EXPLORATORY ACTIVITY: CONSTRAINTS AND OPPORTUNITIES

Organized by Tom Stoffregen and Claes von Hofsten

Detection of Accretion/Deletion of Optical Texture at Occluding Edges Produced by Eye Movement with Head Immobilized

Geoffey P. Bingham
Department of Psychology, Indiana University, Bloomington, IN, U.S.A.

As the point of perspective moves in cluttered surroundings optical texture is revealed or hidden at boundaries corresponding to occluding edges. The point of perspective in the eye is located near the lens and pupil at a distance of about 11 mm from the center of rotation of the eye. Thus, even with the head immobilized, the point of perspective moves as the eye is rotated during eye movements. The resulting accretion or deletion of optical texture occurs at optical boundaries which sweep across the retina in phase with the accretion/deletion. Can observers detect such optical flows? Four observers were tested in monocular viewing. O's head was immobilized via a biteboard with the center of rotation of the right eye located at the intersection of centerlines extended from 2 optical benches, one lying along the line of gaze parallel to the sagittal plane of the head (straight ahead) and one lying along a line of gaze at a visual angle from straight ahead of either 20°, 30°, or 40° nasalward. Two white surfaces were adjusted via translation platforms with micrometers so that a red area on the rear surface was just occluded by the left edge of the front surface as O looked straight ahead. The amount of red texture revealed and detected as O looked nasally at a target located on the second bench was measured by translating the rear surface to the right until the texture was no longer detected by O (method of adjustment). 12 configurations of surface distances were tested with the 3 angles of eye rotation. Predicted visual angles of revealed texture overestimated measured angles. A subsequent test with 2 O's using a criterion free signal detection method at 2 configurations of the surfaces revealed that the texture could be detected up to the predicted angles. A third experiment investigated the use of this information to detect separation of surfaces in depth. Alternative potential sources of information about separation, including texture, luminance, and accommodation were controlled. Practiced observers reliably identified separation whereas naive, unpracticed observers did not.

Haptic Space in Infancy

Philippe Rochat
University of Massachusetts at Amherst, MA, U.S.A.

Haptic activities such as mouthing, bringing hands to the mouth, grasping and reaching are manifested from birth, and are the trademark of early infancy. These activities raise important questions as to what function(s) they serve and what role they play in development. The aim of the presentation is to discuss (1) the perceptual/exploratory aspect of early haptic activities and (2) the rapid expansion of haptic space between birth and 8 months.

(1) Observations are presented showing that haptic activities at birth and in the course of the first months are organized around the mouth. The repertoire of oral activities at birth is not reduced to sucking, but includes exploratory-like action of tongue, gums and lips. Supporting evidence for precocious haptic exploration of the mouth is presented suggesting that when young infants grasp and mouth objects, they do gather information about these objects. Early capacity of cross-modal transfer from mouth to vision indicates that this information is 'a-modal', not specific to the oral modality.

(2) Haptic space in infancy is described in terms of functional zones that expand from the mouth to the limits of manual prehension. The rapid expansion of haptic space from birth to 6 months is discussed. Based on empirical observations, it is suggested that this expansion reflects a) change in the status of the mouth as a dominant and referential system, b) the refinement of hand(s) use in coordination with vision, and c) the emergence of self-sitting posture. Evidence that infants possess a remarkable ability to perceive the limits of their haptic space is presented.

To conclude, the determinants of haptic exploration in infancy are discussed. Although young infants appear to gather and use haptic information, the question is raised whether haptic exploration is primarily incidental early in life.

Search Strategies in Learning to Map Perception and Action

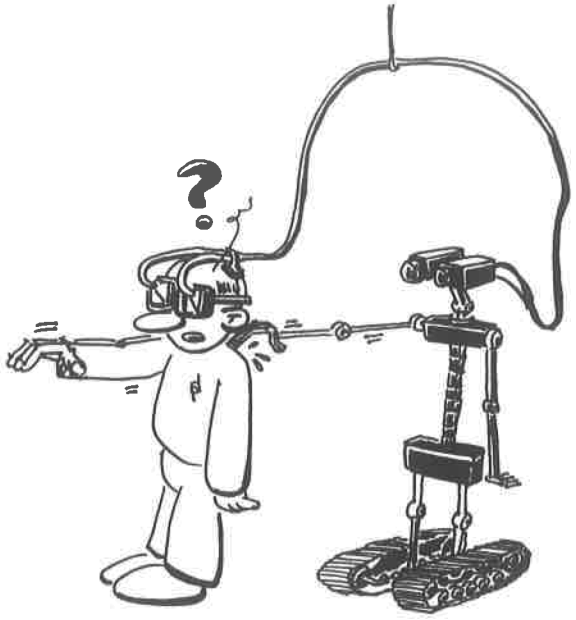
K. M. Newell and P. V. McDonald
Department of Kinesiology, University of Illinois at Urbana-Champaign, IL, U.S.A.

We are investigating how people learn the form of movement coordination patterns by examining the search strategies used to explore and locate stable equilibrium regions in perceptual-motor workspaces. Here we report data from experiments using the Krinski and Shik (1964) protocol where subjects learn to explore various computer derived task spaces through coordinating 2 bio-mechanical degrees of freedom. The task spaces manipulated systematically changed the relation between the error signal and the limb configurations. The spaces were similar in that they were locally linear and continuous but varied in their number of partial local minima, symmetry, and gradient features. The action space was manipulated by varying the joints specifying the 2 degrees of freedom, namely: within-limb; between-joint; and within-joint. The search strategies used in learning to map perception and action under these varying task constraints will be presented.

Exploring the World Ahead of Time

Claes von Hofsten[a] and David N. Lee[b]
a. Department of Psychology, Umeå University, Sweden
b. Department of Psychology, University of Edinburgh, Scotland

Smooth control of actions requires information about events in the world ahead of time. In a dialogue form we will discuss the search for and the extraction of future-oriented information and how such information is used in guiding our movements.



Closing the perception-action cycle