

Speech

PSY 200
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Lecture 29

Why do we say “razzle-dazzle” instead of “dazzle-razzle”?

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Language

- Many levels
 - ♦ grammar
 - ♦ phrases
 - ♦ words
- All humans, who can, communicate through *spoken* language
 - ♦ how does language depend on speech?
 - ♦ what are the units of speech?

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Illusions

- When you hear what I say, you think you hear at least
 - ♦ separate words
 - ♦ separate syllables
- But you do not
 - ♦ words actually overlap in the speech signal
 - ♦ it is nearly impossible to take a speech signal and cut it up into separate words

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Illusions

- The “blurriness” of speech explains some long-held confusions
 - ♦ Oronyms (Mondegreens)

The stuffy nose can lead to problems.

The stuff he knows can lead to problems.

The good candy came anyways.

The good can decay many ways.

It's a doggy-dog world.

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Why the blur?

- The ear is a bottleneck
 - ♦ analogous to the critical flicker frequency in the eye
 - ♦ the ear can distinguish <clicks> as separate only if they are given at less than 20 hertz
 - » 20 clicks per second
 - ♦ above that, a series of clicks sounds like a continuous buzz

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But...

- Speech is seemingly perceived *much* better
- Normal speech provides 10 to 15 distinct *phonemes* each second
- Fast speech is 20 to 30 phonemes per second
- Artificially fast speech is 40 to 50 phonemes per second
- <https://www.ispeech.org/instant-e-learning-text-to-speech>

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Phonemes

- **pho-neme** \fo-,nem\ n
[F *phoneme*, fr. Gk *phonemat-*, *phonema* speech sound, utterance, fr. *phonein* to sound](ca. 1916): a member of the set of the smallest units of speech that serve to distinguish one utterance from another in a language or dialect, the \p\ of *pat* and the \f\ of *fat* are two different *phonemes* in English>

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Phonemes

- Speech is made of phonemes
- Different combinations of phonemes correspond to different syllables and words
- We seemingly hear more phonemes than the ear can actually handle
 - ♦ how?

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Packing

- If the ear can only distinguish up to 20 sounds per second
 - ♦ and we can interpret speech that seems to contain 50 phonemes per second
 - ♦ then the speaker must be *combining* many phonemes together to overcome the limits of the ear
- The listener hears the 20 (or so) sounds in a second, but interprets them as more than 20 different phonemes

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Packing

- If phonemes are being smashed together there must be some blurriness
 - ♦ and this can lead to misinterpretations
- This is also why computer speech sounds “funny”
 - ♦ <https://www.ispeech.org/instant-e-learning/text-to-speech>
 - ♦ The programs do not combine phonemes in the right way

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Speech

- So what are phonemes?
- All speech is made of *sounds*
 - ♦ sound is a *pattern of pressure* on the ear
 - ♦ a tuning fork *vibrates* back and forth to make the sound of a pure tone
 - ♦ Frequency of vibration corresponds to pitch of the sound
- Speech consists of lots of patterns of this sort
 - ♦ With many different overlapping frequencies

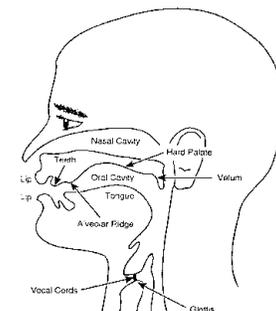
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Physiology

- Lungs push air out to make a sound
 - ♦ other organs shape sound



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Example

- Note where your tongue is as you say
 - bet butt
 - beet bat
- The position of the tongue shapes the vocal tract and makes different sounds!
 - this is true for all vowels

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Example

- Note what your lips do as you say
 - boot book
- The lips add additional frequencies to make different sounds
- Thus, you can *hear* someone smile across a telephone!
- Vowels are all distinguished by the shape of the vocal tract

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Consonants

- Consonants are more complicated
 - different type of control of air flow
- (1) *Voicing*: vibration of vocal cords
 - /b/, /d/, /m/, /w/, /v/ (voiced)
 - /p/, /t/, /f/ (not voiced, or unvoiced)
- (2) *Place of articulation*:
 - /d/, /t/ (upper gum)
 - /m/, /b/, /p/ (lips)
 - /f/, /v/ (lip and teeth)

