Short Report

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Get Me Out of This Slump! Visual Illusions Improve Sports Performance

Jessica K. Witt[1], Sally A. Linkenauger[2], and Dennis R. Proffitt[3]

[1]Department of Psychological Sciences, Purdue University; [2]Max Planck Institute, Tübingen, Germany; and [3]Department of Psychology, University of Virginia

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One of the reasons we (the authors) enjoy going to live college basketball games is to watch the antics of the student section. We love watching the students' creativity in trying to pump up the home team and distract the visiting team, especially during free throws. Such escapades made us question whether manipulating what athletes see can influence their subsequent performance.

Perception is clearly important for performance. For instance, when athletes look directly at a target without moving their eyes around—a pattern known as the *quiet eye*—they are more successful in making free throws, putting, and performing a variety of other tasks (e.g., Vickers, 1996, 2007). The quiet eye might lead to more successful performance by focusing attention on targets, and helping athletes to ignore distractors. Additionally, the quiet eye might change the way targets look. Targets presented in the fovea look bigger than those in the periphery (Newsome, 1972), so the quiet eye might lead athletes to perceive targets as bigger.

Misperceiving a target as bigger could influence performance in one of three ways. It could disrupt performance because the observer might aim for a location that does not correspond with the target. In this case, the misperception would result in worse performance. However, actions and explicit perceptions may not be influenced by illusions to the same degree (Goodale & Milner, 1992). That is, there may be dissociations between perceptions and visually guided actions such that illusions, which fool conscious perception, do not influence subsequent actions (e.g., Ganel, Tanzer, & Goodale, 2008). In this case, misperceiving a target as bigger would not affect performance. A final alternative is that misperceiving a target as bigger could enhance performance. Bigger targets feel as if they should be easier to hit, so people may feel more confident when aiming for a bigger target. Given that increased confidence improves performance (e.g., Woodman & Hardy, 2003), a perceptually bigger target may also lead to enhanced performance. Here, we report an experiment in which we tested these possibilities.

Method

Thirty-six participants (19 females, 17 males) putted to two different-sized holes (5.08 cm and 10.16 cm in diameter; both 10 cm in depth). A downward-facing projector displayed a ring of 11 small (3.8 cm in diameter) or 5 large (28 cm) circles around each hole to create an Ebbinghaus illusion. For each hole and illusion combination, participants stood at a computer approximately 1.7 m from the hole and used MS Paint to draw a circle that matched the hole's size. Then, they attempted 10 putts from a distance of 3.5 m, and we recorded how many balls dropped into the hole. Presentation order was counterbalanced across participants. Data from 4 participants were removed because these participants were outliers, as determined by box-plot graphs.

Results

The illusion influenced perceived size of the 5-cm hole, $t(31) = 2.87$, $p < .01$, $d = 0.51$, and subsequent putting performance, $t(31) = -2.66$, $p < .05$, $d = 0.54$ (see Fig. 1). Participants made more successful putts when the 5-cm hole was perceptually larger. The surrounding circles did not influence perceived size of the 10-cm hole, $t(31) = 0.77$, $p > .44$, $d = 0.14$ (small surround: $M = 10.50$ cm, $SD = 1.74$; big surround: $M = 10.38$ cm, $SD = 1.89$). We are unclear why the surrounding circles did not induce an illusion for the 10-cm hole, though the surrounding circles were smaller relative to the 10-cm hole than to the 5-cm hole, and smaller surrounding circles have less of an effect on perceived size in the Ebbinghaus illusion (Roberts, Harris, & Yates, 2005). Given the lack of an effect of the surround on the perceived size of the 10-cm hole, this served as a control condition that allowed us to examine whether putting performance was influenced by apparent size or by other factors related to the surrounding circles. For the 10-cm hole, we found that performance was not affected by the surrounding circles, $t(31) = 0.37$, $p > .71$, $d = 0.07$ (small surround: $M = 3.69$ successful putts, $SD = 1.67$; big surround: $M = 3.83$ successful putts, $SD = 1.88$). This suggests that the significant effect of the surround

Corresponding Author:
Jessica K. Witt, Department of Psychological Sciences, Purdue University, 703 Third St., West Lafayette, IN 47907
E-mail: jkwitt@purdue.edu

