Ling 151/Psych 156A: Acquisition of Language II

Lecture 4

Sounds

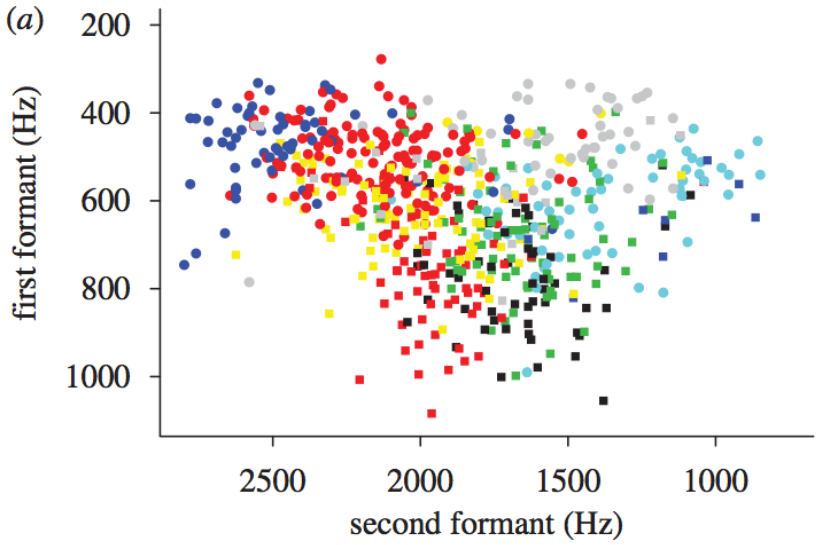
Announcements

HW1 due by 2:50pm today

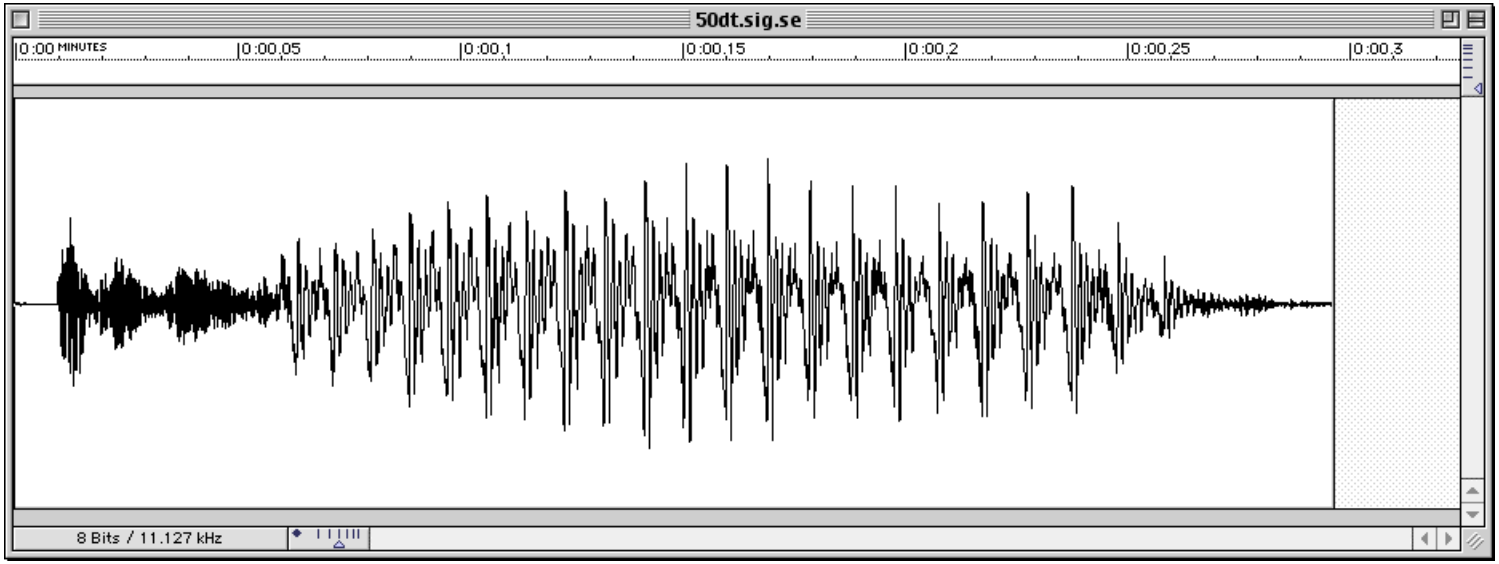
Be working on HW2 (due 1/26/18)

