Chapter 3

Sensation & Perception
What do you see?
WHAT DO YOU SEE?

A cube with a chunk out or a box in a corner?

Half empty or half full?

A hidden word?

Young girl or old witch?
Sensation

• Sensation —
  – When receptors in the sense organs are activated, allowing various forms of outside stimuli to become neural signals in the brain.

• Synesthesia —
  – Disorder where signals from sensory organs are processed in the wrong cortical areas, resulting in the sense information being interpreted as more than one sensation
    • Sensory crossover
      – Color purple smells like a rose
      – Aroma of cinnamon feels like velvet
      – Like effects of hallucinogens
Our Senses

- Doctrine of specific nerve energies –
  - How we interpreter different messages / impulses; encoding
  - Code - Anatomical
  - Different sensory modalities exist because signals received by the sense organs stimulate different nerve pathways leading to different areas of the brain
  - See with brain not eyes; hear with brain not ears
Measuring Senses

- **Absolute Threshold**
  - Lowest level of stimulation that can be consciously detected 50% of the time.

- **Difference Threshold or Just Noticeable Difference**
  - Smallest difference between two stimuli that can be detected 50% of the time.

"And only you can hear this whistle?"
Examples of Absolute Threshold

• Sight – A candle flame at 30 miles on clear, dark night
• Hearing – The tick of a watch 20 feet away in a quiet room
• Smell – 1 drop of perfume diffused throughout a 3 room apt.
• Taste - 1 teaspoon of sugar in 2 gallons of water
• Touch - A bee’s wing falling on the cheek from 1 cm above
Sensation

**Sensory Adaptation**
- The tendency for sensory receptors cells to become less responsiveness to stimulation that is unchanging or repetitious
  - Receptor cells become less responsive
  - Keep us from responding to unimportant information
    - Taste – sour candy almost toooo sour at first
    - Smell - no longer smell gas leak
    - Jump into a cold pond, then not seem soooo cold

**Habituation**
- Tendency for brain to stop attending to constant, unchanging info.
  - Receptor cells sensing; just not pay attention to information
  - Not hear sound of air conditioner until it cycles down or off
Sensory Adaptation
Quiz

1) The smallest difference between 2 stimuli that can be detected 50 % of the time is called__________.
   a) Absolute threshold c) Sensation
   b) Just noticeable difference d) Sensory adaptation

2) When receptor cells for the senses are activated, the process of ___________ has occurred.
   a) Perception c) Adaptation
   b) Sublimation d) Sensation

3) You have a piece of candy in your mouth. After a while, the candy doesn’t taste as strong as it did when you first tasted it.
   a) Sensory adaptation c) Habituation
   b) Sublimation d) Perceptual defense

4) While driving, looking for a new restaurant, not hearing the clicking of the turn signal you forgot to turn off is likely due to:
   a) Accommodation c) Sublimation
   b) Adaptation d) Habituation
Sensing Without Perceiving

• Selective attention
  – Focus on some things; block out others
  – When on overload; fatigued
  – “Cocktail party phenomena”
  – Hear your name in a crowd

• Intentional blindness
  – Fail to consciously perceive something because you aren't attending to it.
  – Look but do not see
    • Pro: protect from overload
    • Con: bad if talk on cell – not see car
The EYE

- Cornea
- Pupil
- Iris
- Lens
- Light
- Retinal blood vessels
- Fovea
- Optic nerve
- Retina
- Optic disk (blind spot)
The Eye

- **Cornea** – bends light waves so the wave can be focused on the retina
- **Pupil** – Opening that changes size depending on amount of light
- **Lens** – changes shape to bring objects into focus
- **Retina** – Visual receptors; neural tissue back of eyeball’s interior; upside down
  - **Rods** – Visual receptors that respond to dim light; non color; cat at night
  - **Cones** – Visual receptors involved in color vision and sharpness of vision
- **Iris** – color of eye; muscles control the size of the pupil
- **Optic nerve** – sends visual information to the brain
How We See Things

1) Light enters through cornea and pupil
2) Iris controls the size of the pupil
3) Light passes through the lens to the retina
4) Retina transforms into nerve impulses
5) Nerve impulses travel to the brain along optic nerve
Vision

• 3 physical characteristics of vision

  1) Hue-

     • visual experience
     • related to color names & wave length

  2) Brightness

     • Lightness or luminance
     • Related to amount of intensity of light
       • emitted
       • reflected

  3) Saturation

     • Vividness or purity of color
     • Related to complexity of light waves
Why We See Color

