



PERCEPTION AND ACTION

ICS 280: Visual Perception



Ecological Approach to Perception

- J. J. Gibson in 1929
- Traditional experiments too constrained
 - Subjects cannot move their heads
 - Study of snapshot vision
- Perception in its natural environment
- Emphasizes relationship between perception and movement
- What is available in environment for perception?



Beginnings

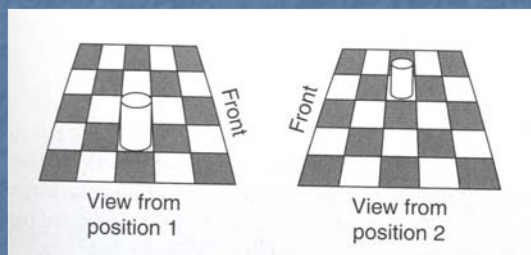
- During World War II
- Pilots ability to land successfully
 - No binocular disparity at that distance
 - No apparent size
 - Characteristics of ground
 - Information provided by the plane's movement

Slide 3

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Information on Retina vs. Environment

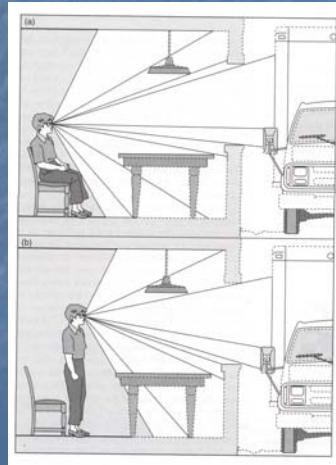


Slide 4

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Ambient Optic Array

- Ecological optics
 - Description of stimulus based on ambient optic array
- Ambient Optic Array
 - Structure of the stimulation available at any point in the environment
- Optic Flow
 - Movement of Ambient Optic Array



Slide 5

ception

Optic Flow

- Effect of movement on optic array
 - Gradient of flow
 - Speed of Flow
 - Focus of expansion
 - Tells where the person is heading to

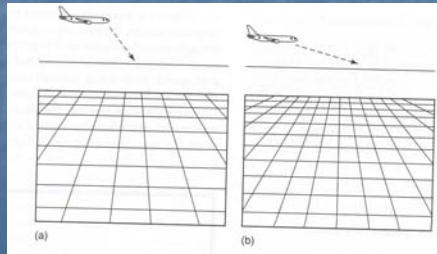
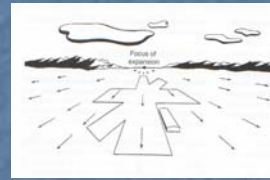
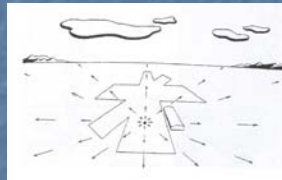


Slide 6

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Cues Used

- Focus of expansion
 - Location
- Texture gradient
 - Angle



Slide 7

Visual Perception

Invariant Information

- Focus of Expansion
- Texture Gradient
- Example of checkerboard

Slide 8

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Visual Control of Action

- Optic Flow help us
 - Reach destination
 - Maintain balance
 - Anticipating collision
- Take appropriate actions

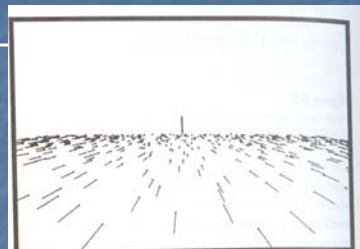
Slide 9

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Judging Destination

- Just from optical flow



(a)



(b)

Slide 10

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Reaching Destination

- Is optic flow sufficient?
 - Yes
- Do people use flow information?
 - Partially
 - Partially other cues

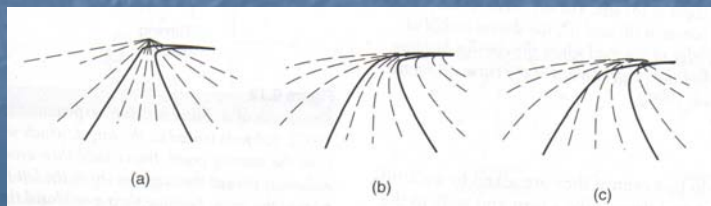
Slide 11

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Reaching Destination

- Locomotor flow of line
 - Experiments
- Visual direction strategy
- Other cues
 - In dark or snow storm
 - Blind walking experiments