Review questions available for sounds & sounds of words

IPA sound conversion chart available



Learning sounds

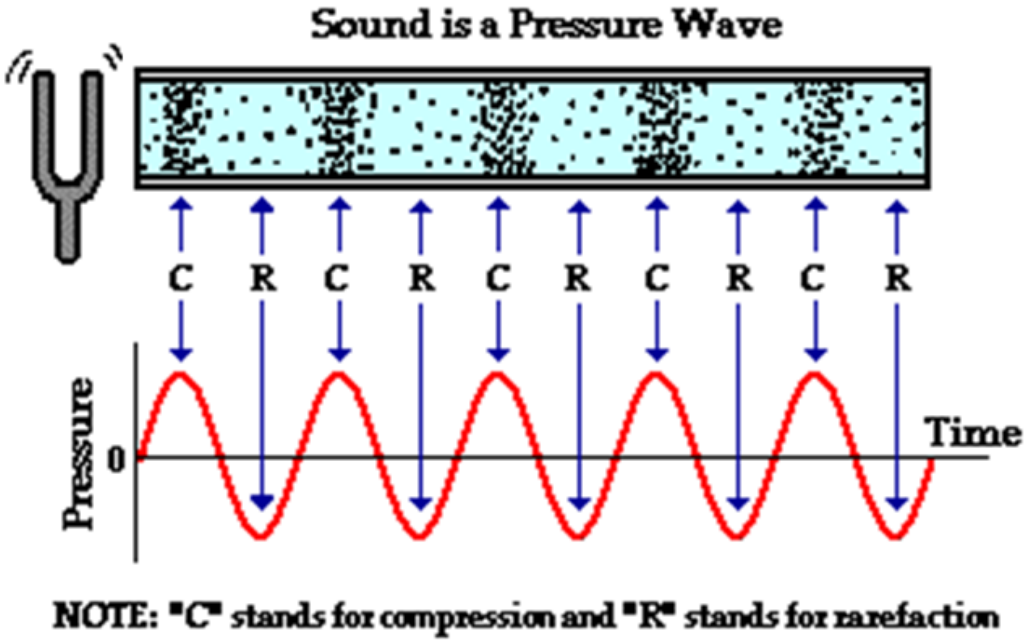


Sound waves

https://www.youtube.com/watch?v=jl4zGRSYqkE&feature=youtu.be

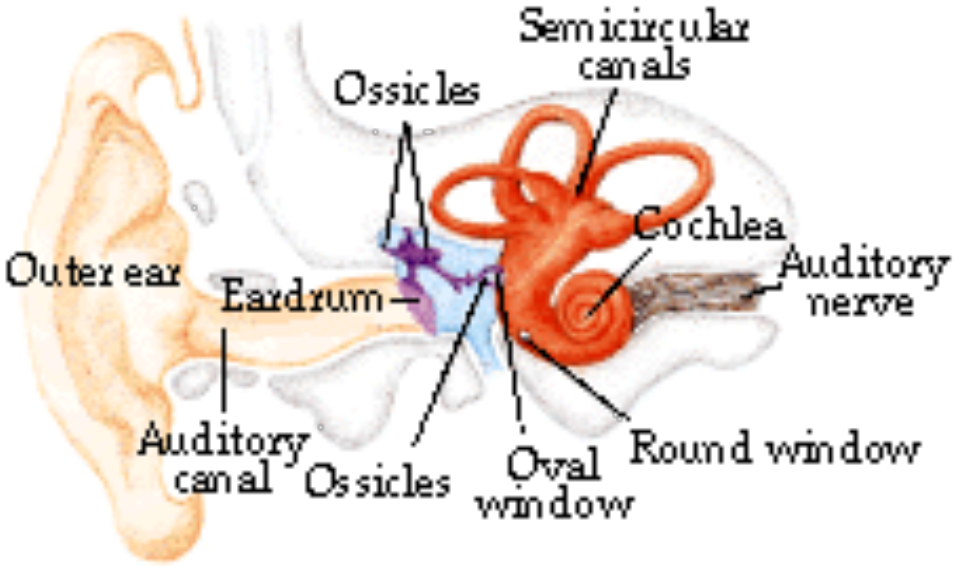
2:33-3:15: sound waves & hertz

Sound waves



A wave is a disturbance of a medium which transports energy through the medium without permanently transporting matter.

