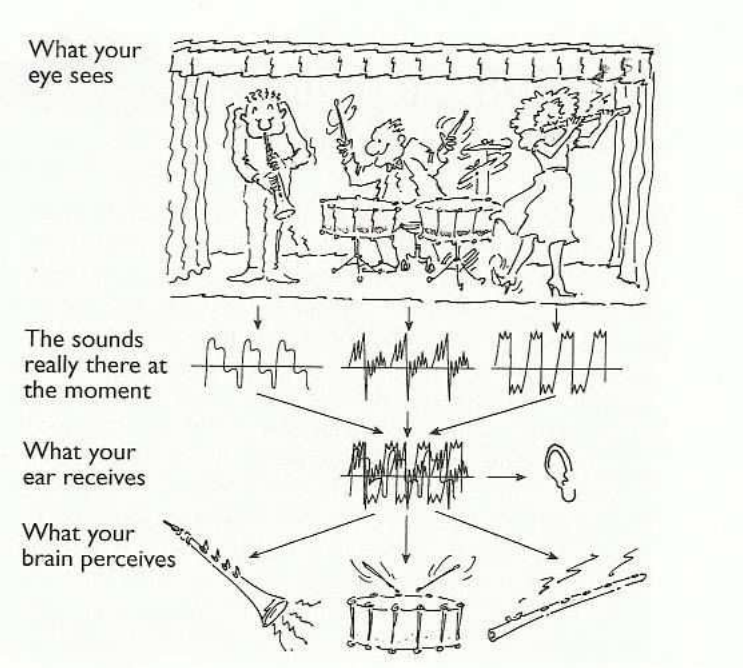
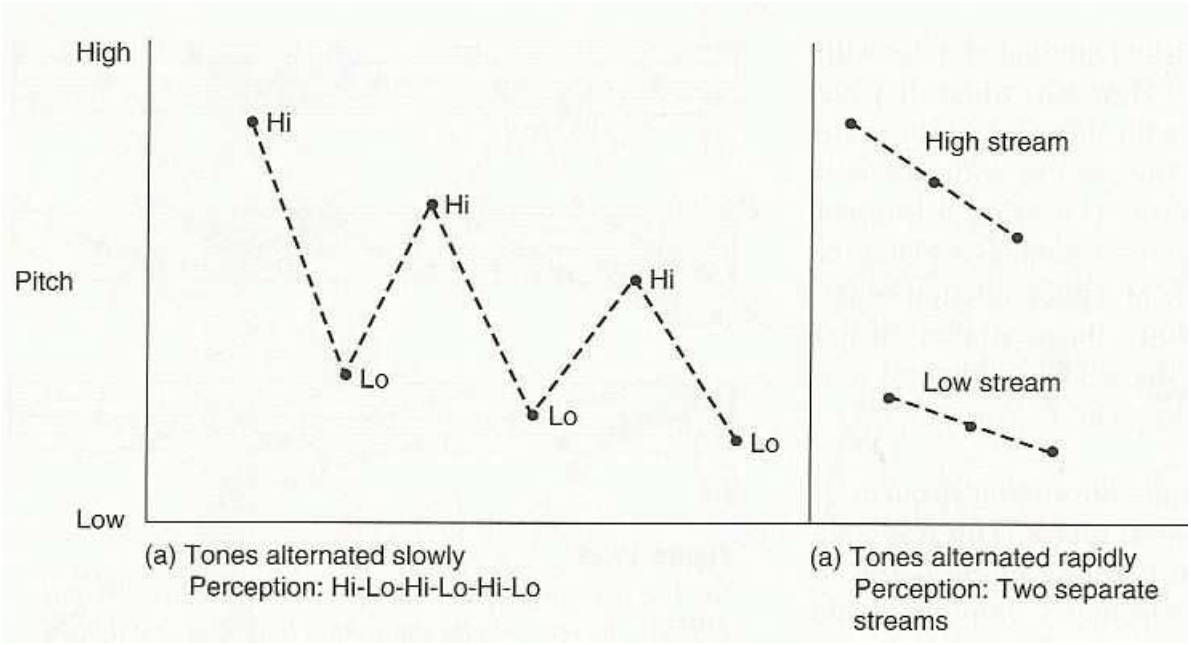
Pattern perception

