Chapter 6

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?
Our Senses

• Sensation —
  – detection of physical energy emitted or reflected by physical objects;
  – it occurs environment or the body stimulates when energy in the eternal receptors in the sense organs.

• Sense organs –
  – eyes, ears, tongue, nose, skin & internal body tissue

• Sensory process –
  – See, hear, taste, hear and feel

• Perception —
  – The process by brain organizing and interpreting sensory information.
  – See 2 dimensional; perceive 3 dimensional

• Sensation and Perception – foundation for learning, thinking and acting
Our Senses

• **Sense receptors** -
  – Specialized cells that convert physical energy in the environment or the body to electrical energy that can be transmitted as nerve impulses to the brain.
  – Located in the sense organs
  – Receptors for smell, pressure, pain and temperature are extensions (dendrites) of sensory neurons.
  – “military scouts” search and scan; send info to “field officer’s” sensory neurons
  – Field officers send to “generals” who analyze the reports.
  – Combined information from scouts; decide what it all means.
  – Generals report to command center – the brain

• Scout – Sense Receptors
• Field officer – Sensory neurons
• General at Command Center – Cells of brain
• All communication – neural impulses
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

• **Synesthesia** –
  – Stimulation of one sense stimulates another
  – Sensory crossover
    • Color purple smells like a rose
    • Aroma of cinnamon feels like velvet
  – Like effects of hallucinogens

• **Codes**
  – Anatomical – like doctrine of specific nerve energies
  – Functional- “Morris code”
    • receptors and neurons fire or don’t depending on specific stimuli
    • Which fire, how many fire, pattern and rate of firing
Measuring Senses

• Absolute Threshold
  – Smallest quantity of physical energy, reliably detected by observer
    • Notice flash or not
    • On a clear night not be able to see the stars with the naked eye

• Difference Threshold
  – Smallest difference in stimulation, reliably detected when 2 stimuli compared
  – “just noticeable difference”
    • Compare weight of two block
    • Brightness of 2 lights

“And only you can hear this whistle?”
Measuring Senses

• Signal Detection Theory
  – Detection of sensory signal divided btw sensory process & decision process
  – Way to avoid response bias (absolute & difference threshold studies)
  – 4 types of answers
    • Detects signal – “hit”
    • Say there when not – “false alarm”
    • Fail to detect when signal present – “miss”
    • Correctly say no signal – ”correct rejection”

– Yea-sayers more hits than nay-sayers; more false
– Nay-sayers more correct rejections, more misses
– Mathematical formula predict correct responses

• Assumes no single threshold- sensitivity depends = person’s choice
  – Screening for jobs
    • Air traffic controllers
Sensory Adaptation

• Sensory Adaptation
  – Reduction or disappearance of sensory responsiveness when stimulation is unchanging or repetitious
    • Keep us from responding to unimportant information
      – Good: no longer feel shoes on feet
      – Bad: no longer smell gas leak
      – Jump into a cold pond, then not seem soooo cold

• Sensory Deprivation
  – Absence of normal level of sensory stimulation
    • Early research – unpleasant surroundings
      – 1st few hours - edgy
      – 1st day - disoriented
      – Longer - confused, restless & grouchy
      – Few stayed longer than 2 or 3 days
    • Later studies- pleasant surroundings
      – Enjoyed limited periods of deprivation
      – Some perceptual and intellectual abilities actually improved
      – Response depends on expectation and interpretation
        » Spa or monastery
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
Quick Quiz

1) Even on the clearest night, some stars cannot be seen by the naked eye because they are below the viewer’s ____________ threshold.

2) If you jump into a cold lake but moments later the water no longer seems so cold, sensory ______________ has occurred.

3) If you are immobilized in a hospital bed, with no roommate and no TV or radio, and you feel edgy and disoriented, you may be suffering the effects of ________________

4) During a break from your job in a restaurant, you are so engrossed in a book that you fail to notice the clattering of dishes or orders being called out to the cook. This is an example of ________________.