Listening



Hearing Frequency:

20 Hz and 20000 Hz

Speech:

200-8000 Hz

Most sensitive to

1000-3500 Hz

Phones (speech sounds):

300-3400 Hz

Sounds of language (Speech perception)

Learner's job: Identify phonemes (contrastive sounds that signal a change in meaning)

big vs. pig

Phonemes are language-specific - r/l is a phonemic contrast in English but not in Japanese

Lisa = Risa for some of my Japanese friends

Curious timing:
Kids of the world require knowledge of phonemes *before* they can figure out what different words are - and when different meanings are signaled by different words

Distinctive sounds for some adults

http://sites.sinauer.com/languageinmind/wa04.06.html

Irish, Ewe

Example 1: Palatalized consonants in Irish

Each audio clip contains either two tokens of the same word spoken by a
they are the same or different.

Audio 1

Audio 2

Audio 3

Audio 4

Audio 5

Example 2: Fricatives in Ewe

Ewe has a set of fricatives that do not appear in Eng
bilabial fricatives. You can hear examples of all of th
following order:

Voiced bilabial

Voiced labiodental

Voiceless bilabial

Voiceless labiodental

Voiced bilabial

Voiceless bilabial

Voiced labiodental

Voiceless labiodental

Audio 6

Sounds across languages

https://www.youtube.com/watch?v=dtf8zGQj9GY
http://www.thelingspace.com/episode-4

1:17-5:07

About speech perception

Important: Not all languages use the same contrastive sounds.

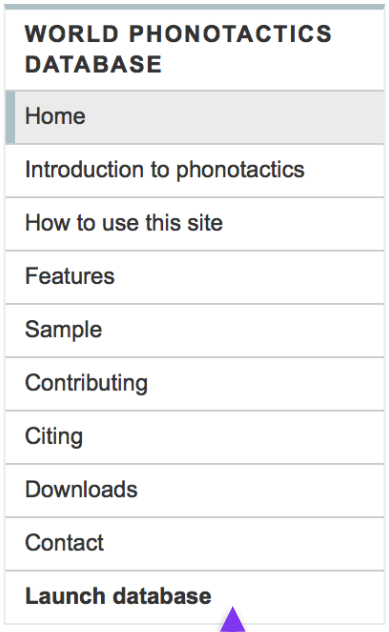
Languages draw from a common set of sounds (which can be represented by the International Phonetic Alphabet (IPA)), but only use a subset of that common set.

The World Phonotactic Database can show you some of the variation we see across the world's languages when it comes to which phonemes they use