Section 1 - Auditory scene analysis




Auditory grouping: the sound wave hitting out ears is often pretty complex, and contains sounds from multiple sources. How do we group sounds together to know what comes from a common source? Group into streams:

- group by pitch: similar frequencies tend to be grouped together - attributed to a common source.



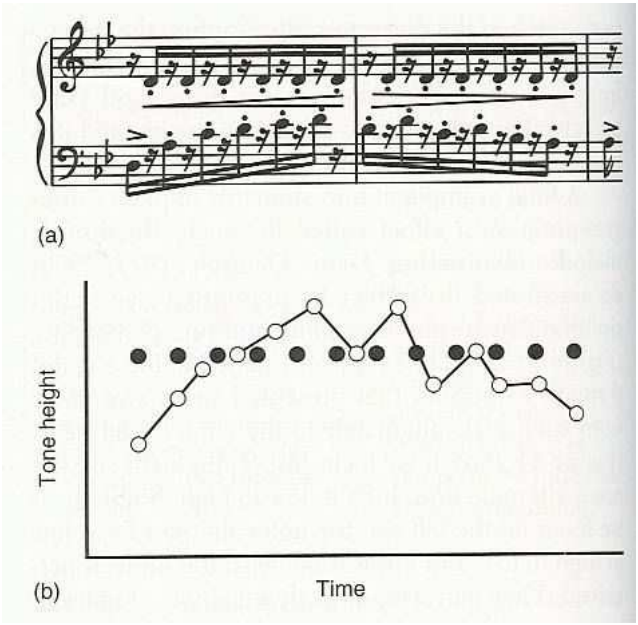

- group by time: group together harmonics with common onset

- group by location: Sounds coming from the same spatial location (which you could tell by iteraural intensity difference, for example) tend to be grouped together.

Gestalt principles (at least) affect sound:

1. good continuation: evidenced by homophonic continuity. vary the amplitude in sound - people perceive two sounds, with one turning on and off.

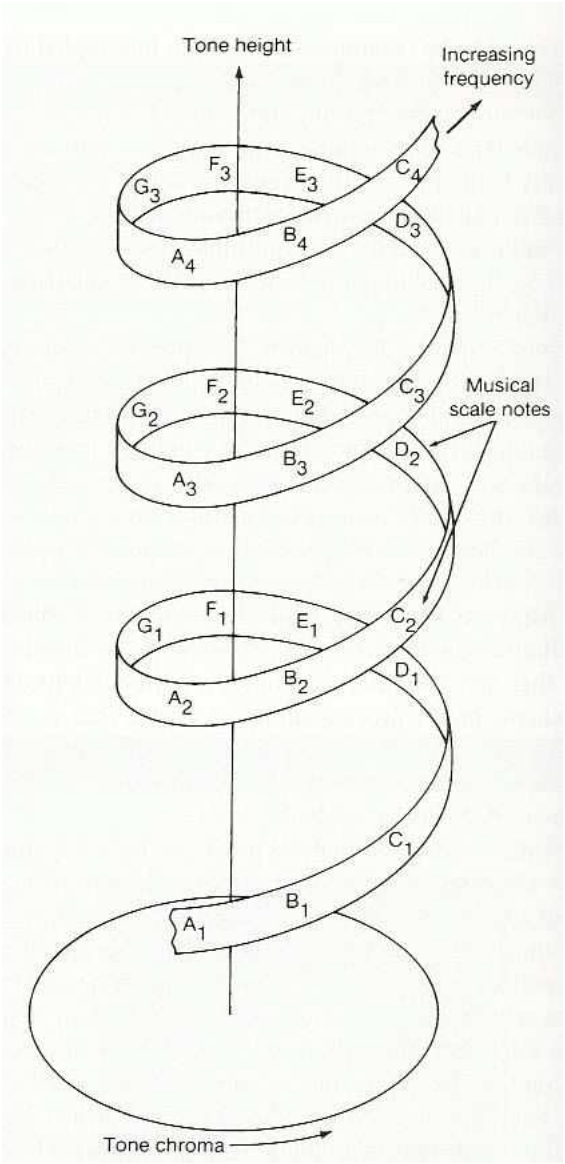
Also sounds that stay constant (or vary smoothly) are often produced by the same source:




2. closure: as evidenced by phonemmic restoration effect (we'll see this later).

Section 2: Music

Musical sounds usually have 2 values: tone height and tone chroma.

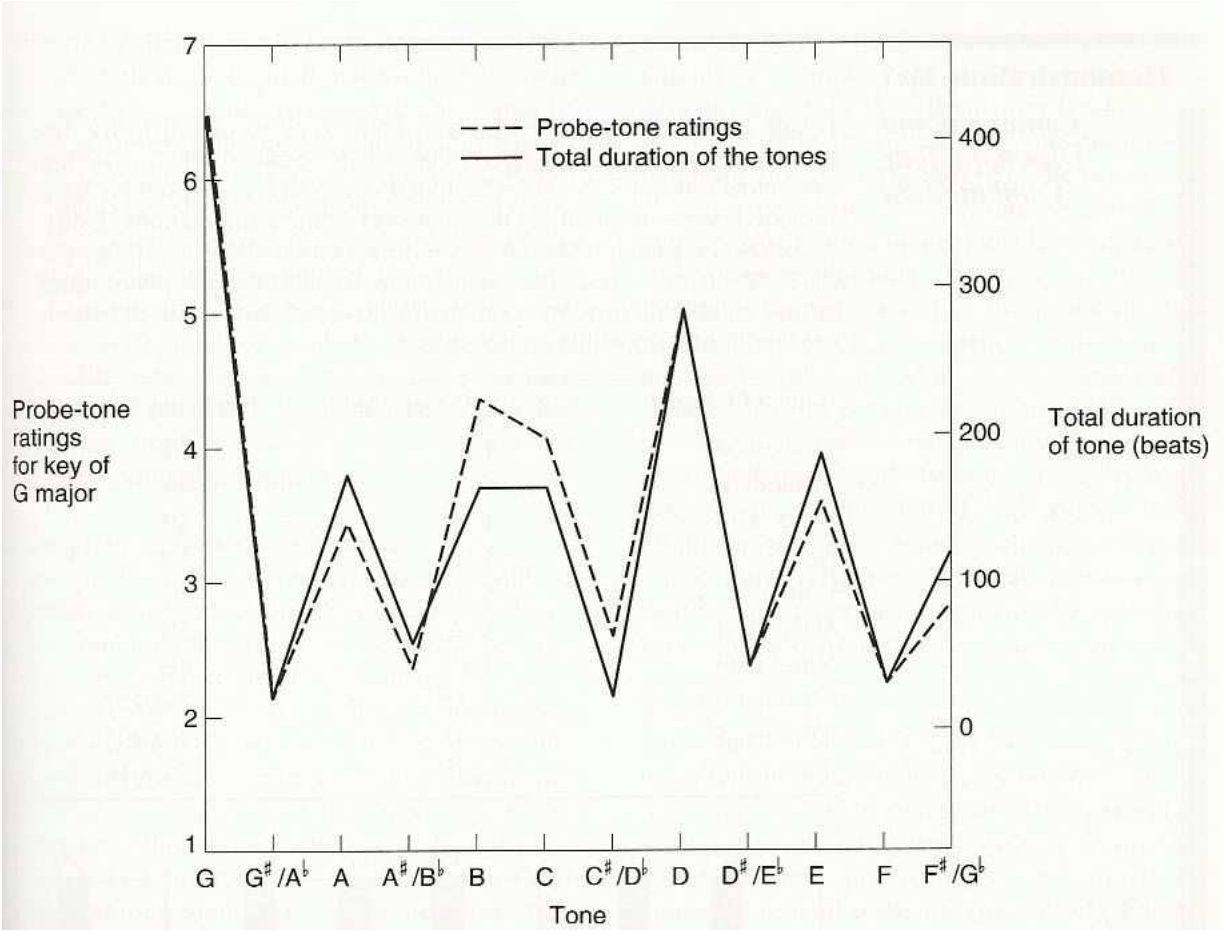



octave: sounds that live directly above one another on the tone helix represent successive doubling of frequencies.

Krumhansl (1983): probe-tone technique. Play a chord (to establish a key), then a tone - one of the 12 found within the octave of the key.

participants rate "goodness" of probe tone.

goodness ratings correlate with use of tones in classical music.




music can impact emotional states: Evers & Suhr (2000) showed music can affect seratonin release in the brain.

perfect pitch: ability to identify a musical note even in isolation from others.

harmonics important for this ability; when presented with pure tones, accuracy drops to about 50%.

nonmusicians have good memory for pitch: Schellenburg & Trehub (2003) played TV themes in a new key: people did better than expected.

auditory cortex larger in musicians with perfect pitch.

amusia: inability to recognize melodies and tunes; other auditory perception (speech, events) unaffected. Brain areas devoted to music perception?

