

Subjectivity of Perception

- We do not perceive the world directly
- Perception depends on brain stimulation
- Distinction between sensation and perception

Sensation vs. Perception

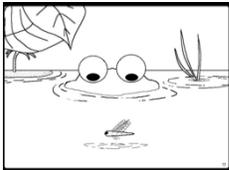
- **Sensation:** Involves the stimulation of sensory organs
- **Perception:** Involves the processing and interpreting of sensory input

Overview

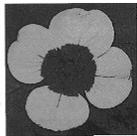
- Sensing the World: Basic Principles
- Vision
 - Structure
 - Information Processing: Retina
 - Information Processing: Brain
 - Sensory Adaptation
- Auditory sensation and perception

Sensing the World

- Sensory systems have developed to enable organisms to obtain needed information



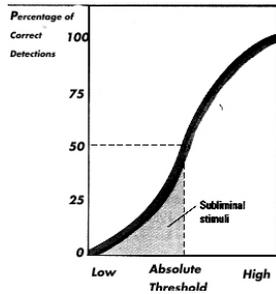
Human Eye



Bee's Eye

Absolute threshold

- **Absolute threshold:** the minimum stimulation necessary to detect a particular stimulus
- Strength needed for detection 50% of the time
- Thresholds vary



Subliminal Stimulation

- Present sub-threshold stimuli
 - Attempt to influence behavior
- Questions
 - Awareness of subliminal stimuli?
 - Effects of subliminal stimuli?

Subliminal Stimulation: History

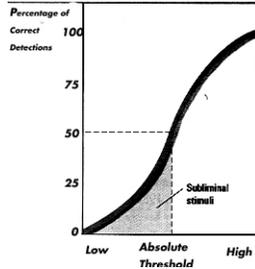
- First time controversy – 1956
 - Movie audiences exposed to the messages “Drink Coca-Cola” and “Eat Popcorn”
- Advertisers manipulating consumers
 - “Sex” printed on crackers
 - Erotic images in liquor ads
 - Rock music
- Self-help tapes

Subliminal

- Two assumptions of subliminal persuasion
 1. We can unconsciously sense subliminal (below threshold) stimuli
 2. Without awareness, these stimuli can have extraordinary suggestive powers

Subliminal Persuasion

- Can we sense stimuli below our absolute threshold?
 - By definition – yes
- Can we be affected by stimuli too weak for us to EVER notice?
 - Yes, but only under special conditions

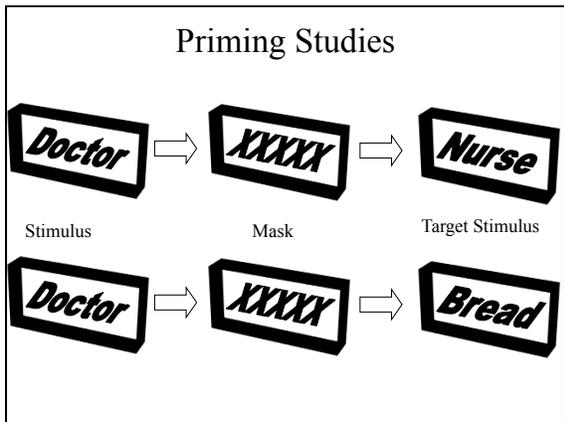


Krosnick, Betz, Jussim, & Lynn (1992)

- Demonstrated effect of subliminal stimuli on people's rating of faces
 1. Subliminally flashed emotional scenes
 - Positive: kittens, romantic couples, etc.
 - Negative: werewolves, dead bodies, etc.
 2. Showed male/female face
 3. Rate faces

Krosnick, Betz, Jussim, & Lynn (1992)

- Gave more positive ratings to people preceded by positive scenes
 - Implies that people look nicer if preceded by unperceived kittens
 - People look less nice when preceded by unperceived werewolves



Priming Studies

- Unperceived word affects how quickly people react to perceived word
- Semantically related
 - Doctor – Nurse
 - React more quickly
- Semantically unrelated
 - Doctor – Bread
 - React more slowly
- Short-lived effect

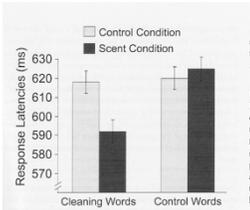
- Subtle, fleeting effect on thinking
- NO powerful, enduring effects on complex behavior
- Canadian Broadcasting Association
 - Subliminal messages during a popular Sunday night show
 - 500 responses
 - Many urges reported
 - TELEPHONE NOW
 - Increase in telephone use – none

Subliminal Stimuli
(Holland, Hendriks, & Aarts, 2005)

- Can odor influence cognition and behavior without awareness?
- Odor – Citrus scented all-purpose cleaner
 - Cleaner in a bucket of water outside participants' cubicle (1/2 participants)
- Are “cleaning” associations cued?