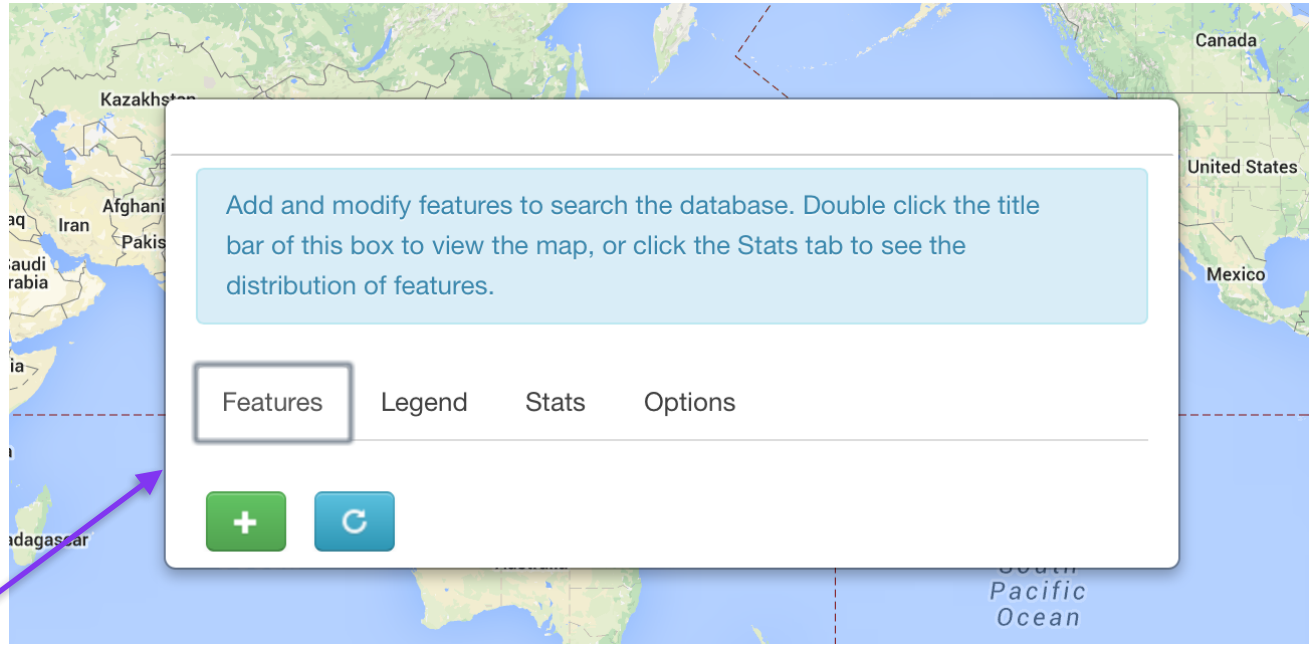
http://phonotactics.anu.edu.au

Cross-linguistic variation in sounds (called segments)

http://phonotactics.anu.edu.au/index.php



Click on this to get this



Cross-linguistic variation in sounds (called segments)

