

PERCEIVING MOTION CHAPTER 8

Overview of Questions

- Why do some animals freeze in place when they sense danger?
- How do films create movement from still pictures?
- When we scan a room, the image of the room moves across the retina, but we perceive the room and the objects as remaining stationary. Why does this occur?

Functions of Movement Perception

- Survival in the environment
 - Predators use _____ as a primary means of location in hunting
 - Attentional capture - _____
 - Thus if prey remains motionless, it is less likely to be noticed.
- Perceiving objects and events
 - Movement of objects or the observer's movement through objects assists in organization of stimuli
- Motion agnosia
 - Damage to the cortex resulting in _____
 - Extremely debilitating and dangerous for the patient

Four Ways to Perceive Motion

- Real motion
- Illusory motion – apparent motion
- Induced motion
- Motion aftereffect
- **Illusory motion: no actual movement**
 - **Apparent Movement**: perception of movement from static stimuli presented in slightly different locations
 - Although this phenomenon was used in motion pictures in the early 1900s, it wasn't until 1912 that it was explained by _____

Four Ways to Perceive Motion

- **Induced Movement:** movement of one object results in the perception of movement in another object.
- **Motion aftereffect**
 - Observer looks at movement of object for 30 to 60 seconds.
 - Then observer looks at a stationary object.
 - Movement appears to occur in the _____ direction from the original movement.

Three Situations That Lead To Movement Perception

- An object moves, and the observer is stationary
- An object moves, and the observer follows the object with his or her eyes
- An observer moves through a stationary environment
- What mechanism explains all three situations?

Two Explanations of Motion Perception

- **Ecological approach**
- **Physiological approach**

Ecological Approach

- Our perception of movement is influenced by how things move relative to one another in the environment.
- **J.J. Gibson (1979)** coined the term _____ to refer to the structure created by the surfaces, textures, and contours of the environment.
- The optic array changes when the observer moves or when something in the environment moves.
- **Local Disturbances in the Optic Array:** _____, covering and uncovering the stationary background.
- The image of the man stays stationary on the observer's retinas, but the man will cover and uncover the stationary background.

Ecological Approach

- **Global Optical Flow:** The movement of the observer causes _____
- This global flow signals that the _____.

Physiological Approach to Motion Neural Feature Detectors & Movement Perception

- **Hubel & Weisel's (1959, 1965a)** complex and end-stopped cells were found to react to specific directions of movement.
- **Tuning Curve:** shows how a complex cell selectively fires to a narrow range of directions.
- The _____ in the **dorsal stream** is thought to be important because _____ in this area are **directionally selective**.
- **Aperture problem** - observation of small portion of larger stimulus leads to misleading information about direction of movement
- **Solution to aperture problem**
 - Responses of a number of V1 neurons _____
 - This may occur in the **medial temporal (MT)** cortex, which is located in the *where/action* stream.
 - Evidence for this has been found in the MT cortex of monkeys.
 - Neurons on the striate cortex respond to movement of ends of objects (e.g., end of a pencil).

Determining Direction of Fields of Moving Dots

- Firing and coherence experiment by Newsome, Britten, & Movshon (1989).
 - **Coherence of movement** of dot patterns was varied.
 - Monkeys were taught to judge direction of dot movement and measurements were taken from MT neurons.
 - Results showed that as coherence of dot movement increased, so did the firing of the MT neurons and the judgment of movement accuracy.
- Lesioning experiment by Newsome and Paré
 - Normal monkeys can detect motion with coherence of _____
 - Monkeys with lesions in MT cortex cannot detect motion until the coherence is _____

Determining Direction of Fields of Moving Dots – continued

- Microstimulation experiment by Movshon and Newsome (1992)
 - Monkey trained to indicate direction of moving dots.
 - Neurons in MT cortex that respond to specific direction were activated by this movement.
 - Experimenter used **microstimulation** to activate different direction sensitive neurons.
 - Results:

Neural Firing and Judging the Direction of Movement

- Neural firing can explain perception of movement that involves _____
- **Movement of the eyes** causes the image of _____ to move across the retina, but we perceive the objects as stationary.
- How do we take this movement of the eyes into account?
- **Corollary Discharge Theory**

Corollary Discharge Theory: Taking Eye Movements into Account

Movement depends on 3 types of signals

- **Motor Signal (MS)**
- **Corollary discharge signal (CDS)** splits off from the motor signal and indicates that a signal has been sent from the brain to move the eye.
- **Image movement signal (IMS)**
- **Movement is perceived** when the **comparator** receives
 - Comparator receives inputs from neurons that carry both of these signals.
- Movement is *not perceived* when comparator receives input from

Research Testing The Theory That Corollary Discharge Is Sufficient To Cause The Perception Of Movement

Physiological Evidence for Corollary Discharge Theory

- **Galletti, Battaglini, & Fattori (1990)** found neurons in area V3 of the monkey cortex (dorsal stream) that respond strongly when the monkey _____ and a _____ the cell's receptive field.
 - These cells do not respond when the bar is held stationary and the monkey moves its eyes.
- Damage to the _____ area in humans leads to perception of movement of stationary environment with movement of eyes.
- Researchers have still not discovered the corollary discharge signal itself, where it originates, or where the hypothetical comparator might be.

Biological Motion - Movement of Person or Other Living Organism

- **Point-Light Walkers** - biological motion made by placing lights in specific places on a person.
- Only when the _____ do they create the perception of a moving person (Biological Movement).
- Neurological studies show biological motion is processed by superior temporal sulcus (STS) and fusiform face area (FFA).

Perception of Biological Motion - continued

- Grossman et al. (2001)
 - Participants viewed point-light stimuli for activities.
 - Task was to determine whether motion was biological or scrambled.
 - Noise was added to dots so they could only achieve 71% accuracy.
 - Transcranial magnetic stimulation (TMS) applied to STS caused _____
- TMS - Disrupt functional of a particular area of the brain by applying a _____, _____ which decreases functioning for seconds or minutes.

Organization of Dots in Point-Light Walkers

- Some neurons in a monkey's temporal cortex (superior temporal area) respond best to people walking & to point light walkers.
- Different neurons respond to different _____.
- PET scans reveal similar brain activity in the human superior temporal sulcus (STS).

The Intelligence Of Movement Perception

- **Shortest-path constraint:** movement tends to occur along the shortest path between two stimuli, even though many other paths are also possible.
- Knowledge About the Human Body Influences Movement Perception
- **Shiffrar & Freyd (1990, 1993) Experiment:**
 - **Showed Ss pictures** that violate the shortest-path constraint.
 - Pictures were presented rapidly to evoke apparent motion.
- **Question:** how will this movement be perceived?
Through the head (shortest path) or around the head?
- It depends on the length of the time between onset of the first and second pictures (**Stimulus Onset Asynchrony – SOAs**).
- About _____, Ss perceive the hand as moving _____.
- SOAs longer than **200 ms**, Ss perceived movement _____.
- **Results suggests that:** The visual system needs time to process information in order to perceive the movement of complex meaningful stimuli.