Section 3: speech perception

Boundaries dividing words are not present in speech:

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Speech perception is good at distinguishing; even though boundaries are absent.

slips of the ear: when speech segmentation fails. (e.g. "get a pill out" heard as "get a pillow")

phoneme: basic unit of speech; smallest unit that makes an important difference in between speech sounds

Alternate definition: group of sounds classified as the same by people who are native speakers of a language.

Usually written with slashes on either side: /p/ or /h/

consonant sounds have three potential values:

1. place of articulation: where is airstream blocked?

   ex: /p/ (two lips) /f/ (lip to teeth)

2. manner of articulation: how completely is air blocked

   ex: /k/ (completely blocked) /th/ (not blocked, just narrowed)

3. voicing: do the vocal chords vibrate?

   ex: /b/ (voiced) /p/ (unvoiced); /t/ (unvoiced) /d/ (voiced)

Different languages have different phonemes:

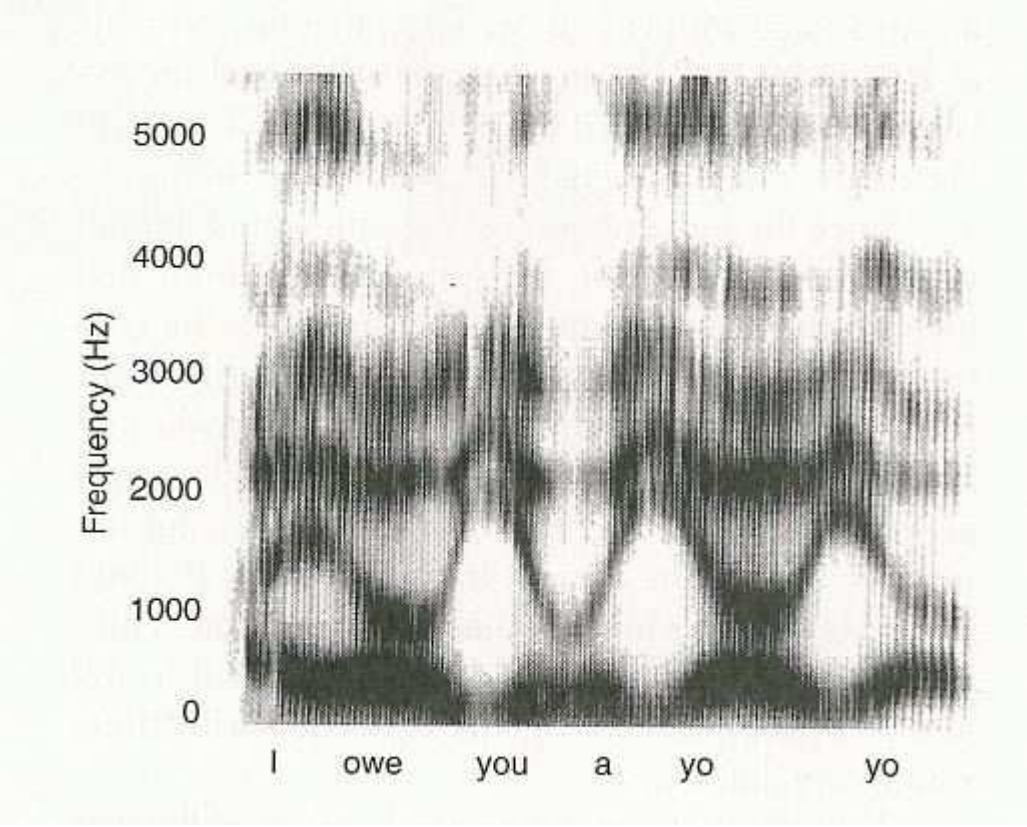
English: about 40.

