Seeing-in-for-action: The cognitive penetrability of perception

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Abstract

I hypothesize perception functions to promote possibilities for safe, effective, and efficient action and, as such, represents not objective facts about the world *as it is in itself*, but, rather, a special set of further *relational* facts for which we have no independent sense. I begin with data suggesting perception is penetrated by perceivers' physical, affective, and cognitive states. Next, I propose hallucinations and other unusual visual experiences indicate that everyday perceptual experiences demonstrate an increased reliance on knowledge over sensation, and that this enhances perceptual performance. I then rebut two main kinds of objection: First, that post-perceptual response processes are responsible for alleged cases of penetration and second, that perception is impenetrable at its underlying level, the early visual system. Overall, I conclude perception "accurately distorts" objective facts about the external world because its function is "seeing-in for-action."

Introduction

In this paper, I aim to inform Philosophers about contemporary scientific research on the cognitive penetrability of perception[1] and Scientists about the ongoing philosophical debate over cognitive penetrability, and to contribute novel insight valuable to both. While some scientific fields take perception to be cognitively penetrated, in Philosophy, the matter is far from settled, and, indeed, orthodoxy favors impenetrability. In part, this cross-disciplinary divide stems from cross- and even inter-disciplinary differences in carving up and defining key concepts. Because these differences are conceptually, and not merely linguistically, grounded, reviewing contemporary scientific research into and ongoing philosophical debate about cognitive penetrability offers more than mere exegesis; it offers complications that bear the potential for fueling new experimental and theoretical work. To that end, I cite a wealth of empirical evidence that perception is cognitively penetrable and rebut common objections from Philosophy and Psychology. Moreover, I also propose the novel argument that the hallucinations brought about by mood disorders not only indicate how and why perception is cognitively penetrated, but also exemplify perception's functioning, not its malfunctioning. This argument weighs in on the ongoing philosophical debate about cognitive penetrability, suggests new avenues for scientific research into perceptual systems, and even recommends additional options for clinical psychiatric treatment of hallucinatory mood disorders.

Common sense assumes we see the world as it actually is, but mounting empirical work suggests otherwise. Imagine you are thirsty and see a bottle of water on your kitchen counter that looks

[1] In this paper, I focus on visual perception and intend "perception" to refer thus.

closer and more easily reachable than it did when you were quenched. But does the water really *look* closer, or do you merely *think* it does? According to data from Experimental Psychology and Neuroscience, it really does *look* closer. On this data, we see the world relative to our abilities, knowledge, and goals, and this makes possibilities for safe, effective, and efficient action visually apparent. Seeing the water as closer prompts your reaching for it to quench your thirst. In contrast to the sharp divide between seeing and thinking maintained by philosophical orthodoxy, I hypothesize perception is meaningful in virtue of representing not objective facts about the external world *as it is in itself*, but, rather, a special set of further *relational* facts for which we have no independent sense. These facts capture the way a perceiver stands in relation to her environment; they capture the possibilities for safe, effective, and efficient action available to a perceiver, given her environment, abilities, knowledge, and goals. On my hypothesis, then, perception prompts action by functioning as a distorting lens; it "accurately distorts" such that perceivers see possibilities for safe, effective, and efficient action *in* their environments. It is "seeing-in-for-action."

