Chapter 8

**MOVEMENT AND ACTION**

1. How fundamental is motion to the visual system? Is there a way to eliminate visual motion? It is impossible to stand perfectly still, though one could be strapped down to eliminate self-motion. However, eye movements could still occur. One way to eliminate visual motion would be to paint opaque images on contact lenses. When worn by a research participant, with each eye movement, the image would move too, and would thus be “fixed” to the retina; there would be no visual motion. What do you think would be the perceptual result of this experiment?

Hints and discussion: Students may offer many guesses, and this can encourage introspection and critical thinking about movement. The answer is that vision “shuts down” in that with continuous activation, the photoreceptors adapt to constant input and stop responding. This experiment is often cited as supporting Gibson’s description of the perception/action cycle and the claim “We perceive in order to move and move in order to perceive”.

1. Consider the point-light display research mentioned in the book. Research shows that observers can recognize age, gender, and even emotional state of the point-light actor. The idea that emotions of others might be perceived via movements raises the possibility that other mental states might also be embodied in this way and perceivable by others. What sorts of mental states might be embodied and which sorts might not be? If some mental states can be embodied and perceived by others, what implications might this have for attributional theory in social psychology? Consider in the discussion the study cited in the book (Swettenham, et al., 2013) that autistic children are impaired in their judgments of point-light actors.

*Hints and discussion: This question provides a platform for teaching students about embodied cognition (that cognitive states are grounded in bodily states). While the connection to social psychology may be a stretch for those who have not taken the subject, a brief connection can be made to how people make personal and situational attributions about others, and the information we use to make those attributions.*

1. Research has shown that bees use optic flow to guide their flight. The researchers observed bees flying down a tube, and noted that bees prefer to fly down the center of the tube, keeping the sides of the tube equidistant. To show that the bees were using optic flow to maintain this state of affairs, the researchers used projectors to artificially speed up the optic flow on one side of the tube compared to the other. Imagine you are the bee: you are flying down the center of the tube when you suddenly notice that the optic flow to your right side is increasing in velocity. What is your response? How do you fly so as to keep the optic flow equalized between left and right?

*Hints and discussion: Normally, an increase in the speed of optic flow signifies you are getting closer to the surface that you are moving past. Thus, an increase in the optic flow on your right should cause you to steer away from that side, toward your left. This maneuver will decrease the flow rate to your right, and increase the flow rate to your left. (in the research, the bees did in fact maneuver to find this ‘sweet spot’ that equalized the flow. Srinivasan, M.V., Lehrer, M., Kirchner, W., & Zhang, S.W. (1991). Range perception through*

*apparent image speed in freely-flying honeybees. Visual Neuroscience, 6, 519–535). A similar thought process can be introduced using David Lee’s moving room study, in which participants were placed inside a false room, suspended from the ceiling by ropes. Postural sway was induced by gently swaying the room to and fro. Participants interpret a visual expansion of the wall in front of them as a forward lean, and counteract this by leaning back. These exercises can help students think for themselves about optic flow and how it is used to control action.*

1. What makes a chair a chair? Cognitive psychology has a long history of studying the nature of categorical knowledge. There are many different types of chairs, and they vary quite a bit in their appearance and specific characteristics, yet all are easily recognizable as chairs (recall some of the theories discussion in Chapter 5 about object recognition). Even some things that are not items of furniture can be called chairs, such as a ledge, or a tree stump. Hence it is difficult to define a chair using concrete and specific characteristics like having 4 legs, a seat, a seat-back, armrests, etc. Gibson’s theory of affordances provides a different way to think about this problem. How could you apply the notion of an affordance to defining the concept of chair? What other categories can be defined in terms of affordances?

*Hints and discussion: Using affordance theory, a chair is anything that affords sitting. For humans, who walk on 2 legs and sit on their rear-end by bending at the waist, a chair is anything that supports one’s body weight, is large enough to fit one’s rear-end, and is not much more than waist high. All of these factors can vary from person to person. Some other categories to consider: table (what things do we do with tables?), passageways/apertures (when is a hole in the wall a means to move from room to room and when it is just a hole?), stair-steps (at what ratio of riser height to tread-depth can stairs be climbed using the usual 2-legged gait, vs having to switch to quadrupedal climbing, i.e., incorporating the arms?), and more.*

1. When using a computer mouse to point and click on a small icon on screen, one must typically slow down and do so carefully. Fast pointing movements tend to be inaccurate. This phenomenon is known as the speed-accuracy tradeoff. What about slow movements makes them more likely to be accurate? What about fast movements makes them less so?

*Hints and discussion: This question connects to the section in the book on visually guided grasping and the importance of continuous feedback guidance of hand movements. This discussion can help students understand how continuous feedback is used to achieve accuracy, and also understand that feedback processing takes time, so slower movements are required to process feedback signal – further, slower hand movements are easier to see and localize than fast ones. Also, very fast movements are often described as being “ballistic” using feed-forward control, so the discussion provides opportunity to introduce theories of control (feedback vs feedforward). See also Fitts’ law (1954). This discussion also provides a launching off point for introducing the field of Human Factors and Ergonomics, and how knowledge of the speed-accuracy tradeoff can be used in the design of computer displays and interfaces.*