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Short Report

Reaching Out With the Imagination

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It has been said that the imagination is a powerful tool. We show here that, in reality, this claim may be more than simply a metaphor.

Recent studies have revealed that items near the hands benefit from enhanced visual analysis (Abrams, Davoli, Du, Knapp, & Paull, 2008; Reed, Grubb, & Steele, 2006; Schendel & Robertson, 2004). These results are thought to reflect the importance of representing objects and events that are in close proximity to the body, such as objects that are soon to be grasped or those that must be avoided. Quite naturally, all previous studies that have found perceptual enhancement near the hands have had subjects assume a posture in which their hands were placed close to a visual display. We show here for the first time that the same benefits can occur when one simply imagines such postures.

METHOD

Sixteen students first completed the Vividness of Movement Imagery Questionnaire (Isaac, Marks, & Russell, 1986), during which they imagined performing a variety of movements and rated how vividly they were able to do so. The primary purpose of the questionnaire was to provide practice in imagining movements.

After the questionnaire, participants performed a computer-based visual search task while imagining their hands either on the sides of the monitor (as if the participant was holding the monitor with both hands; *proximal posture*) or behind their backs (*distal posture*). Participants searched through sets of three or seven distractor letters (*E*s and *U*s) for a target letter (*H* or *S*), and indicated the target's identity as quickly as possible via key press. A 3-s prompt appeared on the screen at the beginning of each trial, telling participants which of the two postures to keep in mind during the search. The target identity, distractor identities, and stimulus locations were randomly selected on each trial (the stimuli were identical to those used in Experiment 1a of Abrams et al., 2008).

Both postures that were to be imagined were demonstrated by the experimenter at the beginning of the session. It was emphasized that participants were not to actually assume the postures. Instead, they were to simply imagine performing them while holding their hands on the keyboard in front of them throughout the experiment. A video camera was used to monitor compliance with the postural instructions. Participants were instructed before the task began to imagine each posture to the best of their ability.

Participants completed two blocks of 64 trials in a 2 (imagined posture) × 2 (display size: 4 or 8) within-subjects design. There were 16 trials per condition per block. The order of trials in each block was randomly determined.

RESULTS

The results are shown in Figure 1. Reaction times increased with increasing display size, $F(1, 15) = 52.46, p < .0001, p_{\text{rep}} > .99, \eta_p^2 = .778$, but there was no main effect of imagined posture, $F(1, 15) < 1$. Nevertheless, imagined posture did interact with display size, $F(1, 15) = 5.71, p = .030, p_{\text{rep}} = .94, \eta_p^2 = .276$: Participants searched through the display at a slower rate when they imagined their hands to be near the display (proximal posture; 23.4 ms per item) than when they imagined their hands to be far from the display (distal posture; 15.6 ms per item). As did Abrams et al. (2008), we argue that the slower rate forces a more thorough analysis of items near the hands (Abrams et al., 2008). No difference was found between reaction times for the proximal and distal postures at either the small display size, $t(15) = 1.03, p > .05$, or the large display size, $t(15) = 1.84, p > .05$. This finding indicates that the observed interaction did not arise from disproportionate differences at one display size. The overall error rate was 6.1%. Errors did not depend on imagined posture or display size, all Fs < 1.

DISCUSSION

Abrams et al. (2008) found that people were slow to disengage their attention from objects near their hands. As a result, their

