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Target Size and Representational Momentum: A Re-Evaluation of the Momentum Metaphor

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Introduction

Memory for the position of a moving target is usually displaced forward from the actual position of that target; this pattern is called *representational momentum* (RM; for review, Hubbard, 1995b). Finke, Freyd, and Shyi (1986) suggested RM resulted from internalization of principles of momentum by the representational system, and this momentum metaphor predicts that factors that influence physical momentum should influence RM. Physical momentum is the product of mass and velocity, and so an object's mass and velocity should influence RM for that object.

Faster targets exhibit greater RM (Freyd & Finke, 1985), but increases in target size (i.e., implied target mass) do not influence RM for horizontally moving or rotating targets (Cooper & Munger, 1993). However, larger horizontally moving targets are displaced downward more than are smaller horizontally moving targets (Hubbard, 1995a). This downward displacement, coupled with failures to find effects of target size on RM for horizontally moving and rotating targets, suggests that effects of target size may be limited to the axis aligned with implied gravitational attraction.

Methods

Observers viewed computer-animated displays that portrayed either a horizontally (Exp. 1) or vertically (Exp. 2) moving black square target (on a white background). Target size (20, 30, 40, 50, or 60 pixels in diameter) and velocity (5, 10, or 15°/second) were constant within a trial and varied across trials. The target vanished without warning, and observers indicated the judged vanishing point by positioning the cursor over the location in which the target was judged to have vanished.

Results

Differences between the judged vanishing point and the true vanishing point were measured, and these differences were referred to as *displacement*. Displacements along the axis of motion (*M displacement*, the x axis in Exp. 1 and the y axis in Exp. 2) and the orthogonal axis (*O displacement*, the y axis in Exp. 1 and the x axis in Exp. 2) were analyzed in separate ANOVAs.

In Exp. 1, size did not influence M displacement, but size did influence O displacement such that larger targets were displaced further downward. In Exp. 1, faster targets also exhibited greater M displacement. In Exp. 2, larger targets produced greater M displacement when targets descended and smaller M displacement when targets ascended. In Exp. 2, size did not influence O displacement.

Discussion

Influences of target size on O displacement in Exp. 1 and M displacement in Exp. 2, and failures of target size to influence M displacement in Exp. 1 and O displacement in Exp. 2, suggest target size influences displacement only along the axis aligned with implied gravitational attraction. This may occur because observers' representational systems respond to implied weight, rather than to implied mass. Within the terrestrial environment, mass is experienced as weight. An interpretation of mass as weight suggests observers internalized subjective consequences of physical principles, rather than literal physical principles per se.

It may be that implied weight biases memory downward, and that this bias increases with increases in target size. For ascending targets, downward bias and RM operate in opposite directions; for descending targets, downward bias and RM operate in the same direction. If remembered position reflects a combination of weight and momentum effects, then increases in RM for descending targets and decreases in RM for ascending targets with increases in target size may be accounted for (see Hubbard, in press).

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