• **Trichromatic Theory**
  – Three mechanisms in visual system;
  • Three basic types of cone; Blue Green Red

• **Opponent-process theory**
  – Visual system treats pairs of colors as opposing or antagonistic
  – Visual neurons are stimulated by light of one color and inhibited by light of another color
Color Blindness

- Color blindness;
  - Black White Grey

- Color deficient
  - Unable to distinguish red and green
  - Rare; not see blue and yellow
  - 8% Caucasian men; rare in women
Feature Detector

- Facial recognition - Evolutionary ability to distinguish friend from foe, or infants mother from stranger.
Quiz

1) Which statement about color deficient vision is TRUE?
   a) There are more men with color deficient vision than women
   b) All people with color deficient vision see only in black and white
   c) Some people with color deficient vision see only in blue
   d) Some people with color deficient vision see only in blue and red.

2) Non color visual receptors are associated with ____ while color visual receptors are associated with______
   a) Rods ancones       b) Saturation and brightness
   c) Cones and rods     d) Brightness and saturation

3) Which one is NOT part of the three characteristics of vision?
   a) Color            c) Brightness
   b) Hue              d) Saturation

4) Which represents the correct path of light through the eye?
   a) Iris, cornea, lens, retina
   b) Cornea, iris, lens, retina
   c) Cornea, pupil, lens, retina
   d) Cornea, lens, pupil, iris, retina.
The Ear

FIGURE 6.10 Major Structures of the Ear

Sound waves collected by the outer ear are channeled down the auditory canal, causing the eardrum to vibrate. These vibrations are then passed along to the tiny bones of the middle ear. Movement of these bones intensifies the force of the vibrations separating the middle and inner ear. The receptor cells for hearing (hair cells), located in the organ of Corti (not shown) within the snail-shaped cochlea, initiate nerve impulses that travel along the auditory nerve to the brain.
The Ear

• Outer Ear –
  – Pinna – visible part of the ear
  – Auditory canal – tunnel from pinna to eardrum

• Middle Ear
  • Hammer, Anvil and Stirrup

• Inner Ear
  – Organ of Corti- organ of hearing
  – Cochlea- snail shaped – fluid filled organ in inner ear
  – Basilar membrane – where cochlea are embedded
  – Auditory nerve- bundle of axons from the hair cells in inner ear; carries message to brain
  – Cilia - Hair cells
    • Hairs can break like blade of grass = damage to hearing
Cilia Damage
Hearing: audition

• What we hear – physical – sound wave
  – **Loudness** - *intensity* of a pressure wave
    • Decibel (dB) – 1/10th of a Bell – Alexander Graham Bell
    • Absolute threshold for humans = 0
  – **Pitch** – *frequency* of pressure wave; height or depth of tone
    • Frequency – how fast the air vibrates
    • Number of times per second
    • One cycle per second = 1herts (Hz)
    • Human – 16 Hz (lowest note on pipe organ) to 20,000 Hz (grasshopper's leg)
  – **Timbre** – distinguishing quality of sound; *complexity* of pressure wave
    • Several sound waves of varying sub-waves and frequencies
    • Noise – when sound wave frequencies are not in harmony
    • White noise – all frequencies of the sound spectrum
      – Sound machine to help sleep
Taste: Gustation

- Papillae - Knob-like elevations on the tongue – contain taste buds
- Taste buds - nests of taste receptor cells – inside buds
- 4 basic tastes + 1 new
  - Salty
  - Sour
  - Bitter
  - Sweet
  - “Umami“ - Japanese for delicious
- Flavor connected to smell of gasses released by food
- People who can’t detect taste have problem with smell not taste
Taste & Smell

- Turquoise – ID food with smell
- Gold – ID food without Smell

![Bar graph showing percent correct for various items](image)
Smell: olfaction

- Vapors enter nose
- Circulate through nasal cavity where smell receptors located
- Olfactory nerve- receptor’s axons – signal to brain’s olfactory bulb
Sense of the Skin

- **4 basic skin senses**
  - Touch (pressure)
  - Warmth
  - Cold
  - Pain

**Pain**

- **Gate-control theory** – pain depends in part on whether pain impulse get past a neurological “gate” in spinal cord & brain
  - Brain controls gate
  - Talk about it; focus on it = make worse
  - Distracted from pain = more endurance
- **Phantom Pain** – pain in a missing limb or other body part
  - No nerve impulses
  - Input from spinal cord + signals from brain + memories + emotion + expectation + attention = PAIN
- **Gender and Pain** – females feel pain more intensely
The Environment Within

• Kinesthesia - sense of body position & movement

• Equilibrium – sense of balance

• Semicircular canals – sense organ in inner ear – fluid filled equilibrium; rotation of head
Quiz

1) What dimensions of hearing correspond to the intensity, frequency & complexity of the sound wave?