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Consonants

- (3) *Manner of articulation*
 - /d/, /t/ (stop)
 - /m/ (nasal)
 - /f/, /v/ (fricative)
- Each consonant is uniquely identified by its voice (or not) and its place and manner of articulation

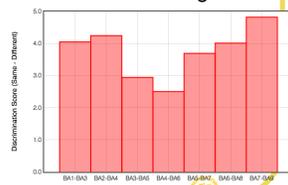
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Consonants

- Some languages have other characteristics as well (e.g., tone, timing)
- For example, in English, the difference between /ba/ and /pa/ is the timing of the release of air for the consonant and the voicing of the vowel
- Voice Onset Time (VOT) is short for /ba/ and longer for /pa/
- CogLab data: sounds differ in VOT, judge if same or different sounds
 - 163 participants



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Fun

- Why do we say *razzle-dazzle* instead of *dazzle-razzle*?
 - for phrases like this, people always first say the word with a leading consonant that impedes air flow the *least*
- | | | | |
|----------------|-------------|---------------|--------------|
| super-duper | willy-nilly | walkie-talkie | It's a rule! |
| helter-skelter | roly-poly | namby-pamby | |
| harum-scarum | holy moly | wing-ding | |
| hocus-pocus | herky-jerky | mumbo-jumbo | |

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Phonemes

- English uses 22-26 (it depends on how you count) combinations of voicing, place, and manner of articulation (and 20 vowels)
 - ♦ Rotokas (Papua New Guinea) uses 6 (and 5 vowels)
 - ♦ Khoisian (Bushman) uses 141
 - » Uses clicks as consonants
- No language uses some possible sounds
 - ♦ raspberries, scraping teeth, squawking,...
 - ♦ Note, these sounds are used for communication, but not as part of language!
- Japanese does not distinguish /r/ from /l/

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Rules

- To say a word, we must combine phonemes
- In every language there are rules (trees) that describe what phonemes can follow other phonemes
- Thus, we can identify possible words from impossible words
 - ♦ plast ptak
 - ♦ vlas rtut
 - ♦ thole hlad
 - ♦ nypip dnom

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Compression

- Moving the tongue (and other articulators) around is difficult and takes time
 - ♦ to say sounds faster, people use coarticulation
 - ♦ shape tongue in advanced preparation for the next phoneme
 - ♦ this influences the sound of phonemes

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Coarticulation

- We generally do not notice these adjustments
 - ♦ we are tuned to recognize the new sounds as coarticulation
- This is the main reason computers have a hard time recognizing human speech!

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Coarticulation

- Notice that your tongue body is in different positions for the two /k/ sounds in
 - ♦ Cape Cod
- Note too, that the /s/ becomes /sh/ in
 - ♦ horseshoe
- And /n/ becomes /m/ in
 - ♦ NPR
- You can enunciate these “correctly”, but in casual speech you do not!

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Coarticulation

- There are rules for how to coarticulate
- When a stop-consonant appears between two vowels, you do not actually stop
 - ♦ flapping
- slapped --> slapt
- patting --> padding
- writing --> wriding

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Spelling

- We have often observed that written language is different from spoken language
- George Bernard Shaw (among others) complained about spelling in English
 - ♦ he noted you could spell “fish” as “g-h-o-t-i”

gh -- tough o -- women ti -- nation

- He offered a prize in his will for someone to create a good alternative to English spelling

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Spelling

- It is true that English spelling does not seem to agree with pronunciation
 - ♦ a problem for learning how to read!
- Nor should it
 - ♦ if words were spelled the way they were pronounced, we would lose the *visual* connection between words
 - ♦ slap --> slapped would become slapt
 - ♦ write --> writing would become wridding
 - ♦ National Public Radio --> NPR would become MPR

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Other approaches

- There are other written forms of language that avoid some of these problems
- The most sensible written language is probably the Korean hangul
 - ♦ Drawn characters indicate how consonants are pronounced



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Conclusions

- Speech
- Blurring
- Phonemes
- Articulation
- Coarticulation
- Spelling

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Next time

- Learning language
- Babies
- Children
- Learning a second language
- CogLab on *Age of Acquisition*.
- *When should you learn a foreign language?*

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