Psychology 020
Tues. 2007
Chapter 5 (part 1)

●Sensation and Perception

Sensation: Stimulation of the sense organs
Perception: Selection, organization and interpretation of sensory input
Psychophysics: The study of how physical stimuli are translated into psychological experience.

●Psychophysics: Basic Concepts

Stimulus: Information in the environment that is picked up by the receptors in our NS.
Sensation: Begins with a detectable stimulus

How strong must a stimulus be before we can detect it?
Fechner: The concept of threshold
Absolute Threshold: Detected 50% of the time.
Difference Threshold: (aka Just noticeable difference [JND])
→The minimal amount the stimulus needs to be increased (or decreased) to be judged as different from the original stimulus.

Weber's Law: The difference threshold (or JND) is directly proportional to the magnitude of the stimulus with which the comparison is being made.

Signal Detection Theory: Concerned with factors that influence an individual's sensory judgments.
→*Subjective Component*

●Sensory Adaptation

Sensory Adaptation: (habituation)—the diminishing sensitivity to a constant stimulus over time.

●Subliminal Stimuli: Can they effect behaviour?

Subliminal Stimuli: Stimuli that register on our NS but are below our sensory threshold

Can they affect behaviour?
→1950s James Vicary: flashed "subliminal" messages "Drink Coke" and "eat popcorn"

Can they affect attitude?
→Krosnick Study (1992)
→emotional priming and attitudes
→effect on attitudes

Research Findings:
→Little effect on behaviour
→Only small effect on attitudes

●**Audition**
The Stimulus: Sound Waves
Frequency: Number of sound waves (cycles)/second.
→*Pitch*
Amplitude: Vertical size of the sound waves.
→*Loudness*

●**Auditory System**
Outer Ear:
-Tympanic Membrane (Eardrum)
-External Auditory Canal

Middle Ear:
-Malleus (Hammer)
-Incus (Anvil)
-Stapes (stirrup)
-Oval Window

Inner Ear:
-Cochlea

●**Perception of Loudness**
Coding Occurs in 2 ways:
Louder sounds:
-greater sound waves
-vibrations in basilar membrane
-greater bending of hair cells

1. More neurotransmitter substance is released
2. Certain cells only respond to very loud sounds.

The brain interprets these signals as "louder"

●**Perception of Pitch**
Frequency Theory: Nerve impulses sent to the brain match the frequency of the sound.
E.g. Sound of 100Hz (i.e. 100 cycles/second) neurons would fire 100x/second.
BUT, Neurons cannot fire more than 1000x/second
→*So, only useful for frequencies under 1000Hz*

Place Theory: (Hermann von Helmholtz—1863)
→Different frequencies stimulate different areas on basilar membrane
→*For frequencies greater than 1000Hz*

●**Perception of Sound**
Pressure Waves:
-Cochlea
-Auditory nerve

-Brainstem
-Thalamus (MGN—Medial Geniculate nucleus)
-Auditory cortex
PERCEPTION of sound

●**Tonotopic Organization of the Auditory Cortex**
-Specialized neurons in the auditory cortex *respond maximally* to sounds of different frequencies. And these neurons are organized *tonotopically.*

●**Perception of Sound**
Locating Sounds in 3-D Space:
-2 ears are better than one.
-Compare information received by each ear
→Intensity
→Time of arrival

●**Our Sense of Taste**
The Stimulus: Chemicals dissolved in saliva.

Tiny receptors in the taste buds absorb chemical substances dissolved in saliva and cause neural firing (routed to the thalamus)

Gustatory cortex: top of brainstem

●**Our Sense of Smell**
The Stimulus: Chemicals dissolved in the air.

Tiny receptors for smell (olfactory cilia) hair-like structures in the nasal cavity

-Smell goes straight to the "Olfactory Bulb" and the "Olfactory Tract" and not through the thalamus.

●**Our Tactile Senses**
Touch
The Stimuli: Mechanical, thermal, or chemical energy applied to the surface of the skin

-Cells in the Nervous System are triggered by small areas on the body's surface.
-Centre-surround receptive fields.
-Stimuli at centre have opposite effect of stimuli falling outside of the centre.

●**Feeling Pain**
Receptors: Free nerve endings in the skin
Sharp (brief): A-Delta fiber
Vs.
Dull (throbbing): C fiber
2 different pathways

-Pain: has survival function
Role of cognition:
→Negative thinking
→Distraction

Gate Control Theory: Spinal cord can block pain signals to the brain.

●Factors Effecting Pain Perception
A complex interplay of numerous factors

Biological:
-Stimulation of nerve endings
-Endorphins reduce perception of pain

Psychological:
-Pain in the absence of physical causes (Psychosomatic disorders)
-Personality
-Beliefs about ability to control pain
-Placebo effects

Cultural:
-Cultural learning
-Cultural meaning of pain

●Phantom Limb Pain
-After losing a limb, patients report still feeling pain or burning sensations, even though they no longer have the body part.
-Pain receptors in the skin & tissue are absent
-So how is this possible?
-Importance of brain circuits in sensation & pain

Is the brain fixed after full development?
Critical Period Theory: After a certain age, the brain is permanently fixed and the function of neurons cannot be changed.

OR

Is the brain adaptable after full development?

I)Cortical Reorganization Theory:
-Neurons within the region of amputated finger fired whenever the two fingers adjacent to the missing one were touched.
-Nerve impulses from neighbouring sections were being "remapped" into the vacated zone
-Suggesting that the adult brain was a much more flexible commodity than most scientists thought
-BUT, some limitations

Cortical Plasticity:

II) Unmasking of Neural Circuits Theory (Merzenich)

-When normal input from one amputated finger ceased, these dormant connections were unmasked, & new impulses from adjacent fingers were sent into the vacated region—but only so far as an individual axon could reach.

*Remapping only possible if pre-existing neurons are in place & can be "reassigned" to other functions.

Conclusion

Nature Vs. Nurture

-Highlights the interplay of biological and environmental factors.

Plasticity of the brain & nervous system

-After critical period, brain is capable of modifying function of pre-existing neural connections

-BUT, more limited than prior to critical period.