Philosophical orthodoxy about the mind owes its roots to Descartes, who, in characterizing mind and world as fundamentally different substances incapable of direct interaction, severs cognition from sensation. Demonstrating this lineage, Chomsky (1959) holds the mind a computer comprised of anatomically distinct information processing systems, such as the linguistic and perceptual systems, which each operate according to proprietary functions, rules, and codes. Likewise in-keeping with Descartes, many contemporary Philosophers studying perception (e.g., Fodor, 1983; Pylyshyn, 1980, 1999, and 2003) maintain a strict divide between thinking and seeing. Thus, Fodor takes the perceptual system to be a "module[2]" that is informationally encapsulated, or unable to access information stored in other systems; operationally inaccessible to central systems, from which intermediate-level representations computed prior to output are hidden; mandatory, or outside of conscious control and thus automatic; "shallow," or computationally cheap and informationally general; fast; innate; domain specific; anatomically localized; and functionally dissociable. Similarly, Pylyshyn claims perceptual processes are cognitively impenetrable, or encapsulated from beliefs and desires. Accordingly, while information can flow between, say auditory and visual perception, these processes cannot access information stored in central memory systems.[3] For Fodor and Pylyshyn alike, then, perception is strictly separated from higher-level cognitive states and, as such, able only to make defeasible inferences from "considerably less than the organism may know" (Fodor, 1983, p. 69). In contrast to both modularity and impenetrability, as exemplified by Fodor and Pylyshyn, respectively, I argue perception can access higher-level cognitive states and, hence, know what the organism knows.

[2] To be precise, Fodor's (1983) modules are more fine-grained than each entire perceptual modality, and include, for example, the mechanisms specific to color perception, visual shape analysis, and face recognition.
[3] I focus on the possibility of perception's being impenetrable because, as a weak type of modularity, proving the former claim false defeats both.

Results

Against modularity, a wealth of psychological research suggests perception makes possibilities for action apparent by calibrating states of the world to physical, affective, and cognitive states of individuals. For example, target walking distances appear farther as a function of prior physical exertion (Witt et al., 2004), pain (Bhalla and Proffitt, 1999; Bian and Andersen, 2013; Cañal-Bruland and van der Kamp, 2009; Sugovic and Witt, 2011 and 2013; Taylor, Witt, and Sugovic, 2011; Witt et al., 2009 and 2011), and old age (Bhalla and Proffitt, 1999; Bian Andersen, 2013; Sugovic and Witt, 2013) and reaching distances nearer as a function of tool augmentation (Witt and Proffitt, 2008; Witt et al., 2005), provided the target object is within reach (Bloesch et al., 2012; Davoli et al., 2012; Linkenauger, Witt, and Proffitt, 2011; Osiurak et al., 2012; Witt, 2011) and use of the tool intended (Linkenauger et al., 2011; Witt and Proffitt, 2008; Witt et al., 2005). Similarly, hills appear steeper to those in a negative mood, depressed, or stressed, and less steep to those accompanied by a friend (Schnall, et al., 2008 and 2010).

Against impenetrability, like results obtain for cognitive states: Goal-directed desires impact apparent size and distance such that a $100 bill is seen as closer when winnable (Cole and Balcetis, 2013) and sources of feedback farther when negative (Balcetis, 2015). In addition, pre-exposure to categorization tasks alters discriminability for stimulus properties (Goldstone, 1994 and 1995), acquisition of an alphabetic system results in gains in visual discrimination skills (Liberman et al. 1974; Morais et al. 1979; Verhaeghe and Kolinsky 1992), and relevant cultural terminology affects visual experience for patterns (Goldstein and Davidoff, 2008), colors (Kay and Kempton, 1984; Ozgen and Davies, 2002; Robinson et al., 2005; Winawer et al., 2007), and object direction (Meteyard et al., 2007). Results such as these, found in overwhelming similar studies, provide reason to think perception is calibrated to what we know and what we can and want to do. They provide reason to think we look through the distorting lens of our abilities, emotions, beliefs, and desires to see possibilities for action in our environment. Therefore, contrary to philosophical orthodoxy, I argue perception can know what the organism knows. Indeed, on my view, cognition and sensation jointly inform each other *during perceptual processes themselves*, making perceptual information an admixture of the two. Perception thus accurately represents the world *relative* to the perceiver; it accurately represents the world *for* action in virtue of distorting it *in itself*.

