

PERCEIVING MOVEMENT

Visual Perception

Ways to create movement

- Perception
- More than one ways to create the sense of movement
 - Real movement is only one of them

Important for survival

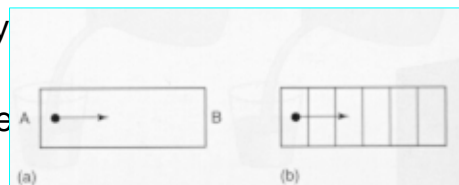
- Animals become still when they sense danger
 - They will be detected if they move
- Many animals have poor depth perception (pigeon) and color vision (cats and dogs)
 - None lack the ability to perceive movement
- Important for survival
 - Motion agnosia
 - Can't even pour tea, follow conversations

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Real Movement

- Movement is not the only criteria for detecting
- Movement detected if the object covers about $1/6$ degree of visual angle per second
- Changes to $1/60$ degree per second with the addition of the bars



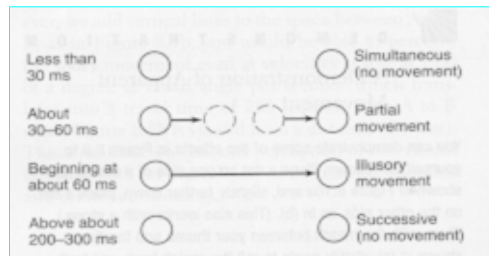
Not only on moving stimulus,
but also on surroundings.

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Apparent Movement

- Inter-stimulus Interval
- Inter-stimulus spacing
- Intensity
- Illusion
 - Perceive movement when it is not there



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Induced Movement

- Motion of one object induced by movement of another
 - Moon racing through clouds on a windy day
 - Sitting in the car and the adjacent car moves out

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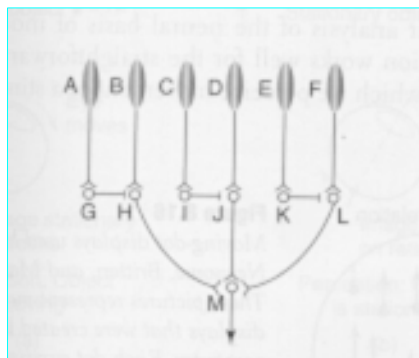
Movement Aftereffect

- Waterfall illusion
- Spiral motion illusion

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Direction specific Movement Perception by Feature Detectors



Directionally Selective Neural Circuit

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MT is important for motion

- Lesion in this region impairs ability to detect direction of motion
- 90% of the neurons are directionally selective
- Stimulating neurons with very small signals makes the monkey sensitive to that particular direction

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Further Up in the MT

- Experiment with the monkey
 - VERY close relationship between MT neurons firing and monkey's behavior
 - Increased with increase in correlation
- May be the sole neurons that are responsible
- Very few neurons in a small region
- May be approaching specificity coding

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Is movement of the image sufficient?

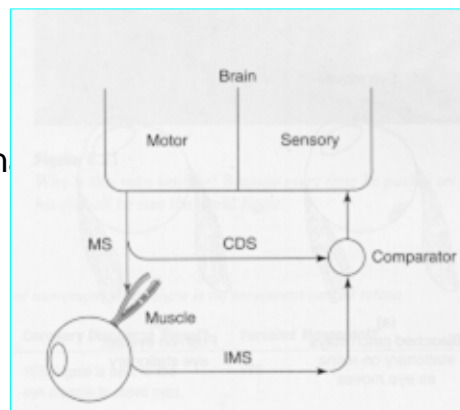
- Perception does not depend only on image on the retina
- How do we track moving objects?
 - Image stays at the same retinal location
- How do we see stationary scenes as stationary?
 - Eye moves
 - Retinal image moves

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Corollary Discharge Theory

- Movement perception depends on
 - Corollary discharge signal
 - Image movement signal
 - Comparator circuit
 - Exclusive OR



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Testing the Theory

- Movement of afterimage in the dark room
 - By moving your eye (afterimage is always at same location in the retina)
- Moving the eyeball
- Following a flying bird
- Physiological evidence
 - Real movement cells

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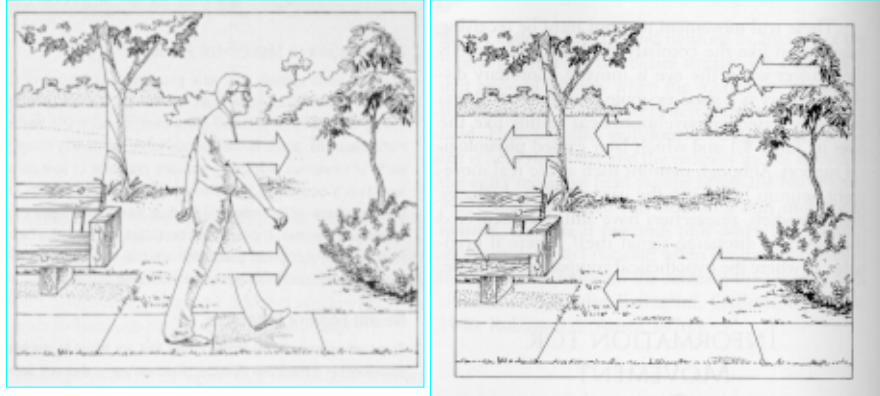
Optic Array

