Prospective Perception

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Abstract

In recent years, more and more data have come to fore that indicate perception to be inherently prospective (i.e., anticipatory). The purpose of the present symposium is to examine the research of three scholars who investigate prospective perception from three different theoretical perspectives: the Theory of Event Coding, the Action-Specific Perception account, and Ecological theory. Panelists will examine differences between theories and address the extent to which prospective perception affords a means of potentially integrating these theories.

Keywords: Prospective control; sensory-motor learning; ecological psychology; Action-Specific Perception account: affordances; anticipation.

What is Prospective Perception?

In recent years, more and more data have come to fore that indicate perception to be inherently prospective (i.e., anticipatory). The purpose of this symposium is to present research from three scholars who investigate prospective perception. Each will discuss the types of dependent variables they measure, the variables they manipulate, and the theoretical frameworks they use to interpret their data. Emphasis will be placed on differences and similarities between theories, as well as possible means of overcoming such differences. In the end, the panel will address what exactly it means for perception to be prospective, and how this might impact current theorizing in cognitive science.

The Theory of Event Coding

J. Scott Jordan is a cognitive psychologist who investigates the well known finding that the perceived vanishing point of a moving stimulus is displaced beyond the actual vanishing point, in the direction the stimulus was traveling just before it vanished (Hubbard, 2005). Numerous studies have revealed that the magnitude of this forward displacement (FD) varies systematically as a function of stimulus factors such as velocity (i.e., FD increases as stimulus velocity increases), movement direction (i.e., upward moving stimuli give rise to less FD than downward moving stimuli), and implied friction (i.e., FD decreases as a stimulus appears to move across a surface). Traditionally, such findings are accounted for in terms of representational-momentum, the idea being that the brain evolved to represent dynamic as well as static stimulus properties. Thus, when the moving stimulus vanishes, its representation entails momentum and continues moving, as it were, in the direction of represented motion. In a series of recent papers, Jordan and colleagues have researched an alternative account; namely, that FD is due to the anticipation underlying action control. This interpretation is based on the Theory of Event Coding (TEC; Hommel, Muessler, Aschersleben, & Prinz, 2001) which assumes the following: (1) actions are planned in terms of the distal effects they are to produce, and (2) action-planning and perception share overlapping neural dynamics. According to TEC therefore, FD occurs because the stimulus' movements are perceived in terms of the action plans participants generate as they interact with the stimulus. In one study (Jordan & Hunsinger, 2008) it was discovered that when participants simply observed the movements of the stimulus, FD was larger for observers who had just recently learned to control its movements via key presses on a computer keyboard. According to TEC, when observers were simply observing the movements of the stimulus, they were 'perceiving' those movements in terms of the plans they had learned while controlling it, due to the neural overlap of perception and action-planning. In short, perception entails plans, and these plans render perception inherently prospective.

Action-Specific Perception Account

Jessica Witt is a cognitive psychologist who also studies perception, and does so in terms of a framework known as the action-specific perception account. According to this framework, perception is scaled to the abilities and intentions of the perceiver. For example, when participants intend to reach with a tool to targets that are just beyond their reach, the targets look closer than they do when participants intend to reach without the tool or when the participants hold the tool but never intend to reach (Witt,

Proffitt, & Epstein, 2005). As another example, targets on the ground look farther away to participants who intend to throw a heavy ball to them compared with participants who intend to throw a light ball (Witt, Proffitt, & Epstein, 2004). However, after throwing a heavy ball, targets only look farther away for participants who intended to throw again, but not to participants who intended to walk (Witt et al., 2004). Only effort for the action-about-to-be-performed influences perception. In addition, as was reported in Jordan & Hunsinger (2008), performance of a task and the plans one generates during such performance, can influence later perception. For example, softball players who were hitting better selected a larger circle as matching the size of the softball used during the game (Witt & Proffitt, 2005), and golfers who are putting better select a larger circle as matching the size of the hole (Witt, Linkenauger, Bakdash, & Proffitt, 2008). This implies that better athletic performance led players to perceive the target as larger.

Collectively, these findings are consistent with the action-specific perception account, and support the assertion that perception is scaled relative to the behavioral possibilities of anticipated actions. Again, as was the case with Jordan, this implies that perception is inherently anticipatory.

Ecological Theory

While on the one hand, the notion that perception takes place in terms of behavioral possibilities might seem new to cognitive science, the idea has been a foundational concept in Ecological Psychology, where perception is argued to take place in terms of *affordances*. That is, ecological theory assumes we perceive the environment in terms of the behaviors it affords. Michael Riley is an ecological psychologist who studies affordance perception during action perception. That is, he and his colleagues investigate the patterns of environmentally-available information generated by body-object systems and the ways perceivers use such information. In one study (Ramenzoni, Riley, Shockley, & Davis, 2008) he and his colleagues asked both short and tall participants to indicate maximum overhead reaching capabilities for both themselves and another participant. The available perceptual information was manipulated by changing the participants' optically specified eye-height. Participants were able to accurately perceive the maximum overhead reach for both the 'self' and the 'other'. However, when the perceiver's eye-height was increased, the perceived maximum overhead reach increased for both judgments about both self and other. Riley and his colleagues interpret these results as revealing a rich source of environmentally-available information that perceivers use when perceiving action possibilities. Given these perceived possibilities refer to possible *future* behaviors, they are, by definition, prospective.

Discussion

Common to the Theory of Event Coding (TEC), the Action-Specific Perception account (ASPA), and Ecological Theory (ET), is the notion that perception is prospective. The theories do differ, however, with TEC focusing on overlapping neural structures, ASPA focusing on task specificity, and ET focusing on information structures available in the optic array. While these may seem to reduce to an internal versus external difference, the members of the panel will address the issue of whether or not this common notion of prospective perception might constitute a means of overcoming the computational-ecological divide that has plagued cognitive science for decades..

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