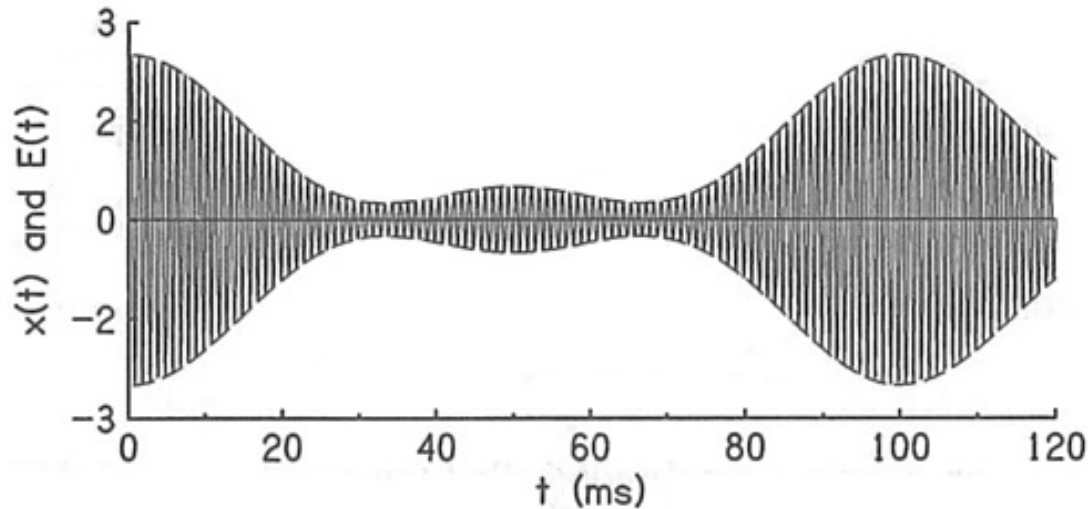


# Pitch

- **Definition: "that attribute of auditory sensation in terms of which sounds may be ordered on a musical scale" (American Standards Association, 1960)**
- **Pitch is related to the repetition rate of the waveform:**
  - For pure tone, pitch corresponds to its frequency
  - For a periodic complex tone, pitch corresponds to its fundamental frequency

