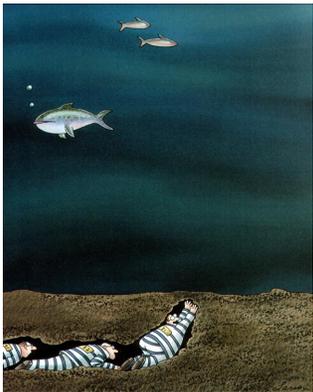


Chapter 4:  
Sensation &  
Perception



"We're almost free, everyone! I just felt a drop of rain!"

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### Sensation vs. Perception

- **Sensation** – the detection of physical energy by the sense organs
- **Perception** – the brain's sorting out, interpretation, and analysis of raw sensory inputs (**stimulus**)
- **Psychophysics** – study of relationship between the physical aspects of stimuli and our experience of them

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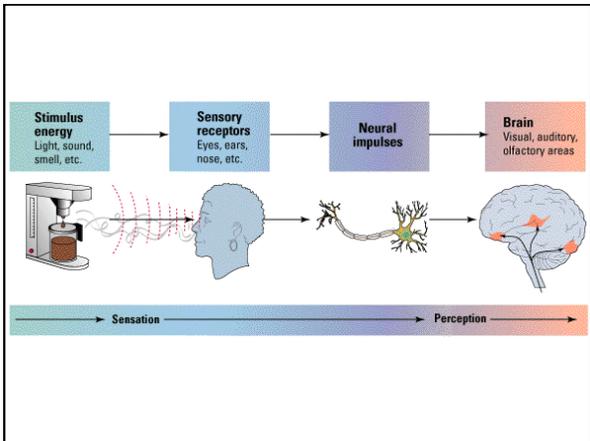
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### Transduction

- What takes place when many sensors in the body convert physical signals from the environment into encoded neural signals sent to the central nervous system

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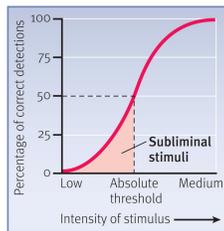
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### Detecting What's Out There

- **Absolute threshold** - smallest stimulus energy needed for the nervous system to detect
- Human error increases as stimuli get weaker



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### Noticing Distinctions

- **Just noticeable difference** - smallest change in intensity of a stimulus that we can detect 50% of the time
  - Weber's law – states that a JND is in constant proportion to the intensity of a stimulus
  - E.g., the stronger the stimuli, the bigger change needed to be detectable

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### Turning Down our Responses

- **Adaptation**
  - An adjustment in sensory capacity after prolonged exposure to unchanging stimuli
- Going from a dark theater to outside during the daylight
- Someone lets a really smelly fart in a car
- Our receptors *cannot* constantly fire messages to the brain

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### Illuminating the Structure of the Eye

- Cornea
  - Protects eye and refracts light
- Pupil
  - Opening depends on amount of light in environment
- Iris
  - Colored part of eye
- Lens
  - Accommodation

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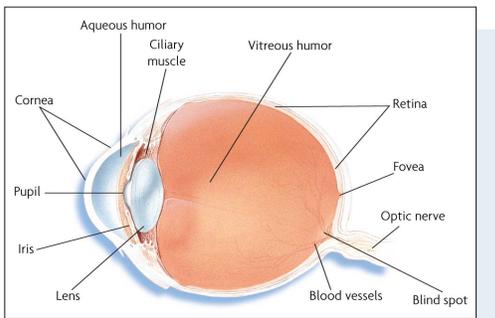
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### Illuminating the Structure of the Eye

- Reaching the Retina
  - Light is converted to electrical impulses for transmission to the brain
    - Rods
      - Receptor cells sensitive to light
    - Cones
      - Cone-shaped, responsible for sharp focus and color perception
      - Concentrated in the fovea

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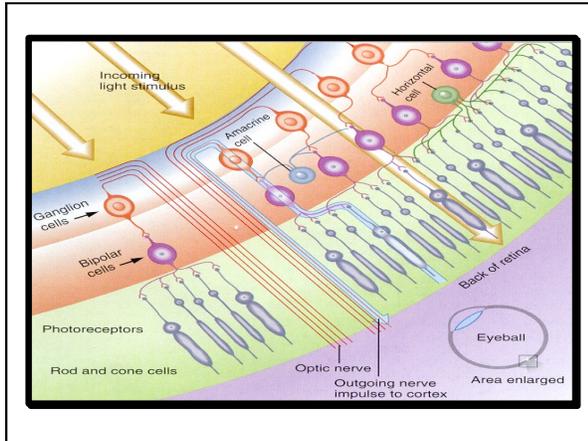
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### Illuminating the Structure of the Eye

