Chapter 1: Introduction to Perception
Why Study Perception?

• Future careers
  – Graduate school work in perception

• Medical applications
  – Devices to assist people with vision and hearing losses

• Understanding how you perceive the world
  – Language processing
  – Color vision
  – Depth perception
Stimuli (Steps 1 and 2)

- Stimulus
  - Environmental stimulus are all objects in the environment are available to the observer.
  - Observer selectively attends to objects.
  - Stimulus impinges on receptors resulting in internal representation.
• Principle of transformation
  – When the stimuli and responses created by stimuli are transformed, or changed, between the environmental stimuli and perception.
• The process
  – Sensory receptors are cells specialized to respond to environmental energy
  – Visual pigment is what reacts to light
  – Transduction occurs which changes environmental energy to nerve impulses
Rod and cone receptors (described in Chapter 2) line the back of the eye. They change light energy into electrical energy and influence what we perceive.
Neural Processing (Step 4)

- The process
  - Neural processing is the changes that occur as signals are transmitted through the maze of neurons.
  - Primary receiving area
    - Occipital lobe
    - Temporal lobe
    - Parietal lobe
Neural processing takes place in the interconnected circuits of neurons like the retina (above) and in much more complex circuits within the brain. Each sense sends signals to different areas of the brain.

**Neural Processing**
Behavioral Responses (Step 5-7)

• Experience and Action
  – Perception occurs as a conscious experience.
  – Recognition occurs when an object is placed in a category giving it meaning.
  – Action occurs when the perceiver initiates motor activity in response to recognition.
Figure 1-5 p8
Knowledge

• Knowledge is any information the perceiver brings to a situation.

• Bottom-up processing
  – Processing based on incoming stimuli from the environment
  – Also called data-based processing

• Top-down processing
  – Processing based on the perceiver’s previous knowledge (cognitive factors)
  – Also called knowledge-based processing
Figure 1-7 p9

(b) Existing knowledge (top down)

(a) Incoming data (bottom up)
Approaches to the Study of Perception

• Observing perceptual processes at different stages in the system:
  • Psychophysical approach (Psychophysics) - the stimulus-perception relationship
  • Physiological approach - the stimulus-physiology relationship
  • Physiological approach - the physiology and perception relationship
• These stages are interconnected and communicate with one another.
• Cognitive influences on perception.
People have a larger brain response when detecting horizontal stimuli than when detecting slanted stimuli.

People detect horizontal and vertical stimuli more easily than slanted stimuli (the oblique effect).

In ferrets, horizontal stimuli generate a larger brain response than slanted stimuli.
**Stimuli:** vertical, horizontal, slanted

Measure the relationship between stimuli (bars with different orientations) and physiological response (brain activity in ferret).

**Brain response:** Bigger to vertical and horizontal orientations
**Stimuli:** slanted and horizontal

**Perception:** Better detection of horizontal

**Brain response:** Bigger to horizontal
Measuring Perception

• Absolute threshold - smallest amount of energy needed to detect a stimulus
  – Method of limits
    • Stimuli of different intensities presented in ascending and descending order
    • Observer responds to whether she perceived the stimulus
    • Cross-over point is the threshold
<table>
<thead>
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<th>Intensity</th>
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</table>

Crossover values: 98.5, 99.5, 97.5

Threshold = Mean of crossovers = 98.5
Measuring Thresholds

• Absolute threshold (cont.)
  – Method of adjustment
  – Stimulus intensity is adjusted continuously until observer detects it
    • Repeated trials averaged for threshold
• Absolute threshold
  – Method of constant stimuli
    • Five to nine stimuli of different intensities are presented in random order
    • Multiple trials are presented
    • Threshold is the intensity that results in detection in 50% of trials.
Measuring Thresholds - continued

• Difference Threshold (DL) - smallest difference between two stimuli a person can detect
  – Same methods can be used as for absolute threshold
  – As magnitude of stimulus increases, so does DL
  – Weber’s Law explains this relationship
    • DL / S = K
Estimating Magnitude

- Magnitude estimation (scaling)
  - Stimuli are above threshold.
  - Observer is given a standard stimulus and a value for its intensity.
  - Observer compares the standard stimulus to test stimuli by assigning numbers relative to the standard.
### TABLE 1.1 Weber Fractions for a Number of Different Sensory Dimensions

<table>
<thead>
<tr>
<th>Sensory Dimension</th>
<th>Weber Fraction</th>
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<tbody>
<tr>
<td>Electric shock</td>
<td>0.01</td>
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<tr>
<td>Lifted weight</td>
<td>0.02</td>
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<tr>
<td>Sound intensity</td>
<td>0.04</td>
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<tr>
<td>Light intensity</td>
<td>0.08</td>
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<tr>
<td>Taste (salty)</td>
<td>0.08</td>
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</tbody>
</table>

Source: Teghtsoonian (1971).
Magnitude estimation (cont.)

- Response compression
  - As intensity increases, the perceived magnitude increases more slowly than the intensity.

- Response expansion
  - As intensity increases, the perceived magnitude increases more quickly than the intensity.
Figure 1

• Magnitude estimation (cont.)
  – Relationship between intensity and perceived magnitude is a power function
  – Steven’s Power Law
    • $P = KS^n$
Beyond Thresholds and Magnitudes

• Phenomenological method involves describe what they are perceiving or to indicate when a perception occurs

• Searching for stimuli
  – Visual search - observers look for one stimulus in a set of many stimuli
    • Reaction time (RT) - time from presentation of stimulus to observer’s response is measured
Threshold Measurements Can Be Influenced by How a Person Chooses to Respond

• There are differences in response criteria among participants
  – Liberal responder - responds yes if there is the slightest possibility of experiencing the stimulus

• Response criterion is a person’s individual response bias.

• Signal detection theory is used to take individual’s response criteria into account.
Figure 1-18 p16

The graph illustrates the relationship between light intensity and percent "yes" responses for two individuals, Julie and Regina.

- Julie's data points are represented by green dots.
- Regina's data points are represented by red dots.

The graph shows that as light intensity increases, the percent "yes" responses also increase. The points for Julie are closer to the y-axis, indicating a lower threshold for "yes" responses compared to Regina.