I propose the hallucinations and other unusual visual experiences presenting with mood disorders demonstrate perception's mixing together cognition and sensation. Moreover, I argue these unusual experiences suggest the same mechanism holds true for everyday perceptual distortions-for-action, and that it is functionally adaptive. Clinical observations and neuroscientific experiments alike show mood disordered episodes are accompanied by top-down perceptual alterations. For example, one patient suffering from an obsessional disorder describes *specifically visual changes*, and not merely, say, feelings of discomfort, whereby she moves from seeing the objectively unchanged objects in her apartment as orderly to disorderly; when anxiously obsessed, but not when calm, she reports the objects *actually appear* out of order (Rachman and Cuk, 1992). This clinical observation, echoed in other patient reports (see, for example, Rachman, 2004, and Rachman and Cuk, 1992), is supported by electrophysiological recordings of the brain, which pinpoint V1 activation in response to fear and anxiety at just 50 to 100 milliseconds after stimulus presentation (Eldar et al., 2010; Pourtois et al., 2004; Rossi and Pourtois 2012 and 2014; Vanlessen et al., 2013 and 2014; West et al., 2011). Mood disorders are thus marked by unusual perceptual experiences; such patients do not simply judge that things seem a certain way; rather, things really look that way.

Prima facie, it seems maladaptive to see the world as it isn't. However, I propose adaptive function underlies the mechanism by which visual distortions are wrought. Suggesting as much, visual tasks relying on prior knowledge find mood disordered participants suffering unusual visual experiences perform over twice as well as healthy controls, and do so as a function not of improved working memory or delusional beliefs, but *the alterations they visually experience* (Teufel et al., 2015). Given well-established (for a review, see Silverstein and Keane, 2011) psychotic deficits in early visual processing, which make for unusually noisy sensory systems, the link between unusual visual experiences and enhanced visual task performance is likely the result of relying on knowledge rather than sensory information to resolve ambiguity.[4] That is to say, the unusual experiences result from a mechanism whereby information due to higher-level central processes is weighed more heavily than that due to the sense organs. If cognitive information were not accessible during, but only after, perceptual processes, during post-perceptual judgment, decision-making, and reporting processes, the alterations experienced by mood disordered individuals would consist in their judging the world to seem some way, not their seeing it to look that way. I therefore conclude these alterations demonstrate cognitive penetrability; they demonstrate information from higher-level central processes and the sense organs can in fact combine during perceptual processes themselves.

That the ambiguity inherent in unusually noisy sensory systems is resolved by weighing cognitive more heavily than sensory evidence suggests a mechanism by which everyday perceptual experiences are calibrated to states of individuals. It suggests that, when there is sensory noise (such as in emotionally charged or arousing, cognitively dissonant conditions) or perceptual ambiguity (such as with distant or poorly illuminated stimuli) a shift in information processing occurs whereby the evidentiary role granted to information from top-down sources overshadows that granted bottom-up ones. Because everyday conditions are frequently imperfect in these ways, I propose perceivers likely often weigh top-down more heavily than bottom-up input. Consistent with this hypothesis, spiders look closer (Riskind et al., 1995) and heights higher to those who fear them (Stefanucci et al., 2012; Teachman et al., 2008), and visual resolution of binocular rivalry and bi-stable figures is biased by arousal (Sheth and Pham, 2008), emotion (Alpers and Gerdes, 2007; Alpers and Pauli, 2006; Coren and Russell, 1992; Seidel and Prinz, 2012), desire (Balcetis, 2006; Voss et al., 2008), religious belief (Riekki et al., 2012), priming (Aarts and Dijksterhuis, 2002; Balcetis and Dale, 2003, and 2006; Bugelski and Alampay, 1961; Leeper, 1935), prior information (Girgus et al., 1977), and visual imagery (Balcetis, 2006).

[4] Consistent with this proposal, bipolar disorder presenting with sensory noise and hallucinatory experiences is so evidently associated with a reduced alteration rate relative to the healthy norm in both binocular rivalry (Miller et al., 2003; Pettigrew and Miller, 1998; Nagamine et al., 2009; Vierck et al., 2013) and bi-stable figures (Krug et al., 2008) that such reduction is considered a possible endophenotype of the pathology (Ngo et al., 2011).

