Perception, as you make it

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Abstract: The main question that Firestone & Scholl (F&S) pose is whether “what and how we see is functionally independent from what and how we think, know, desire, act, and so forth” (sect. 2, para. 1). We synthesize a collection of concerns from an interdisciplinary set of coauthors regarding F&S’s assumptions and appeals to intuition, resulting in their treatment of visual perception as context-free.

No perceptual task takes place in a contextual vacuum. How do we know that an effect is one of perception qua perception that does not involve other cognitive contributions? Experimental instructions alone involve various cognitive factors that guide task performance (Roepstorff & Frith 2004). Even a request to detect simple stimulus features requires participants to understand the instructions (language, memory), keep track of them (working memory), become sensitive to them (attention), and pick up the necessary information to become appropriately sensitive (perception). These processes work in a dynamic parallelism that is required when one participates in any experiment. Any experiment with enough cognitive content to test top-down effects would seem to invoke all of these processes. From this task-level vantage point, the precise role of visual perception under strict modular assumptions seems, to us, difficult to intuit. We are, presumably, seeking theories that can also account for complex natural perceptual acts. Perception must somehow participate with cognition to help guide action in a labile world. Perception operating entirely independently, without any task-based constraints, flirts with hallucination. Additional theoretical and empirical matters elucidate even more difficulties with their thesis.

First, like Firestone & Scholl (F&S), Fodor (1983) famously used visual illusions to argue for the modularity of perceptual input systems. Cognition itself, Fodor suggested, was likely too complex to be modular. Ironically, F&S have turned Fodor’s thesis on its head; they argue that perceptual input systems may interact as much as they like without violating modularity. But there are some counterexamples. In Jastrow’s (1999) and Hill’s (1915) ambiguous figures, one sees either a duck or rabbit on the one hand, and either a young woman or old woman on the other. Yet, you can cognitively control which of these you see. Admittedly, cognition cannot “penetrate” our perception to turn straight lines into curved ones in any arbitrary stimulus; and clearly we cannot see a young woman in Jastrow’s duck-rabbit figure. Nonetheless, cognition can change our interpretation of either figure.

Perhaps more compelling are auditory demonstrations of certain impoverished speech signals called sine-wave speech (e.g., Darwin 1997; Remez et al. 2001). Most of these stimuli sound like strangely squeaking wheels until one is told that they are speech. But sometimes the listener must be told what the utterances are. Then, quite spectacularly, the phenomenology is one of listening to a particular utterance of speech. Unlike visual figures such as those from Jastrow and Hill, this is not a bistable phenomenon; once a person hears a sine wave signal as speech, he or she cannot fully go back and hear these signals as mere squeaks. Is this not top-down?

Such phenomena—the bistability of certain visual figures and the asymmetric stability of these speechlike sounds, among many others—are not the results of confirmatory research. They are indeed the “amazing demonstrations” that F&S cry out for.

Second, visual neuroscience shows numerous examples of feedback projections to visual cortex, and feedback influences on visual neural processing that F&S ignore. The primary visual cortex (V1) receives descending projections from a wide range of cortical areas. Although the strongest feedback signals come from...
An action-specific effect on perception that avoids all pitfalls

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Abstract: The visual system is influenced by action. Objects that are easier to reach or catch look closer and slower, respectively. Here, we describe evidence for one action-specific effect, and show that none of the six pitfalls can account for the results. Vision is not an isolate module, as shown by this top-down effect of action on perception.

The plate. It looks so close. There are days when I first get out to the mound and it feels…like the plate is closer than it’s supposed to be. Then I know right away. It’s over. You are fucked.

— Pedro Martinez (Verducci 2000)

Hall-of-Fame baseball pitcher Pedro Martinez’s experience can be explained by the action-specific account of perception. According to this account, people see the distance to or size of objects relative to their ability to act on these objects. At issue is whether supporting empirical findings reflect genuine effects on perception, or instead are a result of one of the six pitfalls Firestone & Scholl (F&S) outline. Fortunately, their claim that these issues have been “largely neglected” (sect. 4.4, para. 2) does not account for much empirical evidence directly addressing the issue with respect to action.

Their claim that no top-down effects on perception exist can be refuted when the demonstration that one effect survives all pitfalls. We count four effects that meet this criterion. The first three are treadmill manipulations on perceived distance, reach-extending tools on perceived distance, and body-based manipulations in virtual reality on perceived size (see Philbeck & Witt 2015). We describe the fourth in detail.

In a paradigm known as Pong, participants attempted to catch a moving ball with a paddle that varied in size from trial to trial, and then estimated the speed of the ball. Previous research demonstrates that when participants play with a small paddle, the ball is harder to catch and is therefore subsequently judged to be moving faster than when they play with a big paddle (Witt & Sugovic 2010). Notably, paddle size influences perceptual judgments only when paddle size also impacts performance. When the ball is similarly easy to catch regardless of paddle size, the paddle has no effect on apparent speed (Witt & Sugovic 2012; Witt et al. 2012). These findings offer both disconfirmatory findings (Pitfall 1) and rule out low-level differences (Pitfall 4).

F&S criticized the term “perceptual judgments” as being vague and ambiguous. However, its use is frequently the researchers’ acknowledgment that differentiating perception from judgment is nuanced and difficult. Indeed, F&S were unable to provide a scientific definition, instead relying too heavily on their own intuitions to distinguish perception and judgment (Pitfall 2). For example, comfort could very well be an affordance of an object that can be perceived directly (Gibson 1979). Nevertheless, the issue of distinguishing perception from judgment has been previously addressed. One strategy has been to use action-based measures for which no judgment is required. We modified the ball-catching task so that instead of continuously controlling the paddle, participants had only one opportunity per trial to move the paddle. Successful catches required precisely timing the paddle. Successful catches required precisely timing the action, and we analyzed this timing as an action-based measure of perceived speed. If the ball genuinely appears faster when the paddle is small, participants should act earlier than when the paddle is big. As predicted, participants acted earlier with the small paddle, indicating that the ball appeared faster, than with the big paddle (Witt & Sugovic 2013a). Because this measure is of action, and not an explicit judgment, the measure eliminates the concern of judgment-based effects (Pitfall 2). This measure also avoids the pitfall of relying on memory (Pitfall 6) because the action was performed while the ball was visibly moving.