Subliminal Stimuli
(Holland, Hendriks, & Aarts, 2005)

- Participants engaged in a lexical decision task
 - 20 words
 - 6/20 cleaning related words (“cleaning”, “hygiene”)
 - 20 non-words
- Responded faster to cleaning related words than other words



Subliminal Stimuli
(Holland, Hendriks, & Aarts, 2005)

- Participants described future home activities
- Listed 5 activities they were planning to do during the rest of the day
- Cleaner scent resulted in more cleaning related activities listed

Subliminal Stimuli
(Holland, Hendriks, & Aarts, 2005)

- Effects of scent on cleaning related behavior
- Filled out questionnaire in cubicle
- Moved to another room and given a cookie to eat
- Participants exposed to scent cleaned crumbs more often

Subliminal Stimuli

- Nonconsciously activated information
 - Can guide behavior
- Awareness of behavior source is not necessary for engaging in behavior
- Behavior becomes congruent with activated semantic associations

Difference Thresholds

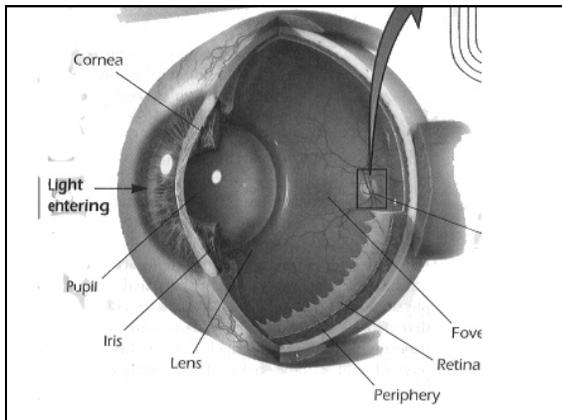
- Just Noticeable Difference (JND)
 - Minimum difference detected 50% of the time
- Increases with stimulus magnitude
- Weber's law
 - Constant proportion of change
 - Varies depending on the stimulus

Weber Fractions

Type of Stimulus	Weber Fraction
Electric Shock	.01 Difference
Heaviness	.02 Difference
Length	.03 Difference
Vibration (fingertip)	.04 Difference
Loudness	.05 Difference
Odor	.05 Difference
Brightness	.08 Difference
Taste (salt)	.20 Difference

Sensory Adaptation

- Diminishing sensitivity to an unchanging stimulus
 - Nerve cells fire less frequently
 - Stimuli perceived as less intense
- Attend to informative changes in our environment
- Our sensory systems are alert to novelty

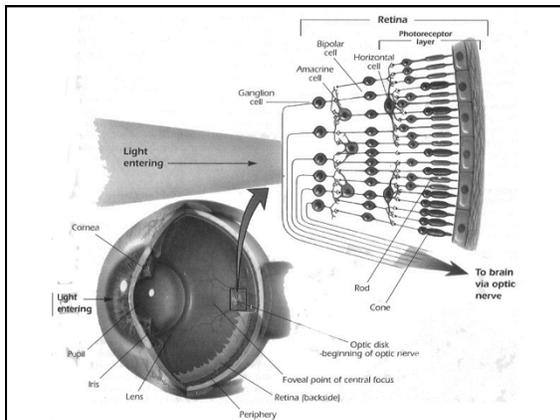


Retina: Inverted Images

- Retina receives an inverted image
 - Baffled scholars for years
- Proposed explanations
 - Lens was sensing device
 - Eye's fluids re-inverted image
- Actual explanation
 - Retina only partially processes image

Retina

- Part of the Central Nervous System
 - Retinal cells can not be regenerated
- The eye as a window
 - Can be used to look inside the body
 - Allows viewing without surgery



Rods & Cones

- Sensitive to light
- Located at innermost layer of retina
 - Receive only 10% of light entering the cornea
- Rods outnumber cones
 - 125 to 6.4 million

Cones

- Do not respond well in dim light
- Provide better visual acuity than rods
- Concentrated most heavily in the center of the retina