- How things move relative to one another
- Optic Array : Structure created by the whole scene, its color and textures
- Local change in optic array
 - Object moves relative to other
 - Covering and uncovering stationary background
 - Even for a moving object, the background content on retina changes
- Global change
 - Observer is moving

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Optic Array



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Perceptual Organization

- Law of Common Fate
 - Perceiving a camouflaged bird



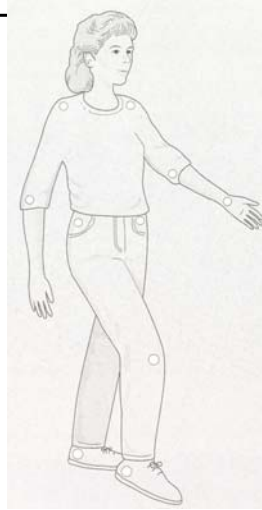
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Perceptual Organization

- Point-light walkers

- Movement helps detect a person



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Perceptual Organization

- Kinetic depth effect

- Moving of 2D object shadow perceived as a 3D object
- Motion can create the sense of depth on 2D surface

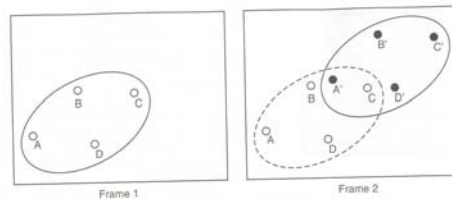
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Perceptual Organization

- Motion capture

- Elements contained in a figure tend to move with the figure



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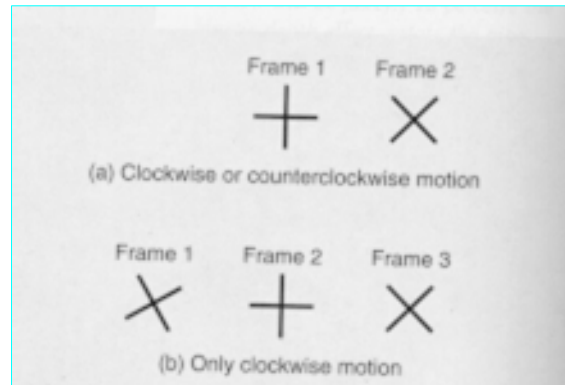
Role of Intelligence

- Movement perception depends on smallest change
- Occlusion
- Meaning
 - Face rotation experiment
 - Shortest path constraint
 - Special sensitivity to human form

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Movement in same direction

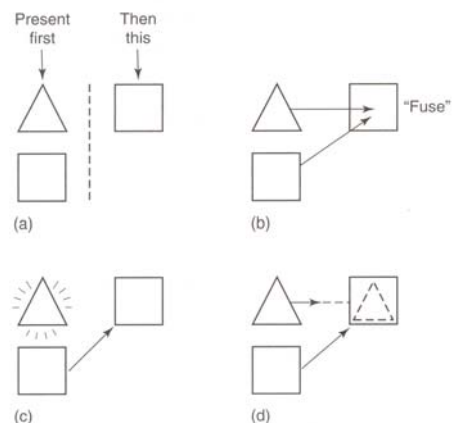


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Occlusion

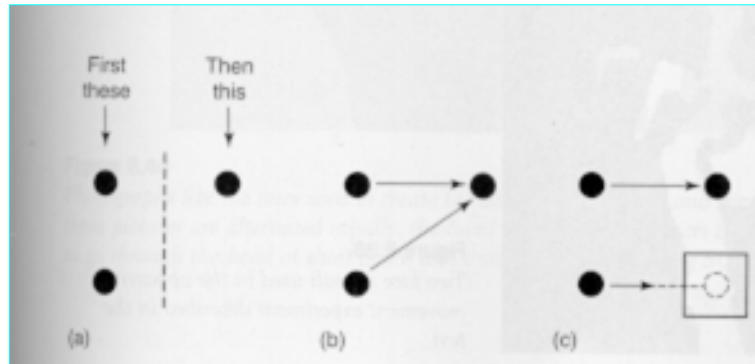
- Moving object will cover and uncover background
- When background is covered it still exists



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Occlusion



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Meaning



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Knowledge and Processing Time



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