



Commentary

Action-specific effects in perception and their potential applications: A reply to commentaries[☆]



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According to the action-specific approach to perception, people perceive the spatial layout of the environment relative to their ability to act in this environment. Hills appear steeper and distances appear farther to perceivers who would have to exert more effort to traverse the space. Objects that are more difficult to reach and grasp appear farther and bigger compared with objects that are easier to reach and grasp. In our target article (Witt, Linkenauger, & Wickens, 2016), we provided a brief overview of these action-specific effects, and then proposed ways in which considering perception as being action-specific could be applied to safety, rehabilitation, diagnostics, and communication. Scholars authoring two of the commentaries commended this extension and called for research to test these speculations (Balcetis & Cole, 2016; Eves, 2016). In contrast, the two other commentators argued these speculations are premature given the outstanding issues related to the theoretical claims of the action-specific effect (Gray, 2016; Loomis, 2016). Our response starts with these theoretical issues.

1. Action-specific approach to perception

The action-specific approach currently provides a broad framework for describing ways that a person's ability to act influences spatial perception. To date, much of the research has focused on documenting the phenomenon (including the conditions under which action-specific effects occur) and addressing the issue of cognitive influences on perceptual judgments.

1.1. Defining action

With the discovery of any new phenomenon, much research is dedicated to understanding the conditions under which the effects do and do not present themselves. Yet Loomis (2016) criticized the evolving view of action-specific effects that results from these new discoveries. To some extent, Loomis's concern is well-founded given that lack of clear definitions contributed to the demise of the New Look approach to perception (Carter & Schooler, 1949). Yet, the more we investigate action-specific effects, the more we learn, and for this reason, our approach is updated. The point of science is to refine and develop theories by conducting research. Loomis's complaint of a constantly moving target is only problematic if one's sole goal is to strike down the approach, rather than engage in the process of discovering more about our perceptual systems.

Allowing new evidence to update the approach is part of the pathway to attaining a precise definition of action. By criticizing the approach for having not achieved this goal already, Loomis (2016) undermines the difficulty of declaring this definition by

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ignoring all the nuanced ways that action can impact spatial perception. As Eves (2016) argued in his commentary, even one aspect of action-specific effects (effort) is likely to involve multivariate factors such as weight, fatigue, fitness, sex, and age. One of us (Witt) proposed a 4-factor definition for which action consists of the likelihood of success of a given action, the energetic costs associated with attempting the action, the benefits gained from successfully performing the action, and the costs associated with failing to perform the action (Witt & Sugovic, 2013b). Action has not been simply defined because action's influence on perception is not simple.

In contrast, Balcetis and Cole (2016) argued for a simpler definition by claiming that all action-specific effects can be reduced to understanding how motivation impacts spatial perception. They claimed that all effects can be understood within an approach versus avoidance framework. It is not clear to us how a motivational framework can explain many action-specific effects such as that of athletic success on apparent size of the target (e.g. Witt & Proffitt, 2005). Presumably all of the softball players were motivated to hit the ball, but those who had more success judged the ball as bigger compared with those who had less success. The simplistic approach/avoidance framework does not even explain all effects of motivation, as desirable objects and fearful objects both appear closer despite one prompting approach and the other prompting avoidance (Balcetis & Dunning, 2010; Cole, Balcetis, & Dunning, 2013). This is not to say that motivation is irrelevant, but to our minds, the effect of motivation is separate from that of action. This stance is supported by research showing separate and independent effects for action and motivation (Witt & Sugovic, 2013b). In a series of studies, participants attempted to block a threatening object (a spider) or a neutral object (a ball) with various sized paddles. Two parallel effects emerged, one for the object and one for the paddle size. Spiders were judged as faster than balls, and both objects were judged as faster when the paddle was small than when it was big. The lack of significant interaction indicates the two effects are parallel and separate. Thus, when both performance and motivation are included within the same study, the effect of action cannot be reduced to mere motivation, and vice versa; both produce their own effects.