Further, that hallucinations and other unusual visual experiences are linked to improved visual task performance (Teufel et al., 2015) and the perception of a more stable environment (Krug et al., 2008; Miller et al., 2003; Pettigrew and Miller, 1998; Nagamine et al., 2009; Vierck et al., 2013) implies an adaptive reason for the mechanism by which everyday perceptual distortions are wrought. It implies knowledge modulates sensation during perceptual processes to promote possibilities for safe, effective, and efficient action. Study results bear out this prediction. For example, believing that one is using a professional golfer's putter increases the golf hole's apparent size and improves putting performance (Lee et al., 2011). Similarly, verbal (Lupyan and Spivey, 2008; Lupyan and Thompson-Schill, 2012) and visual (Egeth and Smith, 1967; and Pachella, 1975) cues and context (Biederman et al., 1982; Boyce and Pollatsek, 1992; Boyce, Pollatsek and Rayner, 1989; Long and Toppino, 2004) influence the speed and accuracy of object identification, and expertise affords knowledge of the structure of appearances (Goldstone, 1994 and 1995; Livingston, Andrews, and Harnad, 1998;) that improves the ability to re-conceptualize (Goldstone and Hendrickson, 2010) and select paradigmatic object-type information (Gombrich, 1960; Kozbelt et al., 2010; Sowden et al., 2000). I therefore argue that sensory noise and ambiguity, which are frequently at issue not only for mood disordered individuals, but also in everyday perceptual experiences, result in favoring non-visual input to perceptual processes over visual input, and that this alters perceptual content in ways connected to improved performance.

Given corresponding improvements in performance, I claim visual distortions are not perception gone wrong, but right. Delusional beliefs are maladaptive, but distorted perceptions are not.[5] Rather, perceptual distortions promote possibilities for adaptive action by representing the world relative to perceivers such that, for example, "[t]hreatening objects appear… clearer, sharper, even larger" (Rachman, 2004, p.42). However, while the phenomenon of seeing-in-for-action is itself adaptive, the adaptiveness of specific distortions depends on the adaptiveness one's knowledge. This suggests that clinical treatment for mood disorders requires delusional beliefs be corrected. Because beliefs cannot be altered by will, I propose treatment for mood disorders mirror that for phobias. Such treatment consists in a series of carefully controlled interactions that increases in intensity and duration as patient fear of and comfort levels with the phobic object improve. These interactions involve the perceptual modalities; patients are required to imagine, hear, see, touch, and eventually even hold the phobic object until reporting, for example, that snakes appear significantly less slimy, ugly, and sinister and significantly smoother and drier (Rachman and Whittal, 1989) or that spiders appear significantly less hairy, ugly, and threatening and significantly lighter and more feathery (Rachman and Whittal, 1989. Also see Rachman and Cuk, 1992).[6] Treatment for phobias, then, relies on information's flowing between central memory and perceptual systems and, hence, tells against modularity and impenetrability. Given the wealth and scope of evidence, as presented thus far, I therefore conclude perception is penetrated by, and

[5] Maladaptive behavior may well present in conjunction with perceptual content distorted relative to perceivers' states, but the phenomenon of seeing-in-for-action is itself adaptive; any such maladaptive behavior stems not from seeing the world as it is for oneself, but from seeing the world as it is for a believer of delusional information.

[6] Similar methods have been suggested to reduce the perceptual alterations that accompany addiction. For more on their use to treat addition, see Berridge and Robinson (1998). For more on addiction's perceptual alterations, see Clune et al., 2008.

represents the external world relative to, perceivers' physical, affective, and cognitive states, and that this makes possibilities for safe, effective, and efficient action visually apparent.