Cherokee: about 85.

Hawaiian: about 18.

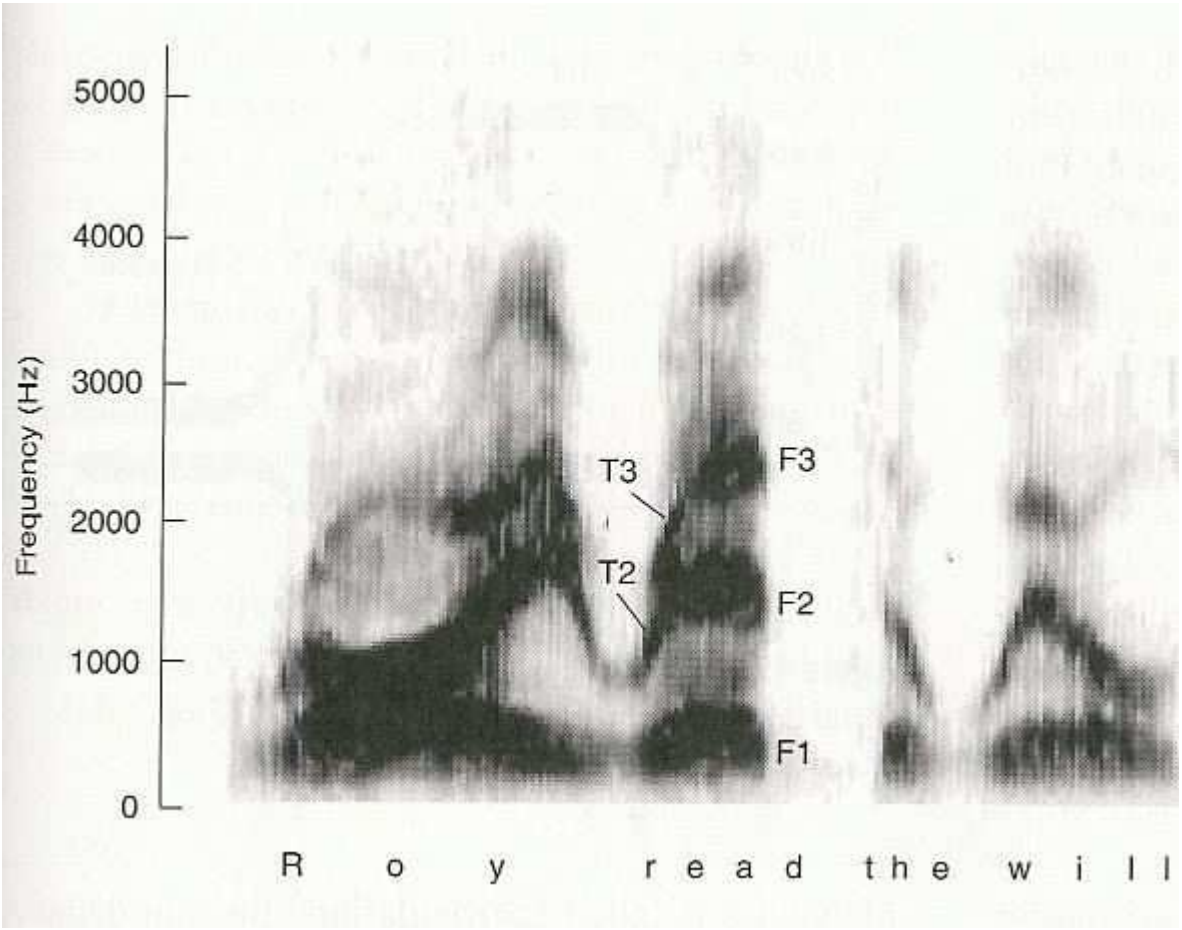
!kung: over 100.