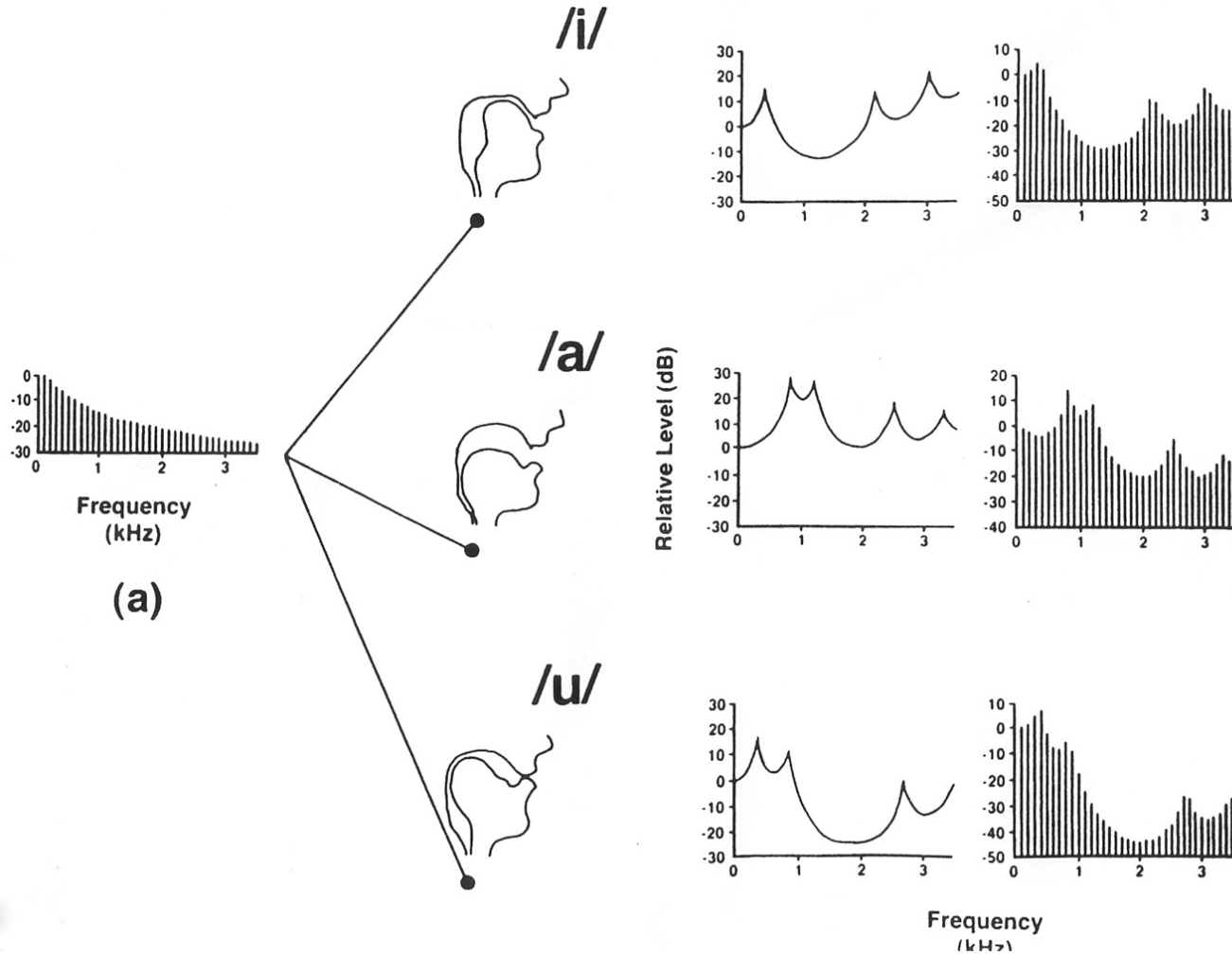
# Envelope and formant

- **Envelope: Amplitude variation (modulation)**



- **Formant: A resonance in the vocal tract which is usually manifested as a peak in the spectral envelope of a speech sound**

# Formant illustration



# Basics of auditory perception

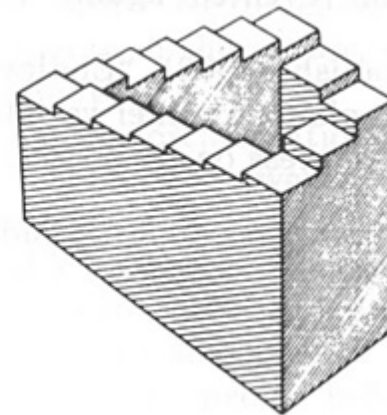
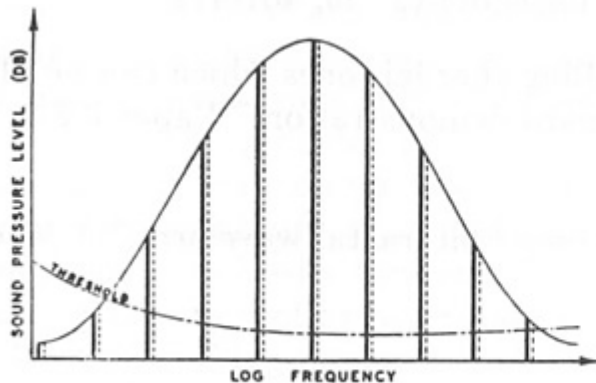
## **Demonstrations by the Institute for Perception Research (IPO) and the Acoustical Society of America**

- **Section I. Frequency analysis and critical bands**
  - Demo 1. Cancelled harmonics (Track 1; 1 min and 33s)
  - Demo 2. Critical bands by masking (2-6; 1:50)
- **Section II. Sound pressure, power, loudness**
  - Demo 4. Decibel scale (8-10; 1:57)
  - Demo 5. Filtered noise (12-15; 1:50)

# Basics of auditory perception (cont.)

- **Section IV. Pitch**

- Demo 12. Dependence of pitch on intensity (27-28; 0:48)
- Demo 19. Pitch streaming (36; 1:22)
- Demo 26. Scales with repetition pitch (49-51; 1:25)
- Demo 27. Circularity in pitch judgement, or Shepard scale illusion (52; 1:20)