- Sending the Message from the Eye to the Brain
  - Optic nerve
  - Ganglion cells
  - Blind spot
    - Optic chiasm

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### Processing the Visual Message

- Takes place in the visual cortex of the brain
- Feature detection
  - Neurons in the VC are extraordinarily specialized
  - Some respond to certain orientations of lines, some to widths, some by moving stimuli

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### Explaining Color Vision

- Trichromatic theory of color vision
  - Suggests that there are three kinds of cones in the retina
    - Blue-violet colors
    - Green colors
    - Yellow-red colors
  - Not successful at explaining afterimages

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### Explaining Color Vision

- Opponent-process theory of color vision
  - Receptor cells for color are linked in pairs, working in opposition to each other
  - Explains afterimages via fatigue of cells
- Both theories are at work, but in different parts of visual system
  - Trichromatic in retina
  - OP in retina *and* neuronal process

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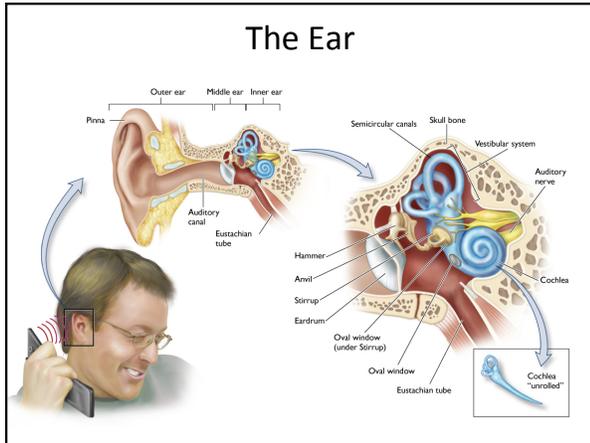
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### Sensing Sound

- Sound
  - Movement of air molecules brought about by a source of vibration
- Eardrum
  - Vibrates when sound waves hit it
  - Middle ear (hammer, anvil, stirrup) acts as amplifier

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### Sensing Sound

- Inner Ear
  - Changes sound vibrations into a form in which they can be transmitted to the brain via...
- Cochlea
  - Filled with fluid and vibrates in response to sound
- Basilar membrane
  - Dividing cochlea into an upper chamber and lower chamber
  - Covered with *hair cells*

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### The Physical Aspects of Sound

- Frequency
  - Number of wave cycles that occur in a second
    - Pitch
- Amplitude
  - Spread between the up-and-down peaks and valleys of air pressure in a sound wave as it travels through the air
    - Decibels

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### Sorting Out Theories of Sound

- Place Theory of Hearing
  - States that different areas of the basilar membrane respond to different frequencies
- Frequency Theory of Hearing
  - Suggests that the entire basilar membrane acts like a microphone, vibrating as a whole in response to a sound

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### Balance: The Ups and Downs of Life

- Semicircular canals
  - Three tubes containing fluid that sloshes through them when the head moves, signaling rotational or angular movement to the brain
- Otoliths
  - Sense forward, backward, or up-and-down motion, as well as the pull of gravity

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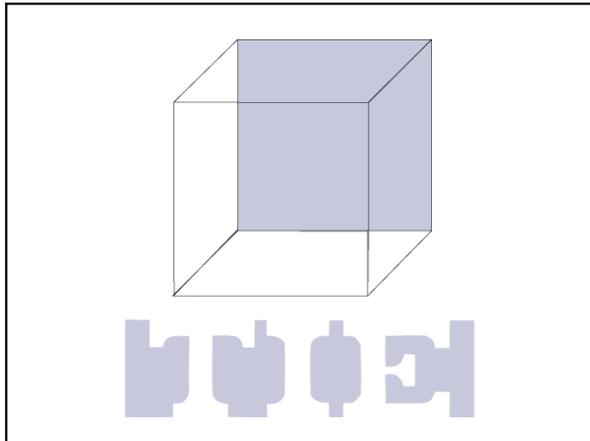
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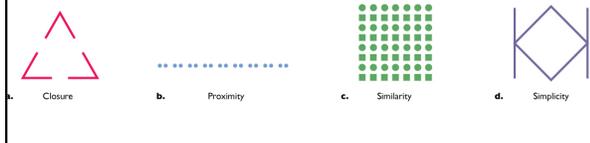
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### The Gestalt Laws of Organization