speech spectrogram: diagram showing frequency components of speech.




formant: more intense frequency components are darker in the spectrogram.

transitions: rapid shifts in frequency following or preceding formants.




Speech spectrograms do not reveal discrete phonemes: phonetic segments overlap considerably.

parallel transmission: phonemes are influenced by surrounding phonemes.

Massive variability:

(Levinson & Liberman, 1981: different words spoken by the same speaker can be more similar than the same word spoken by different people!)

Emotion changes speech stimulus

Sloppiness changes speech stimulus: "did you eat yet?" vs "jeetye?"

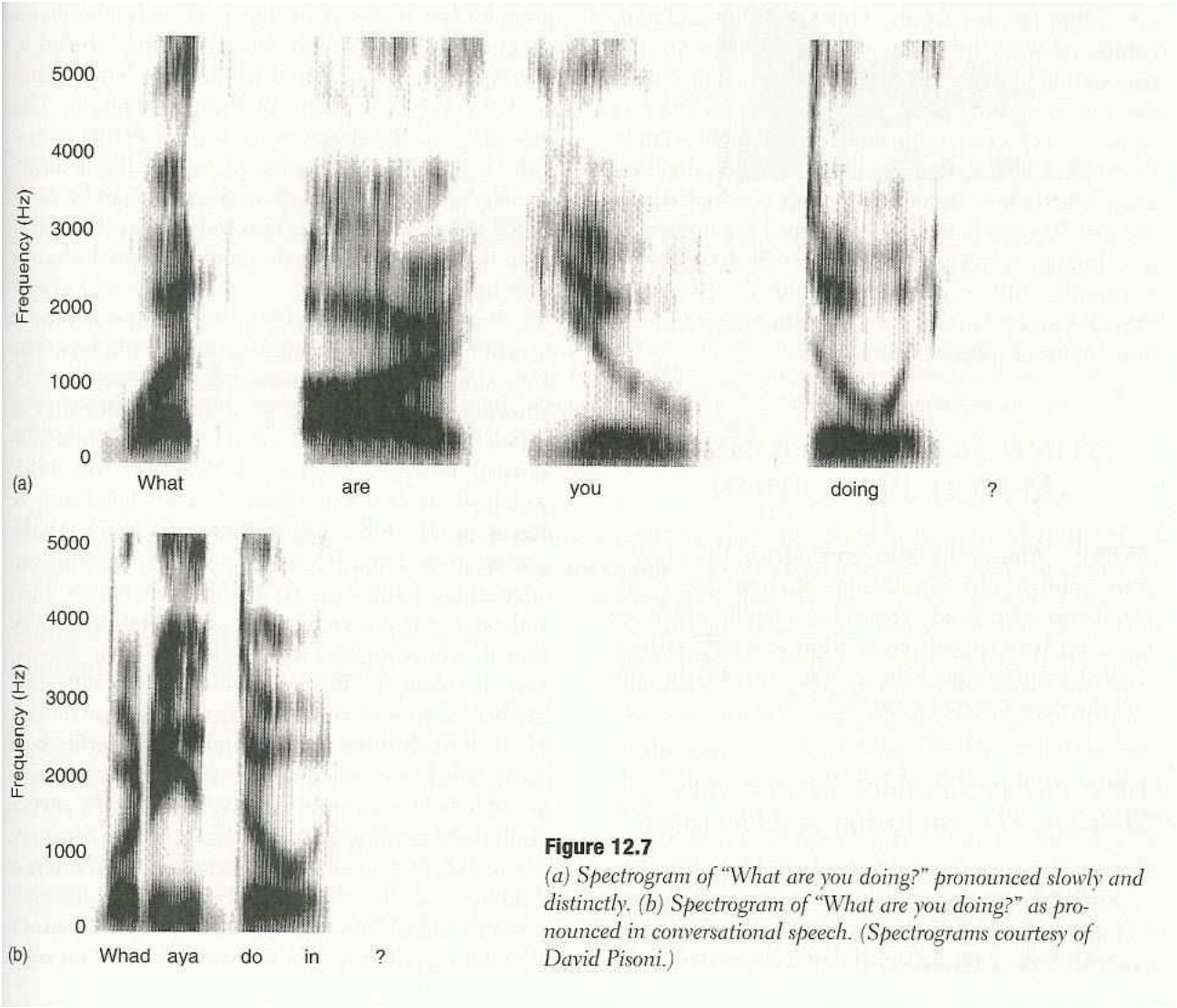



