Kulvicki (2006).

[16] For arguments that perception includes states with propositional formats, see Quilty-Dunn (2020b).

[17] Thanks to an anonymous reviewer for mentioning this worry.

[18] For discussion of diachronic cognitive influence in other forms of perceptual learning, see Goldstone, de Leeuw, and Landy (2015) and Connolly (2017).

[19] For further discussion of whether various forms of perceptual learning are truly perceptual, see Connolly (2019). For further discussion of whether purported cognitive penetration effects are truly perceptual, see Macpherson (2011), Deroy (2013), Bitter (2014), Arstila (2016), and Firestone and Scholl (2016).

[20] While this data indicates that chunking is perceptual rather than linguistic or cognitive, it does leave open whether chunking occurs in visual processing or in visual working memory. I take both visual processing and visual working memory to be part of the perceptual system, so either way chunking would count as perceptual.

[21] See Landers (2021) for additional arguments that chunking in chess is a perceptual process that results in perceptual experiences of chunks.

[22] I remain noncommittal as to how reasons should be individuated here. One option is that the input and unitization rule jointly provide a single reason because absent either state, the other would not provide a consideration in favor of the output. The same point can be made about the premises in modus ponens inferences generally. P is not a reason for Q unless it is conjoined with P → Q. A second option is that the visual input provides the only reason, but the unitization rule is a necessary background condition for this input to provide a reason. A third option is that the input and unitization rule each provide separate reasons. For simplicity, I write as if one reason is jointly provided, but the reader can substitute in their preferred view.

[23] If the unitization rule is not explicitly represented in a mental state, it can be thought of as enabling condition for the input to provide a reason. I discuss this possibility in more detail later in this section.

[24] Thanks to an anonymous reviewer for raising this objection.

[25] 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 & Stanovich, 2013), classical cognitive architecture (Fodor, 1983), and mental logic (Braine & O'Brien, 1998).

[26] Thanks to an anonymous reviewer for raising this objection.

[27] While the meaning 'rationally evaluable' is clearly relevant to epistemic basing, it does not help get undernth the idea of basing or determine its psychological scope.

[28] Vision likely comprises multiple subsystems individuated by tasks such as color perception, shape perception, and motion perception (Fodor, 1983).

[29] I do not deny that subsystems also house states and processes that are merely subpersonal, such as the secretion of neurotransmitters.

[30] See Montero (2018) for an argument that conscious deliberation is involved in speed chess.

[31] Sherlock Holmes is a notable exception in that he relies almost entirely on conscious deduction. For further discussion of unconscious reasoning in detective fiction, see Keller and Klein (1990).

[32] Other plausible examples of responding to reasons without phenomenology or articulability include an experienced driver automatically downshifting at the right moment (Railton, 2009), a student detecting that a sentence is grammatically incorrect but being unable to state the syntactic rules explaining why (Chomsky, 1957), and a philosopher realizing how to make an argument while focused on her taxes (for related examples see Dacey, 2018). For empirical results supporting unconscious reasoning, see Reverberi et al. (2012) and Garrison and Handley (2017).

[33] McDowell (2013b) makes a similar point.

[34] For replies to additional objections to the claim that perception can be based on reasons, see Jenkin (2020).

[35] For arguments that mental states can in fact be based on fixed, innate reasons through mechanisms that are only minimally responsive to new reasons, see Jenkin (2020).

[36] This case is plausibly an example of cognitive dissonance, in which individuals feel psychological discomfort at having contradictory beliefs and then suppress one of the beliefs to relieve the discomfort (Festinger, 1957).

[37] Thanks to an anonymous reviewer for making this point.

[38] 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 Reasons-then-Status and Reasons-Responsiveness. The gist of the ensuing arguments remains unchanged.

[39] 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), even if there is no such condition on basing. My arguments do not entail that perception is an instance of inference.

[40] As discussed in §5, the rule may be explicitly represented or merely implicit. The experience and belief provide reason for both explicitly representing the rule and for implicitly following the rule, so in either case the agent's use of the rule is epistemically supported.

[41] Some phenomenal states may provide reasons despite lacking truth-evaluable content. E.g., the feeling of a headache provides reason for the belief that you have a headache (Pryor, 2003). On the flipside, some truth-evaluable states fail to provide reasons, such as idle imaginations. My claim here is that truth evaluability makes a state a good candidate for providing reasons, rather than that truth evaluability and providing reasons are perfectly co-extensive properties.

[42] Meuwese et al. (2013) tested whether perceptual learning on textured figure-ground stimuli occurs when the stimuli are masked (so never consciously experienced) and when stimuli are presented alongside a stream of distractors (so consciously experienced but unattended). They found that according to both behavioral and neural measures, learning occurred in the inattentive condition but not in the unconscious condition.

[43] For further discussion of the difference between reasoning/inference and association, see (Peirce, 1905; Broome, 2013; Boghossian, 2014; Siegel, 2017; Quilty-Dunn & Mandelbaum, 2018).

[44] Although there is also evidence for cognitive modules (e.g., Cosmides & Tooby, 1992).

[45] For arguments for the related view that perceptual learning result in justified beliefs see Lyons (2011) and Chudnoff (2017).

[46] For discussions, see Macpherson (2012), DeRoy (2013), Zeimbekis (2013), Brogaard and Gatzia (2017), and Valenti and Firestone (2019).

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