Objections and Replies

Counter to my conclusion, critics in Psychology (e.g. Firestone, 2013; Firestone and Scholl, 2014; Loomis and Philbeck, 2008; Shaffer and Flint, 2011; Woods et al., 2009) claim individuals' states impact the way the world seems, not the way it looks; they claim states of individuals affect judgments about, but not perceptions of, states of the world. Specifically, these critics object that experimental results alleging to show penetration, such as those given above, are not reflected in subjective perceptual experience[7] and, indeed, are mere post-perceptual artifacts arising from flawed experimental design. These flaws include experimenter effects, whereby participants are unduly lead to act in accordance with experimental hypotheses; task demands, which can allow participants to assume an experiment's hypothesis and purpose; biased reports, including judgements about nonvisual or irrelevant visual features; and memory-encoded responses, which reflect post-perceptually memorized action plans. Studies subject to these weaknesses fail to overcome the thesis that perception functions to track and encode information about the world as it is in itself and, hence, fail to prove we see the world relative to our abilities, beliefs, and desires. Perhaps only post-perceptual, not perceptual, processes are informed by what we know and can and want to do. Perhaps perception does not access higher-cognitive states after all, but simply makes rule-governed inferences about states of the world as it is in itself, not as it is for the perceiver. In response to this possibility, proponents of perception's being calibrated to individuals' states point to additional studies that replicate the given results while overcoming prior design flaws.[8]

To curtail experimenter effects, these studies minimize interactions between experimenters and participants (Kirsch and Kunde, 2013; Witt, 2011b; Witt et al., 2005) or keep experimenters in the dark about participants' performance levels (Witt and Proffitt, 2005; Witt, et al., 2008). To reduce task demands, participants are asked about their assumptions (Balcetis, 2006), manipulated without their knowing (Schnall et al., 2010), and tested on non-salient individual differences (Bhalla and Proffitt, 1999; Sugovic and Witt, 2011) or indirect, basic properties (Changizi and Hall, 2001; Stefanucci and Proffitt, 2009; Witt, 2011b).[9] To take aim at participants' *compliance* to task demands (Balcetis and Dunning, 2010; Sugovic and Witt, 2013), accuracy is rewarded (Balcetis and Dunning, 2010) or additional task demands introduced with the goal of checking for such compliance (Witt and Sugovic, 2013). To diminish reporting biases, precise questions focus on *appearances* (Philbeck and Witt, 2015), nonverbal responses measures not open to interpretation

[7] Proponents of the given results argue subjective experience is lacking only because the visual system filters out rapid perceptual changes (for a review, see Philbeck and Witt, 2015). While I agree that perceptual changes may sometimes be filtered out, I nevertheless consider that, for example, water often does *actually appear* closer and stairs steeper; on my view, perceptual distortions are so commonplace as to be ignored; as the norm, we fail to notice anything unusual. Therefore, for reasons of space, in this paper I skip over the literature debating the necessity of subjective experience.
[8] For a review of the generalizability and replicability of results, see Philbeck and Witt, 2015.
[9] For example, Changizi and Hall (2001) investigat the effects of desire on perception by testing thirsty and quenched subjects for relative apparent transparency, a basic property associated with water, in ambiguous objects.

are employed (Loomis and Philbeck, 2008), procedures are varied such that, for example, the desirous interpretation of an ambiguous figure is switched *after* establishing desire and motivation (Balcetis, 2006), and converging results across varied response measures are established (Balcetis, 2006; Gajewski, Wallin, and Philbeck, 2014; Sugovic and Witt, 2013).