**Figure 12.7**
*(a) Spectrogram of "What are you doing?" pronounced slowly and distinctly. (b) Spectrogram of "What are you doing?" as pronounced in conversational speech. (Spectrograms courtesy of David Pisoni.)*

Theories of speech perception.

Special mechanism theory: We have a separate module in our brains solely devoted to speech perception. Speech perception is innate.

Motor theory (distinct version of special mechanism theory): speech perception and speech production are inherently linked.

when you hear a sound, you connect it to the way that sound must have been produced, thereby deciphering the phonemes.

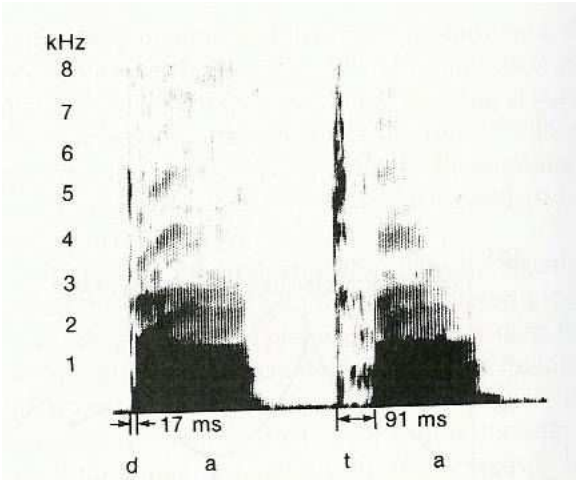
General mechanism theory: No special mechanism exists; speech perception and general auditory perception use the same mechanisms.

2 phenomena (at least) speak to issue of general vs. special speech perception.