We reject the claim that all action-specific effects can be considered effects of approach versus avoidance, and we also reject the idea that action can be reduced to a simplistic explanation. Action's effects on spatial perception are varied and nuanced. Thus, we agree with Eves's (2016) call for larger studies that can simultaneously measure multiple aspects of action and with Loomis's implicit call for studies that involve parametric variation of action. Appreciating the varied ways that action can impact spatial judgments is also especially important because the various aspects of action may impact perception via different mechanisms (Proffitt & Linkenauger, 2013; Witt & Riley, 2014). If action is as intricately linked to spatial perception as we have argued, there are likely to be multiple ways in which the two are connected, rather than via a single mechanism. We return to the issue of mechanisms later.

Embedded in our approach is that action is selected by the perceiver's intention. Eves (2016) questioned the need for including intention in the approach as much of his (and other's) research reveal action-specific effects without appealing to intention. As he pointed out, none of the studies on hill slant perception required participants to ascend the hill, and in the studies on stair slant perception, in many cases, participants had already descended the stairs and were walking away when asked to estimate slant. He further points out that he has obtained similar effects when asking perceivers to judge slant when viewing images of stair cases, in which case, there is certainly no intention to walk up the picture. Eves may very well be right. However, we are unwilling to let go of intention as a critical component of selecting action at this time. It is not unreasonable to presume that the ground plane

solicits a default and implicit intention to walk, and so hills and stairs are viewed with respect to walking even if no explicit task is set before the viewers. With respect to images, the perceptual system is likely to use the very same processes as used to view a real scene. This is why effective images, drawings, and paintings are ones that recreate the same kind of perspective cues as the real world. If the visual system had a whole different set of rules and processes for images, images could look a lot different. Consequently, evidence that action-specific effects can be observed when viewing life-sized images does not necessarily rule out intention as a relevant factor. Nevertheless, our claims regarding intention are certainly speculative and need to be empirically examined.

1.2. Accounting for cognitive bias

Critics of the action-specific account are primarily concerned with the issue of cognitive bias (also known as demand characteristics, task demands, and response bias). Many proponents of the action-specific approach have shown an appreciation for the nuanced ways that cognitive biases may account for purported action-specific effects. We have conducted dozens of studies *specifically* on this issue, and used many strategies that have been proven to be effective in the literature and specifically suggested by critics of this approach, such as the use of indirect measures and action-based measures.

In the current article, we take the strong stance that action-specific effects can be perceptual. This is not, as Loomis (2016) claims, throwing caution to the wind. This is the direct result of a decade of research on tackling this particular issue. We have used several indirect methodologies, including, but not limited to, perceived aspect ratio (Linkenauger, Leyrer, Buelthoff, & Mohler, 2013), perceived parallelism (Witt, 2011), perceived shape (Witt, 2011), weight perception (Linkenauger, Mohler, & Proffitt, 2011), and affordance judgements (Linkenauger et al., 2014), and several action-based measures such as blindwalking (Stefanucci & Proffitt, 2009; Tenhundfeld & Witt, in preparation; Witt, Proffitt, & Epstein, 2010) and reaction time (Witt & Sugovic, 2013a). Having conducted the very types of experiments suggested by Loomis and others, and having found support that the effects are perceptual, we are justified to refer to action-specific effects as perceptual.

One reason for the discrepancy between our strong claim that these effects can be perceptual and Loomis's (2016) concern that the evidence is not sufficient to make such a claim is that there is no standard set in the field as to what evidence is needed to assert an effect is perceptual. Loomis himself does not indicate what evidence would be sufficient, only that the current evidence is not. Critics have created a moving target themselves by calling for indirect and action-based measures, and then minimizing the outcomes found with these measures. Give us a standard, and let us use the standard to evaluate the nature of action-specific effects. Testing for perceptual effects should be an empirical question, not one dependent on "paying close attention to [one's] own perceptual experience" (Loomis, 2016, p. 77).

1.3. Phenomenology

Although this has not been explicitly stated, we speculate that one of the reasons why critics hold on so dearly to the cognitive bias explanation is that it provides them a theoretical outlet to reject claims of perceptual effects, and this rejection is actually driven, as Loomis (2016) admits, by their lack of phenomenological experience with action-specific effects. This is understandable. People want to believe their own eyes, and so if their eyes do not reveal an effect to them, it is hard to believe in the effect. Gray (2016) also asserts that action-specific effects are not noticeable.

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