5) In real-life detection tasks, is it better to be a “nay-sayer” or a “yea-sayer”?
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
The Eye

- **Retina** - Visual receptors; neural tissue back of eyeball’s interior; upside down
- **Rods** - Visual receptors that respond to dim light; more sensitive to light; cat at night
- **Cones** - Visual receptors involved in color vision
- **Cornea** - Transparent; protect eye; bends light toward lens
- **Pupil** - Opening
  - More light – smaller; constricted, pinpointed
  - Less light – dilated, large
- **Iris** - Color; surrounds pupil; adjust amount of light into eye
- **Lens** - More or less curved to adjust for objects near or far
- **Fovea** - Center o
Feature Detector

• Facial recognition - Evolutionary ability to distinguish friend from foe, or infants mother from stranger.
Why We See Color

• **Trichromatic Theory**
  – Three mechanisms in visual system;
    Each sensitive to a certain range of wavelength;
    Their interaction is assumed to produce hues;
  – Three basic types of cone; Blue Green Red
  – 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

• **Opponent-process theory**
  – Visual system treats pairs of colors as opposing or antagonistic
  – Respond or inhibited by firing of wavelengths
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
  – Binocular cues – cues to depth or distance; 2 eyes; 50 feet
  – Convergence – eyes turn inward; focus near by object
    • Closer object = more convergence
  – Retinal disparity – slight difference in lateral separation between two objects as seen by right and left eyes
• Hold finger out 12 inches look using one eye at a time

– Monocular cues – visual cues to depth or distance; 1 eye; 50+ feet
  • Interposition – object between; 1st object will seem closer
  • Linear perspective – 2 parallel lines appear to come together or converge
    – Train track = distance seem to come together
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
Visual Illusions
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
Quick Quiz

1) How can 2 Gestalt principles help explain why you can make out the Big Dipper on a starry night.

2) True or False: Binocular cues help us locate objects that are very far away.

3) Hold one hand about 12 inches from your face & the other one about 6 inches away. A) Which hand will cast the smaller retinal image: B) Why don't you perceive that hand as smaller?

4) From an evolutionary point of view, people are most likely to have a mental module for recognition of A) flowers, B) bugs, C) faces, D) chocolate, E) cars.
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
The Ear

• Outer, middle & inner ear

• Ear drum - sound causes to vibrate

• Organ of Corti - organ of hearing
  – In the cochlea; hair cells that serve as receptors

• Cochlea - snail shaped – fluid filled organ in inner ear;
  – Contain Organ of Corti
  – Same job as retina for eye

• Cilia - Hair cells
  – Hairs can break like blade of grass = **damage to hearing**

• Basilar membrane – where Cochlea are embedded
  – Stretches across interior of cochlea

• Auditory nerve - carries message to brain
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.
Constructing the Auditory World

- Figure and Ground
  - **Figure**: most important; forefront
  - **Ground**: less important; background

So ....... Lecture is figure while rustling papers ground

- Gestalt Principles apply to hearing:
  - Proximity – notes in melody
  - Continuity – follow melody
  - Similarity – timbre and pitch hick out voices
  - Closure – help understand conversation on cell while breaking up
Quick Quiz

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

2) Fred has a nasal voice and Ted has a gravelly voice. Which psychological dimension of hearing describes the difference?

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

4) During lecture, a classmate draws your attention to a buzzing florescent light that you had not previously noticed. What will happen to your perception of figure and ground.
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 chart showing percent correct for various items]
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
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
Quick Quiz

1) April always has trouble tasting food, especially those with subtle flavors.

2) May, a rock musician does o hear as well as he used to.

3) June a chronic shoulder pain, though the injury that initially caused it seems to have healed (think gait – control theory).
Perceptual Powers

Inborn abilities

- Visual Cliff – at 6 months hesitate to crawl “over edge”; depth perception
Critical Period

• Critical Period – experiences within a crucial window of time without exposure; ability not developed or impaired

• Kittens raised in darkness
  – Exposed to only vertical or horizontal black & white stripes
  – After several months;
    • Kittens exposed only to vertical stripes seemed blind to horizontal
    • Kittens exposed only to horizontal stripes were blind to vertical
Psychological & Cultural Influences

1) Needs –
   • Interested in something; perceive it
   • Hungry – see every fast food on trip

2) Beliefs –
   • If believe in extraterrestrials; see round object = space ship

3) Emotions –
   • Small frightened child see robe perceive as ghost

4) Expectations –
   • Pervious experience affect how e perceive the world
   • Perceptual Set – habitual way of perceiving based on expectation
Quick Quiz

1) On the visual cliff, most 6 month old babies;
   a) Go right across because they cannot detect depth
   b) Cross even though they are afraid
   c) Will not cross because they can detect depth
   d) Cry or get bored

2) Newborns and infants;
   a) Have few perceptual abilities
   b) Need visual experiences during a critical period for vision to develop normally
   c) See as well as adults

3) “Have a nice ...” says Dewey but then he gets distracted and doesn’t finish the thought. Yet Clarence is sure he heard Dewey wish him a nice day. Why?
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
"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?