- Series of principles that focus on the ways we organize bits and pieces of information into meaningful wholes



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### Top-Down and Bottom-Up Processing

- Top-Down Processing
  - Perception is guided by higher-level knowledge, experience, expectations, and motivations
- Bottom-Up Processing
  - Consists of the progression of recognizing and processing information from individual components of a stimuli and moving to the perception of the whole

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TOP-DOWN PROCESSING

**A B C D E F**  

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**10 11 12 13 14**

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BOTTOM-UP PROCESSING



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Perceptual Constancy

- Phenomenon in which physical objects are perceived as unvarying and consistent despite changes in their appearance or in the physical environment

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### Shape Constancy



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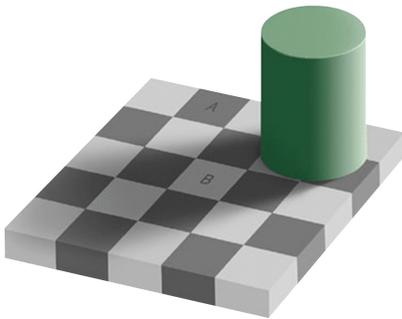
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### Color Constancy



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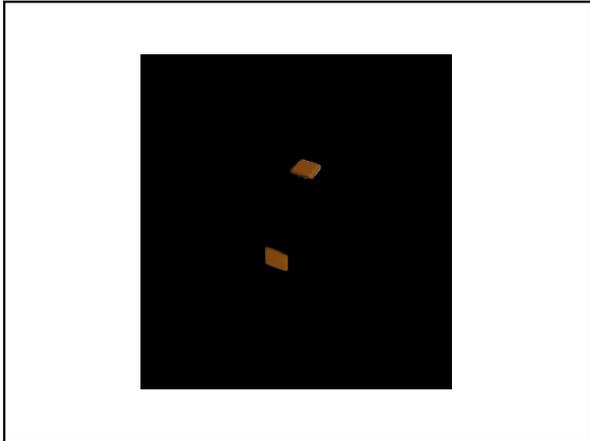
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Color Perception Derives from Context

Blue Red Yellow Red

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### Depth Perception

- Ability to view the world in three dimensions and to perceive distance
  - Largely due to the fact that we have two eyes
    - Binocular disparity
    - Monocular cues
      - Motion parallax
      - Linear perspective

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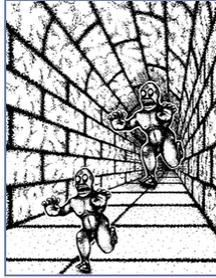
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### Relative Size



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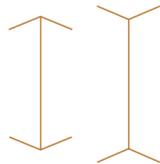
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### Perceptual Illusions

- Visual Illusions
  - Physical stimuli that consistently produce errors in perception
    - Muller-Lyer illusion



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### Subliminal Perception

- Perception of messages about which we have no awareness
  - Called *priming*
    - Written word
    - Sound
    - Smell

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### Extrasensory Perception (ESP)

- Perceiving events outside of typical sensory channels of seeing, hearing, touch
  - 41% of Americans believe in it, 66% say they've had an ESP experience
- Three major types:
  1. Precognition - predicting events
  2. Telepathy - reading minds
  3. Clairvoyance - detecting hidden objects or people

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### Scientific Evidence for ESP

- **Zener Card Studies** - subjects scored better than chance performance on precognition, telepathy and clairvoyance, but:
  - Not replicable
  - Methodology flaws (see-through cards)
- **Ganzfeld technique** - experimental setup to reduce background noise and increase sensitivity to ESP
  - Not replicable
- Parapsychologist terms for explaining away negative scientific findings: experimenter effect, decline effect, psi missing

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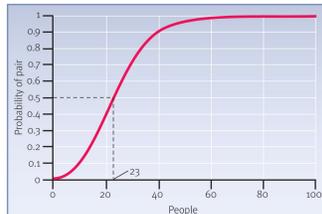
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### Why does anyone believe in ESP?

- **Fallacy of positive instances** - we focus on events that appear to be amazing coincidences and forget those that don't
- Underestimation coincidences




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Tricks of the "Psychics"

- **Failed psychic predictions** - people forget these
- **Multiple end points** - open-ended predictions
- **Cold reading** - a set of skills to persuade strangers that we know all about them

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