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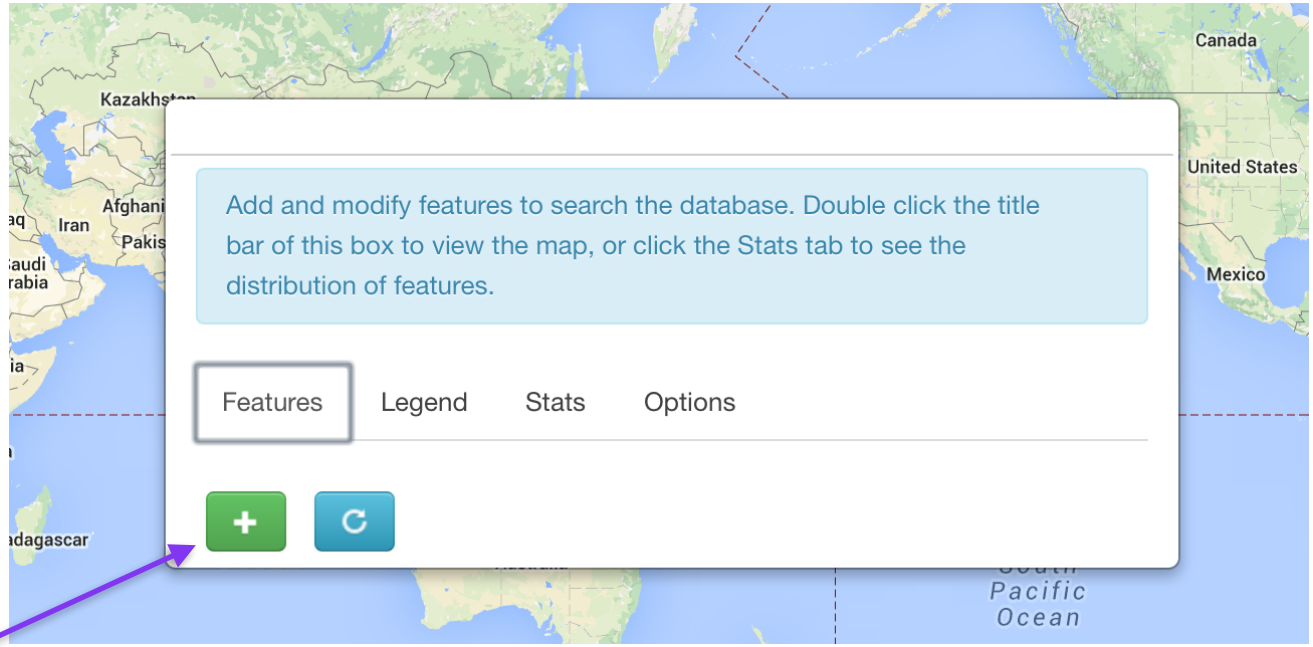
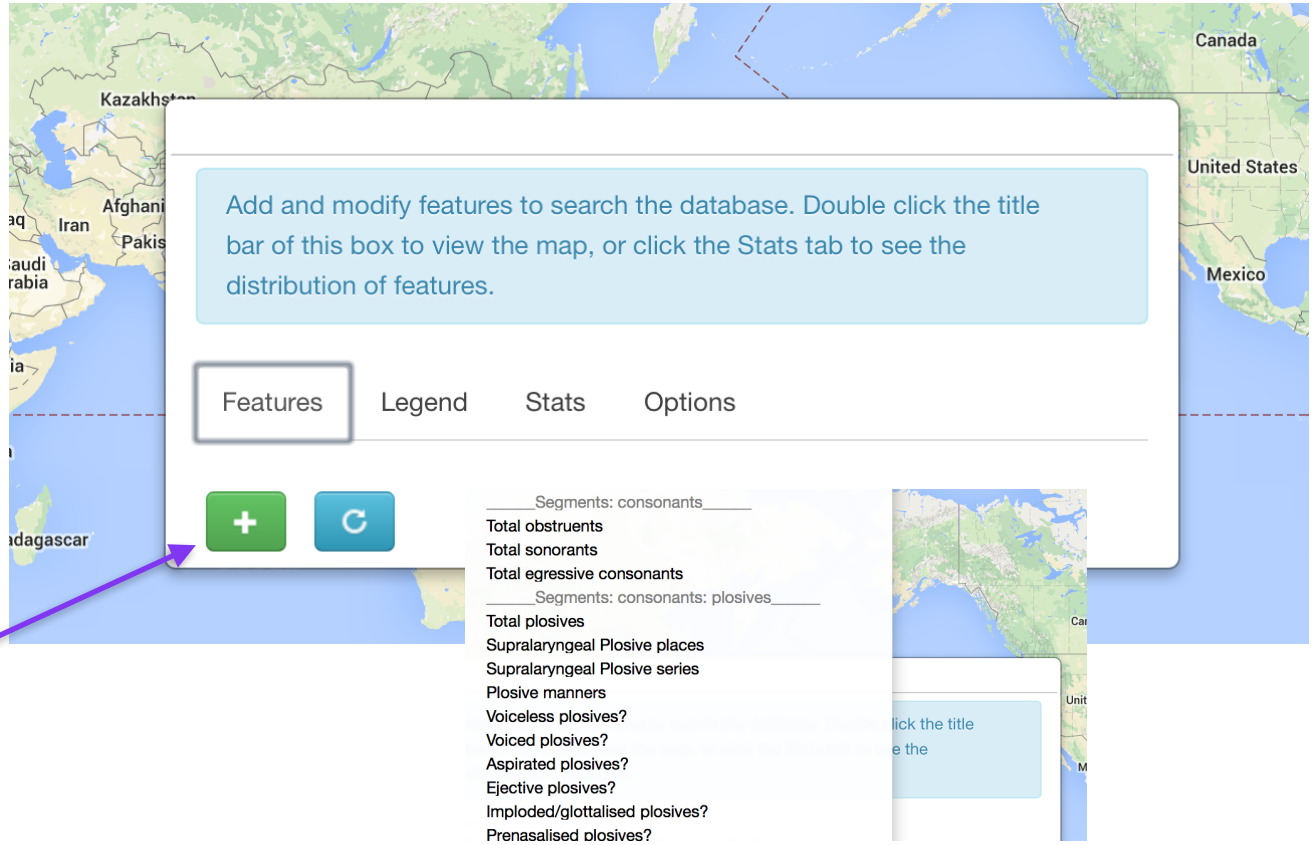


