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

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?

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

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.

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

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
Phonemes

- **phoneme** /fə-ˌnem/ 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.

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

Physiology

- Lungs push air out to make a sound
  - other organs shape sound
**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
  - helter-skelter roly-poly namby-pamby
  - harum-scarum holy moly wing-ding
  - hocus-pocus herky-jerky mumbo-jumbo

It's a rule!
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)
  - Khoisan (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/

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
  - vias  rtut
  - thole  hlad
  - nypip  dnom

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

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!

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!

Coarticulation
- There are rules for how to coarticulate
  - When a stop-consonant appears between two vowels, you do not actually stop
    - flapping
    - slapped --> siapt
    - patting --> padding
    - writing --> wriding
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”
- He offered a prize in his will for someone to create a good alternative to English 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 → slapp’d would become slapt
- write → wridding
- National Public Radio → NPR would become MPR

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.

Speech
Blurring
Phonemes
Articulation
Coarticulation
Spelling

Next time
- Learning language
- Babies
- Children
- Learning a second language
- CogLab on Age of Acquisition.

When should you learn a foreign language?