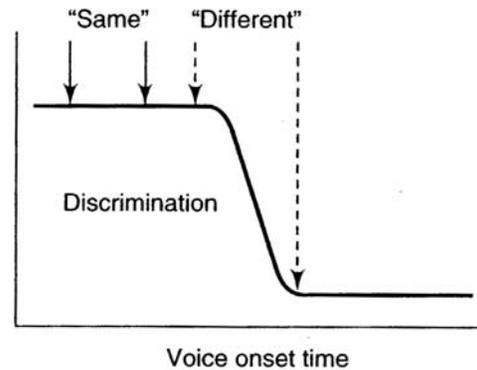


SLHS 1301 Study Guide

Chapter 8: Speech Perception

1. Supposed you have been selected to be the principal investigator of a major research laboratory that specializes in speech perception. What are some of the key questions you would like your research team to work on? Can you justify your selection of questions?



You can come up with your own answers. You are not required to know all the information about a-l. But it is interesting and fun to share with you some hot topics in the field:

- a) Perceptual constancy vs. acoustic variability. How do we perceive constant categories given the huge amount of acoustic variability in speech?
 - b) Nature vs. nurture. Is speech perception ability innate or learned? Do animals have the same ability? Can they learn human speech?
 - c) Bottom-up vs. top-down processes. How do these processes contribute differently to speech perception?
 - d) Speech vs. music. How is speech perception different from music perception? Does prosody perception for speech follow the same rules as those for music perception?
 - e) Speech vs. nonspeech sounds. Is there something unique about speech perception?
 - f) Segmentation and unit of perception. How do we segment connected speech into words? What is the basic unit of perception? Is it phoneme, syllable or word?
 - g) Role of language experience. How does learning experience change perception? How do bilinguals (trilinguals) differ from monolinguals?
 - h) Role of language input. What are the acoustic characteristics of the input that promotes language learning? What hinders learning? Is there something unique about the “baby-talk” that mothers use?
 - i) The perception-production link. Is speech perception dependent on production? Do visual cues of speech articulation aid speech perception?
 - j) The development of speech perception. How does our speech ability change over age? Do infants perceive speech in the same way as adults?
 - k) Clinical studies of people with speech perception problems. How do we diagnose speech perception problems? How do we treat them? What are the causes?
 - l) The brain mechanisms of speech perception. Is speech and language processing lateralized? How does the neural network in the brain process speech sounds? What regions are involved? How do the two hemispheres cooperate in speech perception? What is the time course of the rapid brain processing? How do we use the information about brain mechanisms of speech perception to enhance learning and improve treatment efficacy?
2. What is a speech intelligibility test? Can you give some examples about how one can measure speech intelligibility?

Intelligibility test is an experimental task which asks the listener to report the words/syllables they hear given various presentation conditions. The intelligibility score is the percent correct response.

One can design various speech stimuli for this kind of test:

- a. Words
- b. Nonsense words
- c. Words of a foreign language
- d. High-pass or low-pass filtered speech
- e. Speech recorded over telephone
- f. Speech recorded in natural environment
- g. Speech masked by noise ...

3. What were the findings of the speech perception experiments in 1920s through 1940s? Check your lecture slides.

4. What invention dramatically changed speech perception studies? Why?

Pattern playback machine in 1954 by Franklin Cooper. Because it allowed researchers to synthesize speech sounds by systematically varying the acoustic features on the spectrogram. Using this type of artificially created stimuli, scientists came to know what acoustic cues or features were important for what kind of speech sound. This knowledge also helped scientists and engineers to build speech synthesis machines.

5. Give examples of how different classes of speech sounds are perceived based on their distinct acoustic features.

Consider the sounds in a CV context

Vowels: formants

Stops: burst followed by formant transition

Nasals: nasal murmur followed by formant transition

Fricatives: noise bands of relatively long duration

Approximants: formant transitions in F2 and F3.

6. What is formant transition?

Frequency slides in a formant visible on a spectrogram. It occurs due to changes of properties (size and shape) in the vocal tract by moving articulators such as the tongue.

7. What is co-articulation?

The co-occurrence and coordination of speech sounds in producing connected speech. Before finishing the preceding sound the articulators are already preparing for the production of the following sound.

8. What does suprasegmental mean?

Beyond the level of speech sound in isolation. Stress, prosody, intonation patterns are suprasegmental. Individual phonemes are segmental.

9. What is categorical perception? How was it discovered?

CP is the perceptual phenomenon about how speech sounds are perceived in a categorical fashion. It has two features: (1) the existence of phonetic boundary in an identification function

of the continuum of stimuli varying from one sound to the other in equal intervals of change; (2) enhanced sensitivity towards cross-category stimuli as compared with within-category stimuli in a discrimination function despite the fact that the amounts of physical difference were equated.

It was discovered as an accident when researchers were playing around with the pattern playback machine. They drew spectrograms that varied in small steps from one category to another and found the CP phenomenon in perceptual tests.

10. What is motor theory of speech perception? Why is called motor theory?

Speech perception relies on one's knowledge of how the speech sounds are produced to overcome the acoustic variability. It is called motor theory because it emphasizes the importance of speech motor activity (production) in order to perceive sounds correctly.

11. Is speech perception exclusively dependent on acoustic cues in the speech signal? Give some evidence to argue why non-acoustic cues are also important for speech perception.

No. Lip-reading has been shown to be very important for some people, which does not use any acoustic cues. Contextual knowledge helps speech perception. Nonverbal cues such as facial expressions and hand gestures also help. Speech perception is not just a bottom-up process.

12. Nature vs. Nurture: Do you think our speech perception ability is genetically programmed? Why or why not?

No.

- Chinchillas show categorical perception for stops (/pa/ vs /ba/ for example) just like humans. See Kuhl and Miller (1975) (not required for this course)

http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=1166301&query_hl=2

- As we learn our native language, we become good at perceiving our native speech sounds but not those of a foreign language. In the learning process, we become neurally committed to our native language.

See Zhang et al (2005) (not required for this course)

http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15955480&query_hl=4

