Hearing

Lecture 10

Outline

• Auditory stimulus
• Auditory system (ear)
• Pitch perception
• Auditory system (ear to cortex)
• Auditory localization
• Hearing loss

Audition

• Amplitude similar to loudness (range: 10 - 90 dB)
• Frequency (# waves/sec) similar to pitch (range: 15 – 20,000Hz)
• Speech: combination of multiple freqs
**Theories of pitch perception**

- **Place theory**
  
  Better for high freqs

**Theories of pitch perception**

- **Frequency theory**

  N.B.: neurons tend to fire at the same phase of the sound wave

  Frequency of firing = frequency of sound
  
  Works up to 500-1000Hz
• Sound coming from side travels different distances to reach each ear *(phase difference)*

• Phase difference is related to the *azimuth* of the sound source
Phase differences
Works best with low frequency sounds
Problems arise with high frequency sounds

0 phase lag: should indicate a source coming from straight ahead, and yet this one comes from the side!

Hearing loss

- Conductive deafness
  - problems with bones of the middle ear, eardrum
  - caused by tumors, infection, disease
  - usually corrected by surgery or hearing aids

- Nerve deafness
  - damage to cochlea, hair cells, auditory nerve
  - caused by genetics, disease
  - potential treatment with cochlear implants

Cochlear implants

- Controversial
- Huge individual differences in success rate
- For adults, best if previous hearing experience
- For children mixed results