To eliminate memory-encoding, participants are not allowed to observe targets before as well as after relevant manipulations. Participants who view targets *both before and after* they are manipulated for, say, expected effort or intention to act have the chance to encode different action plans into memory. To guard against this possibility, Witt et al. (2010) manipulated participants first for expected walking effort by use of a treadmill, which is shown (Rieser et al., 1995; Proffitt et al., 2003; Witt et al., 2004, 2009, and 2010) to correlate a new relationship between forward *walking effort* and optic flow, and then for intention to act by changing instructions *after* viewing of the target. Thus, half of the participants viewed the target with the intention to walk to it and half to throw to it, but, after viewing it, all were instructed to walk. Individuals' states, such as intentions to act, can only serve as a scaling metric according to which perception of the world's objective geometry is distorted if they are held *during* perceptual processes and such processes are penetrable. Consistent with penetrability, once the target was out of view, walkers blind-walked significantly father than throwers-turned-walkers, who did not adjustment their blind-walking. Walkers blind-walked past the target, but throwers-turned-walkers did not because their intention to throw while perceiving the target made the manipulation for *walking* effort irrelevant. This demonstrates not only that the target appeared closer for throwers than walkers,[10] but also that the relevant action was generated on initial viewing of the target only, i.e. *during* perceptual processes, and not post-perceptually, from a memorized action plan.

Despite the above results, the debate about cognitively penetrability continues raging in Philosophy. Indeed, orthodox theorists (e.g. Pylyshyn, 1999) maintain that even if some, later stages of perceptual processing can access higher-level information, the earliest, underlying level, or the early visual system, cannot. To demonstrate as much, these Philosophers point to visual illusions, which rely on low-level information about edges, colors, textures, and velocities detected by early visual processes, and persist despite conflicting beliefs and desires. In particular, the Müller-Lyer illusion, which persists in the face of knowing the lines to be of equal length, is invoked to prove that perceptual processes are cognitively impenetrable and, as such, governed by natural constraints,[11] or fixed rules of transformation.

However, against philosophical orthodoxy, neuroimaging (Weidner and Fink, 2007) shows the strength of the Müller-Lyer illusion is mediated from the top down, by higher-level cognitive factors. Moreover, because the effect does not present across non-carpentered cultures, it is unlikely due to innate, inflexible rules, but, rather, learned expectations (Deregowski, 2013; Gregory, 1968). Indeed, the illusion arguably arises because the overlearned interpretation to perspective trumps other sources of information (Lotto and Purves, 1999, 2000, and 2002). Hence, far from proving

[10] Blind-walking reliably correlates to apparent distance. See Elliott, 1987; Loomis et al., 1992; Philbeck and Loomis, 1997; Reiser et al., 1990; Steenuis and Goodale, 1988; Thompson, 1983.
[11] For first use and further discussion of 'natural constraints,' see Marr, 1982.

perception cognitively impenetrable, this illusion arguably demonstrates access to stored memory patterns. Characterizing early visual processes as inferences governed by fixed, innate rules of transformation and based on sensory premises less informed that the organism itself is thus question-begging; perhaps, instead, such processes interpret information based on knowledge of the world. For example, the kinetic depth effect, which arises from the rigidity constraint, could be an inference from the learned expectation that an array of points lies in a rigid 3-D configuration (Wallach and O'Connell, 1953). And, after all, the visual system must still decide which constraint to use if several compete.

Additional illusions suggest top-down penetration. In figure 1, below, the illusion of motion arises because encoding an exact Euclidean model of the world from non-Euclidean visual space requires several descriptions of space-time[12] that each capture partial aspects of objective reality (Aloimonos, 1995; Aloimonos et al., 1995; Fermüller and Aloimonos, 1996; Fermüller et al., 1998). These non-general descriptions (Fermüller and Aloimonos, 1995) only make sense in the context of actions, decisions, or plans and, as such, cannot be cognitively impenetrable.

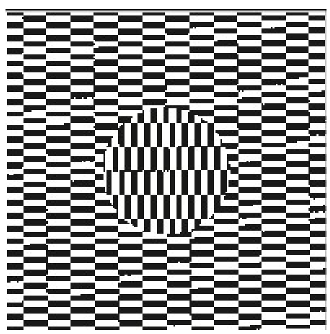

Figure 1: Shaking one's head produces the illusion of motion.