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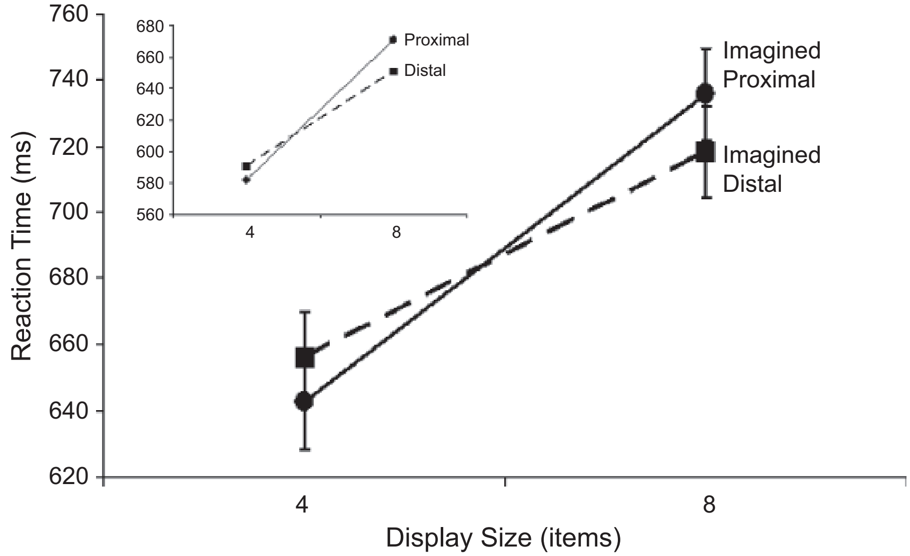

Fig. 1. Mean reaction time for each imagined posture as a function of the number of items in the search set. Responses with latencies less than 100 ms or greater than 1,500 ms, as well as incorrect responses, were considered errors and were not included in the calculations. Error bars represent the within-subjects 95% confidence intervals. The results from Experiment 1a of Abrams, Davoli, Du, Knapp, and Paull (2008), which involved actual postural changes, are shown in the inset.

participants searched through visual displays near their hands more slowly (and hence more thoroughly) than displays that were far from their hands. We replicated that effect of hand proximity on search rate—however, our participants only imagined that their hands were close to the display. Our results show that thinking about a posture may have effects that are similar to actually assuming that posture, in much the same way that preparing for (Fagioli, Hommel, & Schubotz, 2007; Vishton et al., 2007), viewing (Rizzolatti & Craighero, 2004), and imagining (Creem-Regehr & Lee, 2005; Higuchi, Imamizu, & Kawato, 2007) an action have been shown to have effects similar to the effects of performing that action.[1]

Hand-proximity effects are thought to be a function of a system that monitors the space around the body, or *peripersonal space*—an invisible "bubble" that extends several inches from the skin in all directions (e.g., Graziano, Gross, Taylor, & Moore, 2004; Lloyd, 2007). This system includes brain mechanisms specifically dedicated to events occurring within peripersonal space (Graziano et al., 2004; Makin, Holmes, & Zohary, 2007; Schendel & Robertson, 2004). Because such events are often highly relevant, it is reasonable that they would be subjected to enhanced visual analysis.

[1]It is worth considering the possibility that the differences we have reported for the two different imagined postures stem from differences in task demands of the two sets of instructions. Perhaps one posture, by virtue of being easier to imagine, afforded more resources to devote to the visual search task than the other. However, differences in task demands seem unlikely as an explanation of our results because such differences would be expected to produce an overall difference in reaction times or errors between the two imagined postures, and, as noted earlier, we did not observe a main effect of imagined posture on reaction times or errors.

Our results reveal a remarkable property of the peripersonal bubble: It can be extended into the space where an imagined postural change would take the body. This finding complements results that show that peripersonal space is sensitive to actual changes in posture (Kennett, Spence, & Driver, 2002) and can expand to include functional extensions of the body such as tools (Berti & Frassinetti, 2000; Iriki, Tanaka, & Iwamura, 1996; Maravita, Spence, Kennett, & Driver, 2002; Schendel & Robertson, 2004) and virtual-reality representations of the limb (Iriki, Tanaka, Obayashi, & Iwamura, 2001) or body (Ehrsson, 2007). In contrast to these earlier results, our results show that peripersonal space can be extended purely endogenously, using only the mind.

There are clear advantages of representing the "space" of an imagined posture. For example, before performing an action, an individual may imagine it to learn about its feasibility ("Can I reach that box on the top shelf?"). Furthermore, because representations of peripersonal space may also help people avoid unwanted collisions (Graziano & Cooke, 2006), it is fitting that an individual would be able to extend his or her peripersonal representation into the space where the body may soon be, as if to "scout out" that space for obstacles or threats. The results of the present study provide confirmation of an idea that has long been espoused by motivational speakers, sports psychologists, and John Lennon alike: The imagination has the extraordinary capacity to shape reality.

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