2) An extremely loud or sustained noise can permanently damage the ____ of the ear?

3) Which are closely associated?
   a) Sight and sound   c) Taste and smell
   b) Taste and sound   d) Sight and touch

4) Which is NOT associated with pain theories?
   a) Gate Control Theory
   b) Gender differences between levels of intensity
   c) Release of endorphins
   d) Kinesthetic sense
Perception
Constructing the Visual World

• Form perception
  – Know where one thing begins and another ends
    • Vision: desk within room
    • Taste: marshmallow from chocolate
    • Sound: guitar solo from drums

• Gestalt principles
  – “configuration” or “form”
  – “the whole is more than the sum of the parts”
  – Figure and Ground
    • Figure stands out
    • Geese, fish or salamander
  – Brain’s organization of sensory information
    • Useful patterns and meaningful units
Gestalt Principles

1) Proximity – things close together grouped together
   • Left = 3 groups of dots; Right = vertical columns of dots not horizontal rows

2) Closure – brain “fills the gaps”

3) Similarity – things alike are perceived as being together
   • Left = see X; Right = see horizontal bars rather than vertical columns

4) Continuity – lines & patterns perceived as continuing…..
   • Left = see oval on top of line; Right = curved line with straight
Constructing the Visual World

• Depth and Distance Perception – where it is

• **Depth perception** – ability to perceive the world in 3D
  
  – **Binocular cues**– cues to depth or distance; 2 eyes; 50 ft
    • Binocular disparity – difference in images between both eyes

  – **Monocular cues** – visual cues to depth or distance; 1 eye; 50+ feet
    • Linear perspective – 2 parallel lines appear to come together or converge
      – Train track = distance seem to come together
    • Relative size- smaller seems farther
Visual Constancies

1) Shape Constancy
   • Frisbee – round yet on table seems eclipse; KNOW = Round

2) Location Constancy
   • Telephone pole “fly by” as we drive; KNOW = stay there

3) Size Constancy
   • Friend not growing as come closer; car not shrinking as leaving

4) Brightness Constancy
   • Snow still white even in darkness

5) Color Constancy
   • Indoor = more yellow;
   • Outdoor = more blue: KNOW = same color
I have no sense of depth perception. Could you tell me—is that someone standing way up there on the corner, or is there a little man in your hair?
The Hermann Grid
Visual Illusions

(a) 

(b) 

(c)
Visual Illusions

• Mueller-Lyer – brain follows rule – so can be fooled
  – Two objects produce the same sized retinal image
  – If one is farther away the farther is larger

• Joseph Albers – color in context
Perception

- **Perceptual Set** – the tendency to perceive things a certain way because previous experiences or exceptions influence these perceptions.
Perception

- **Bottom up processing**: analyze small features to build up to complete
Puzzles of Perception

• **Subliminal perception**
  – Perceiving without awareness
  – Respond below threshold
  – Priming – measure unconscious cognitive process
    • Person exposed to info & later tested
    • Does it influence another task or situation = YES -
      – Honesty flashed then attributed to picture of person
  – Old marketing “Eat Popcorn” “Drink Coke”
  – Subliminal tapes on self esteem / motivation
    • Placebo tapes worked just as well
E.S.P. Institute

"What do you mean you didn't know that we were having a pop quiz today?"
Puzzles of Perception

• Extrasensory Perception
  – Evidence or coincidence?
  – What would it take for you to believe?
Quiz

1) The tendency to perceive a quarter as being round even when it is viewed as an angle is called.
   a) Size constancy   c) Brightness constancy
   b) Shape constancy   d) Color constancy

2) Ned found a decaying carcass lying on the beach. Looking at the size of it he decided that it was like the Loc Ness monster. Ned likes to read about mythical animal. We might expect that he has made an error of perception due to:
   a) Perceptual set   c) Bottom-up processing
   b) Perceptual defense   d) Cognitive convergence

3) The tendency to perceive objects that are close to one another as part of the same group is called.
   a) Size constancy   c) Brightness constancy
   b) Shape constancy   d) Proximity constancy