Fovea

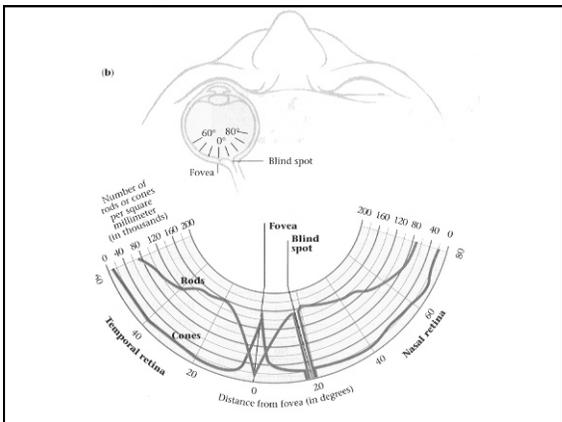
- Center of retina
- Contains only cones
- Visual acuity greatest at this spot
- One-to one mapping between cones and bipolar cells

Rods

- No one-to-one mapping with bipolar cells
 - Signals combined on the way to the brain
- Consequences of many-to-one mapping
 - Poor with detail
 - More sensitive

Rods

- Sensitive to light
 - Dazzled by bright light
 - Work well in dim light
- Density greatest just outside fovea
- Enable black and white vision

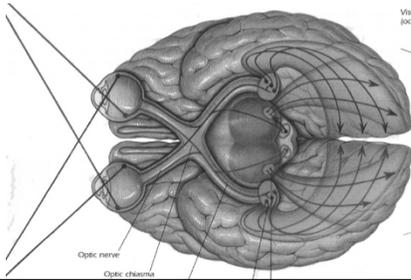


Optic Nerve

- Rods/cones to bipolar cells
- Bipolar to ganglion
- Ganglion axons converge to form optic nerve
- Leaves eye through optic disk
 - Blind spot

Divergence

- **Main pathway:** Thalamus to visual cortex
- **Secondary pathway:** Superior colliculus to thalamus to visual cortex



Two Pathway System

- Different types of visual input extracted in each pathway
 - Occurs in parallel
- Main Pathway
 - Perception of form, color, contrast, brightness and depth
- Secondary Pathway
 - Localization of objects in space
 - Coordination of visual input with other sensory input

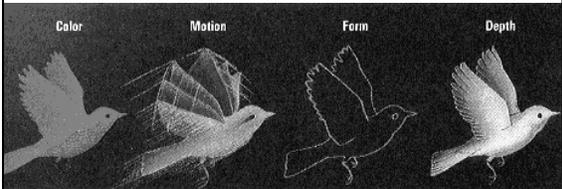
Main Pathway Lesions

- Impair only certain aspects of visual stimuli
 - Perception of other aspects remains intact
- Sometimes lesions cause visual field deficits
 - Visual field associated with damaged cells cease to exist for those afflicted

Blind sight

- No conscious perception of visual images
- Responses to those visual images remains above chance
 - Reaching for object, naming object, forced choice tasks
- 10% of visual information travels secondary pathway
 - Receives processing in superior colliculus

- Visual pattern recognition requires tremendous brain power
 - 30% of cortex
 - 10 times the area devoted to auditory processing
- Manner in which each aspect of visual stimuli is integrated into a single perception is still unknown



The image shows four birds in flight against a black background, each illustrating a different aspect of visual processing. From left to right: 1. 'Color': A bird with a white body and a grey wing. 2. 'Motion': A bird with a white body and a grey wing, with a semi-transparent, overlapping version of itself behind it to suggest movement. 3. 'Form': A bird with a white body and a grey wing, with a semi-transparent, overlapping version of itself behind it to suggest shape or form. 4. 'Depth': A bird with a white body and a grey wing, with a semi-transparent, overlapping version of itself behind it to suggest depth or perspective.

Feature Detection

- Visual input appears to be processed in terms of features
- Hubel & Wiesel (1962)
 - Examining receptive fields in cat cortex
 - Accidentally discovered cortical cells respond to lines of different orientations
 - Resulted in Nobel prize in 1981

Layering in Visual Cortex

- Visual cortex organized into layers
- Each layer responds to different types of stimuli
 - Simple cells
 - Complex cells

Simple Cells

- Respond most vigorously to lines and edges
- Very selective
 - Light must fall in a particular area of the retina
 - Line must be in the correct orientation
- Different cells respond to lines of differing orientations

Complex Cells

- Respond to more complex stimuli
 - Moving lines
 - Lines moving in a specific direction
 - Lines moving in either direction
 - End stopped cells
 - Respond most vigorously when stimulus ends in cells receptive field
 - Good for detecting corners and edges

Cortical Architecture

- Primary visual cortex is arranged in a series of columns
- Cells within a column respond to stimuli of same orientation
- Neighboring column has cells that respond to lines differing by 10 degrees

Sensory Adaptation (revisited)

- Ultimate basis of vision is the action potential
- Constant neural stimulation causes fatigue
 - Rate of firing slows
 - Appears as if stimuli is less strong or nonexistent