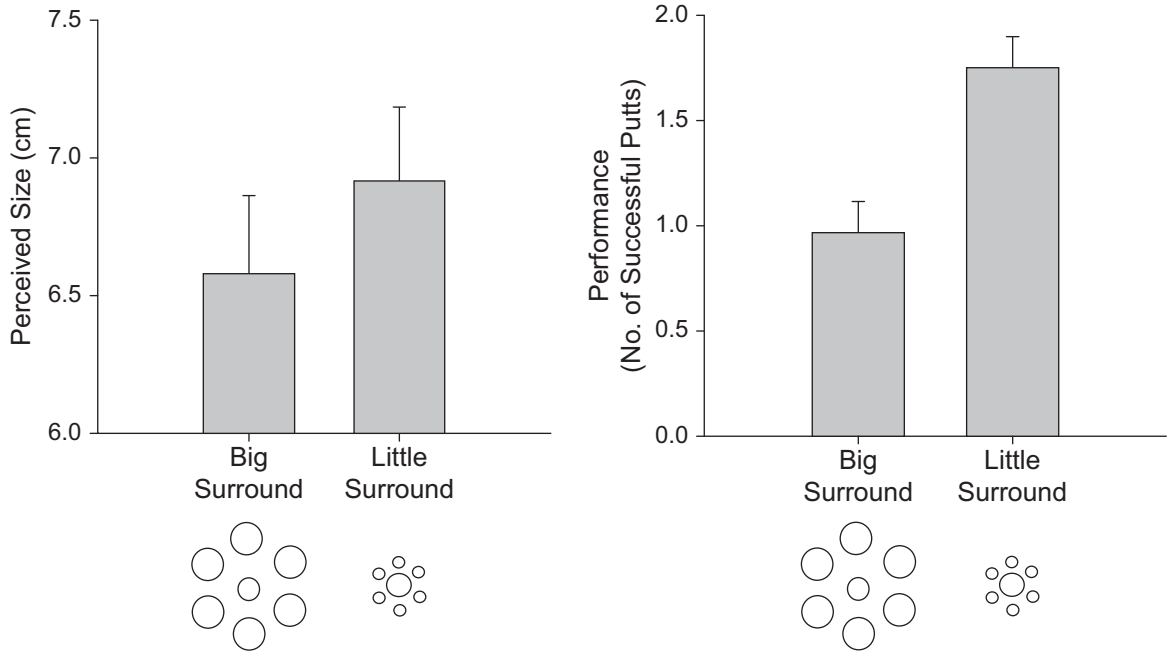

Fig. 1. Perceived size of the 5-cm hole (left panel) and participants' performance putting to that hole (right panel) as a function of the size of the surrounding circles. Error bars represent 1 *SEM*.

on putting to the 5-cm hole was due to the hole's perceived size, rather than other factors related to the surrounding circles.

Discussion

Participants putted more successfully to the perceptually bigger hole. As outlined in the introduction, this result suggests a link between perceived size and performance. A likely explanation for this effect is that an increase in the apparent size of the target increased participants' confidence in their abilities, which in turn improved performance (Woodman & Hardy, 2003).

The results do not support the prediction of a dissociation between perception and action, as might be expected by the two-visual-streams hypothesis (Goodale & Milner, 1992). However, putting is different from the kinds of actions typically studied with respect to this hypothesis. Once the ball is struck, try as one might, one cannot change its path. Ballistic actions such as putting might not benefit from additional online visual processing in the same way as visually guided actions such as grasping can (Glover & Dixon, 2001). Thus, our demonstration of a link between perception and performance does not challenge the idea of a separate visual processing stream for visually guided actions.

This study extends the action-specific account of perception, according to which people perceive the environment in terms of their ability to act in it (Proffitt & Linkenauger, in press; Witt, 2011). For example, in one study, softball players who were hitting better than others judged the ball as bigger (Witt & Proffitt, 2005). Similar patterns of results have also been demonstrated for throwing darts (Wesp, Cichello, Gracia, & Davis, 2004), kicking field goals (Witt & Dorsch, 2009), returning tennis balls (Witt & Sugovic, 2010), and golfing (Witt, Linkenauger, Bakdash, & Proffitt, 2008), as well as for children throwing balls to a target (Cañal-Bruland & van der Kamp, 2009). The action-specific account suggests that successful performance causes the action's target to be perceived as bigger than it is perceived in the case of unsuccessful performance. Here, we demonstrated the reciprocal relationship: Seeing the target as bigger leads to a subsequent improvement in performance.

Could this reciprocal relationship between perception and performance be one of the mechanisms underlying streaks and slumps? To answer this question, one would first have to test if these effects are cyclical, with perception and performance continually influencing each other. Regardless, our results suggest that our visual-illusion paradigm could be used to induce the perception that a target looks bigger, which would then lead to improved performance and might help an athlete get out of a slump.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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