In addition, figure 2, below, is associated both with a dominant an alternative percept, which becomes vivid *via* conscious visualization (Kanizsa, 1976; and Stadler and Kruse, 1995). This shows schema-driven cognitive processes influence 3-D surface layout, which suggests cognitive signals directly reach very early mechanisms, including V1 (Grosof et al. 1993) and V2 (von der Heydt and Peterhans 1989; von der Heydt et al., 1984).

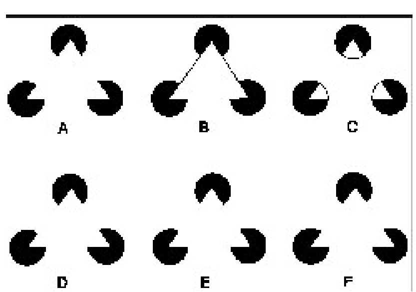

Figure 2: 'A' can produce both a dominant and alternative percept, shown in 'B' and 'C.'

[12] It is widely agreed the early visual system represents 3-D surfaces. See Brown, 1984; Marr, 1982; Richards, 1988; and Ullman and Richards, 1990.

Other instances of early vision's being cognitively penetrable abound. Indeed, physiological data show early vision is directly modulated by higher-level cognitive states, including expectation, intention, and conceptual knowledge, in ways independent of the allocation of attention and connected to subsequent action possibilities. For example, fMRI data reveal that neurons in early visual area V1 encode anticipatory-driven information independent of attention (Kok et al., 2014) and that V1 responses are not only related to high-level content-bearing intentions independently of spatial attention effects, but also increase with improved task performance (Li, Piëch, and Gilbert, 2004).

Quantitative evidence also demonstrates intentions affect depth organization independently of eye or attentional movements (Peterson and Hochberg, 1983; Peterson and Gibson, 1991), and work on stereograms (which are not associated with relative retinal motion and allow for Nonius fixation to control large and small eye movements) results in like effects of intention on perceived depth organization (Peterson 1986). Moreover, EEG measurements show concepts affect early visual processing prior to the first impact of attention (Boutonnet and Lupyan, 2015; Thierry et al. 2009; Mo et al. 2011). Indeed, while perceptual learning involves selectively attending to relevant features (Ahissar and Hochstein, 1993; O'Toole and Kersten, 1992; Shiu and Pashler 1992; Sowden et al. 1996), experts are further distinguished from novices by modifications within early vision that enhance analysis of salient visual dimensions (Davies et al. 1994; Sowden et al., 2000) and are reflected physiologically (Frégnac et al. 1988; Gilbert and Wiesel 1992). Further, conceptual context impacts recognition of ambiguous and suppressed stimuli (Balcetis and Dale, 2007; Lupyan and Ward, 2013) and alters V1 neuronal sensitivity independently of attentional effects (Teufel et al., 2015).

Conclusion

Overall, substantial evidence indicates high-level goals, expectations, and concepts interact with the visual system at the earliest stages of cortical processing to improve perceptual speed and reliability and facilitate responses relevant to subsequent behavior. That said, acknowledging instances of penetrability is not tantamount to denying instances of impenetrability. Indeed, guiding principles likely apply that additional study might investigate. Perhaps perception tests hypotheses to resolve ambiguous visual information. Perhaps early vision brings to bear spatial attention and conceptual knowledge to embed desire into representations. Further experimental work and theoretical discussion is needed to understand the mechanism I sketch in this paper as combining input from both sensory organs and central systems during perceptual processes themselves. However, regardless of the details, contrary to philosophical orthodoxy, I conclude against modularity and impenetrability and for perception's being distorted as a function of ability, desire, and knowledge. And I add that mood disorders demonstrate that perception distorts objective facts about the world as it is in itself in light of individuals' states, and that this makes possibilities for safe, effective, and efficient action visually apparent. In sum, I claim perception is meaningful in virtue of representing a special set of relational facts for which we have no independent sense; perception thus "accurately distorts" to promote "seeing-in for-action."

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