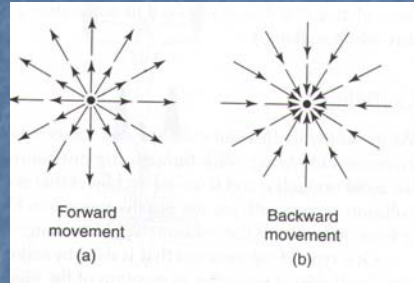


Slide 12

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Posture or Balance

- Visual stimulus is critical for balance
 - Standing on one leg experiment
- Maintaining posture
 - Swinging room experiment
 - Children fell
 - Adults acted like puppets
 - Ripley's Believe It or Not

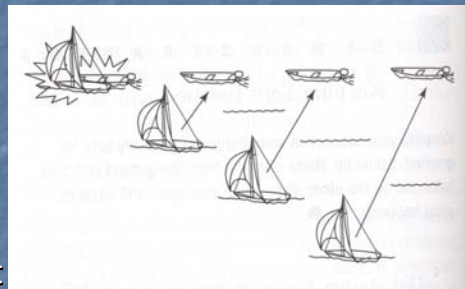


Slide 13

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Anticipating Collision

- Direction of View : Bearing
- Estimating object's distance and speed
- Tau strategy
 - Size of object in different pictures
 - Rate of expansion of object's edges
- Visual cues for gymnasts



Slide 14

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Neural Mechanisms

- Collision sensitive neurons in pigeons
- Neurons in medial superior temporal (MST)
 - One kind fires with expanding stimulus
 - Other fires with circular movement

Slide 15

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Does flow information affect neurons?

- MST responds to large receptive fields
- Perception flow summates over a large area of the visual field
 - Spatial summation experiment

Slide 16

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Slant based on Potential for Action

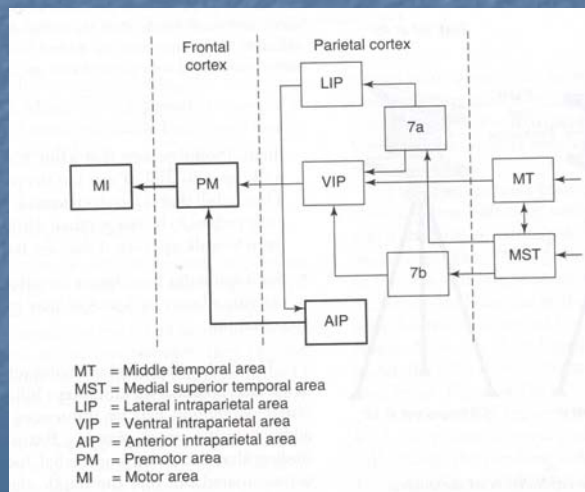
- Subjects asked to estimate the slant of a hill
 - Verbal
 - Visual
 - Haptic
- Verbal and visual
 - Overestimated
 - Depends on the hardness of the task of climbing it
 - Depends on the physical condition of the subject
- Haptic
 - Correct estimation
 - Helps to do job with maximum efficiency

Slide 17

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Perception meets the Motor System



Slide 18

Visual Perception



Important Parts

- Anterior inter-parietal area (AIP)
- Pre-motor area (PM)
- Motor area (MI)



Anterior Inter-parietal Area (AIP)

- Motor dominant neurons
 - Responds to action only
- Visual dominant neurons
 - Responds to vision only
- Visual and motor neurons
 - Responds to both
- Located between the vision and the motor area



Pre-motor Area (PM)

- Mirror Neurons
 - Monkey grasps an object
 - Looks at another person grasping an object
 - Not to a pair of pliers grasping an object
- What are these for?
 - Understand motor actions and react to them
 - Mimic actions

Slide 21

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Mirror Neurons in Humans

- Responds to observation, action and imitation
- Maximum during imitation

Slide 22

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Action, Hearing and Vision

- Sound cues are very important
 - Gymnasts
- McGurk Effect
 - Different perception based on
 - Only speech
 - Both vision and speech