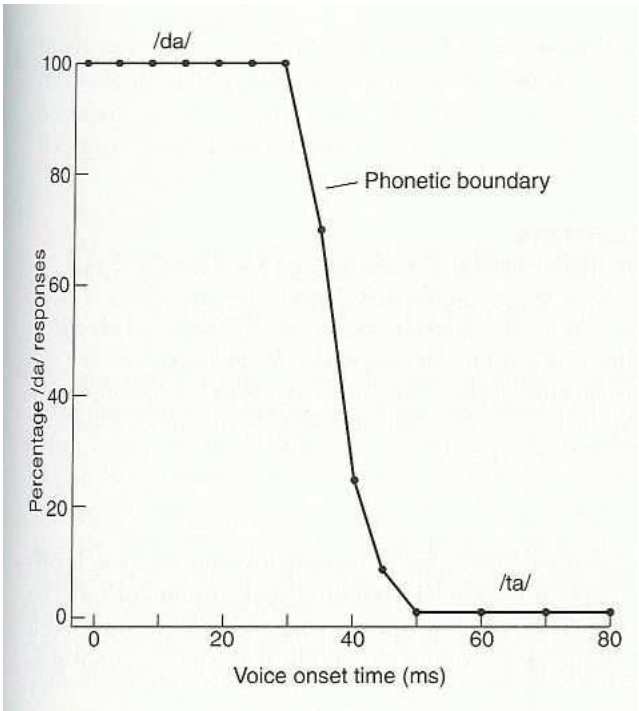
1 - Categorical speech perception.

categorical perception: when difficulty discriminating between members of the same category, but easily distinguish between members of separate categories.

voice onset time: time between when a sound begins and when vocal chords vibrate.




even though VOT is changed across a wide range, only two categories are perceived: /da/ and /ta/ - and the difference between them is quite abrupt:



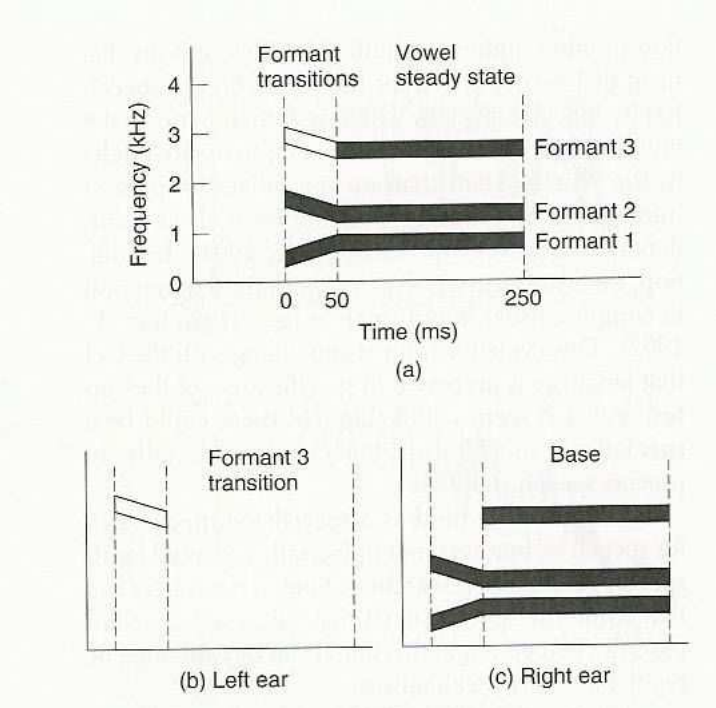
evidence for special mechanism? Possibly, since non-speech sounds are usually identified on a continuum, rather than as discrete categories.

BUT species without speech also show categorical perception effect, and humans can (sometimes) show categorical perception for nonspeech sounds.

2 - Duplex perception.

duplex perception: the same sound has both speech and nonspeech qualities.

take a speech sound (like /da/); present one formant transition to one ear, the rest of the signal to the other.



percept: chirping sound in one ear (where the transition was presented); speech sound in the other.

Special mechanism argument: general auditory mechanism hears the chirp; special speech mechanism hears the speech. Because both are perceived, there must be two mechanisms.

General mechanism argument: duplex perception can occur with nonspeech sounds as well (ex door slamming)

conclusion: no conclusion yet - it's up in the air.