# Basics of auditory perception (cont.)

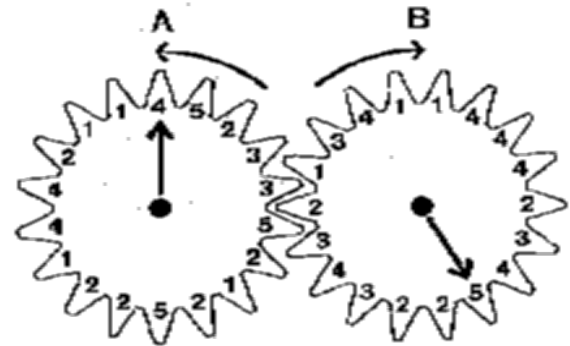
- **Section V. Timbre**
  - Demo 28. Effect of spectrum on timbre (53; 1:17)
- **Section VI. Beats, combination tones, distortion, echoes**
  - Demo 32. Primary and secondary beats (62; 1:32)
  - Demo 35. Effect of echoes (70; 1:47)

# Auditory scene analysis (ASA) demos

## Demonstrations by Albert Bregman and Pierre Ahad

- **Sequential organization**

- Demo 1. Stream segregation in a cycle of six tones (1; 0:47)
- Demo 7. Streaming in African xylophone music (7; 1:30)
  - Notes chosen from pentatonic scale



- Demo 11. Stream segregation of vowels and diphthongs (11; 1:17)
- Demo 14. Stream segregation of high and low bands of noise (14; 0:44)

# ASA demos (cont.)

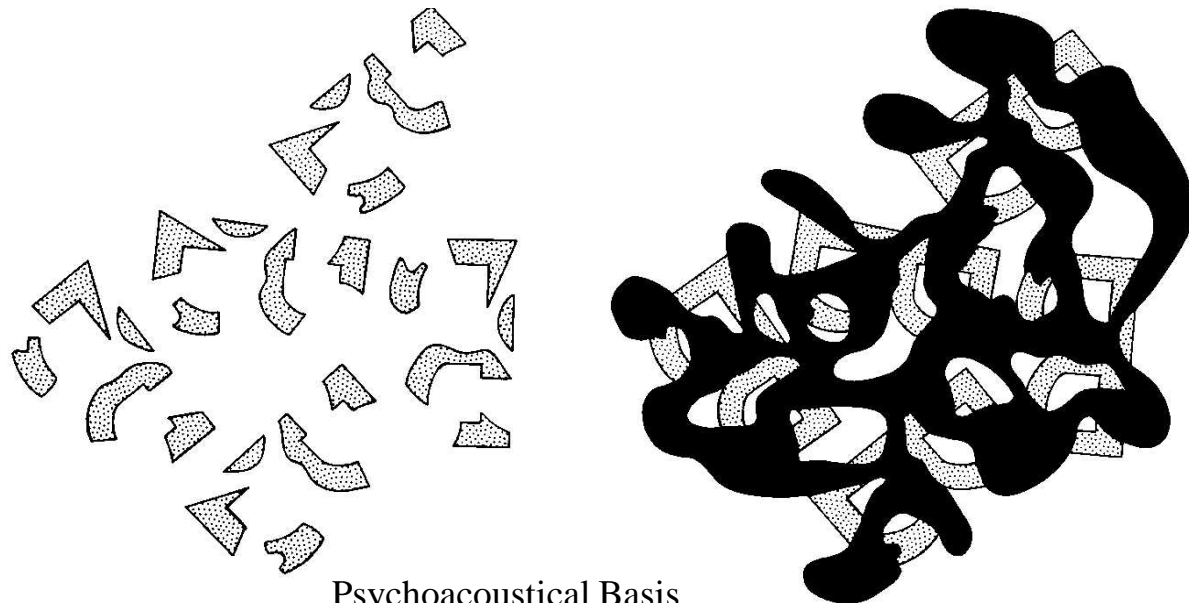
- **Simultaneous (Spectral) Integration**
  - Demo 19. Fusion based on common frequency change: Illustration 1 (19; 1:00)



# Advanced auditory perception

## Demonstrations by Richard Warren and James Bashford

- **Phonemic restoration**
  - Demo 2. Temporal induction of speech (10-15; 4:37)
- **Bregman figure: Pattern completion**



# Advanced auditory perception (cont.)

- **Illusory changes of repeated words: The verbal transformation effect**
  - Demo 5. Diotic monosyllabic reversible word “ace/say” (51-52; 1:31)