Sensation & Perception

Ch. 12: Sound Localization

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Main topics
Auditory localization
Perceptual grouping
• Dan Levitin and his interview (NPR)
• http://www.psych.mcgill.ca/levitin/
linked together grew as their orientations became

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Law of similarity

Similar things are put together
Do you see a spinal motion? This picture is called “Dance.” Do you see why?
Perceptual organization

• Grouping in music?

• Demonstration
  – Structure in music
Sound localization

• Demonstration:
  – Where does this sound come from?
  – YouTube Ventriloquist (America's Got Talent)
    • http://video.google.com/videoplay?docid=-4976377170423854180&q=ventriloquist&total=2398&start=0&num=10&so=0&type=search&plindex=4
• 3 different coordinates
  – The horizontal coordinate
  – The elevation coordinate
  – The distance coordinate
Figure 12.2 Measurements of sound localization ability. Red squares indicate the actual sound locations, and the circles are the listeners' estimates of their location. Longer lines connecting the squares and circles indicates less accurate localization.
Identifying the sound source in the horizontal coordinate

• Interaural differences
  – Interaural time differences
    • Capture the difference in the time that a sound reaches the left and right ears
  – Interaural level differences
    • Capture the difference in the level of the sound intensity (sound pressure level) that a sound reaches the left and right ears
Identifying the sound source in the elevation coordinate

- Spectral cues
  - Capture the way the head and pinnae affect sound frequencies
Depending on the level of elevation, the same sound enters the ears in a different manner.
Information about distance

• Different sound levels
• Frequency
  – atmospheric perspective (vision)
  – The quality of sound (frequency) is modified by the atmosphere.
• Movement parallax
  – The nearby sound moves quickly than the far away sound.
• Direct sound vs. reflected sound
  – Nearby sound tend to be direct, distant sound tends to be indirect
The physiological basis for localization
• Interaural time difference detectors

  – E.g., a neuron that responds best when a sound reaches the left ear first and the right ear (vice versa) 1 millisecond later.
The same time
Left Ear

Right Ear

The same time
Different time
Left Ear

Right Ear

Different time

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Different times...