Then look through the features

Cross-linguistic variation in sounds (called segments)

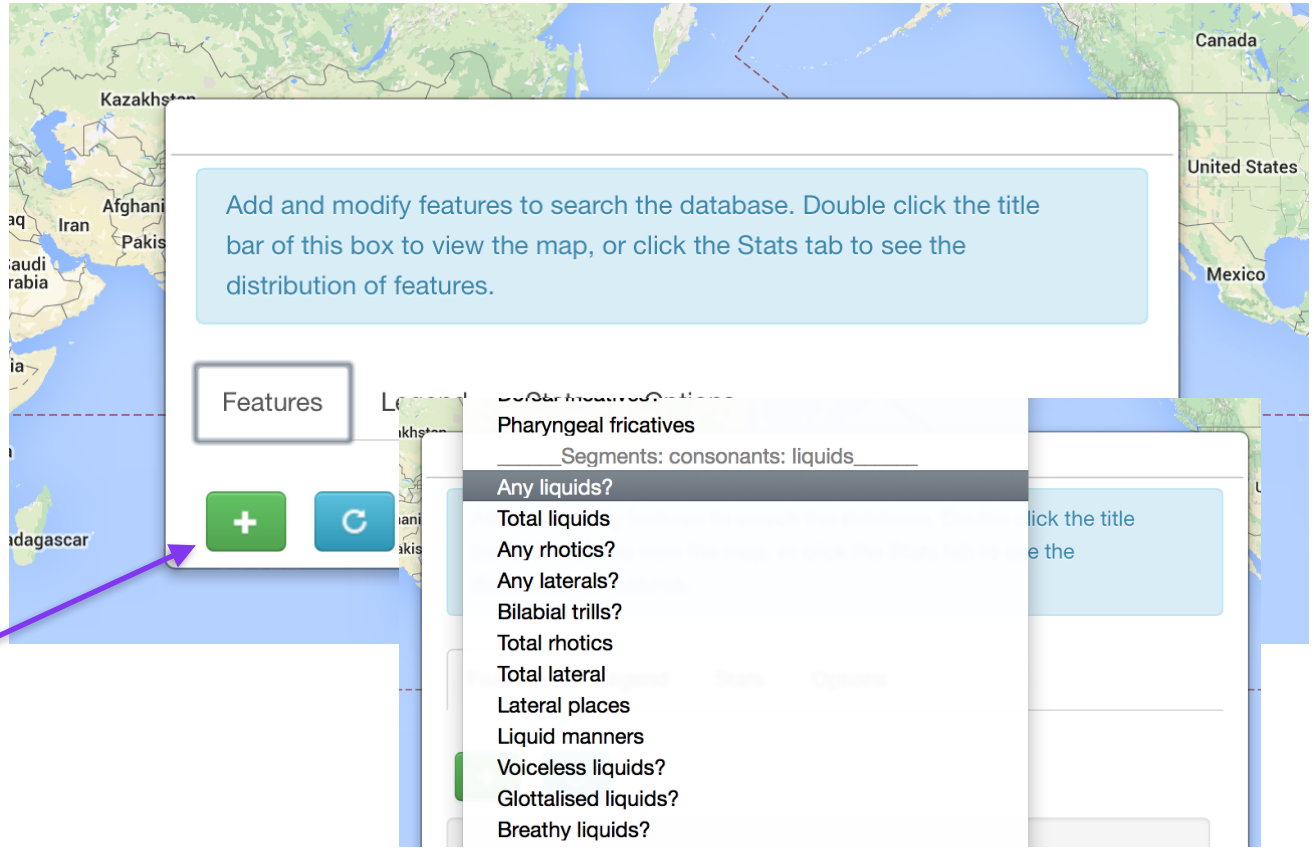
http://phonotactics.anu.edu.au/index.php



Then look through the features till you find segments

Cross-linguistic variation in sounds (called segments)

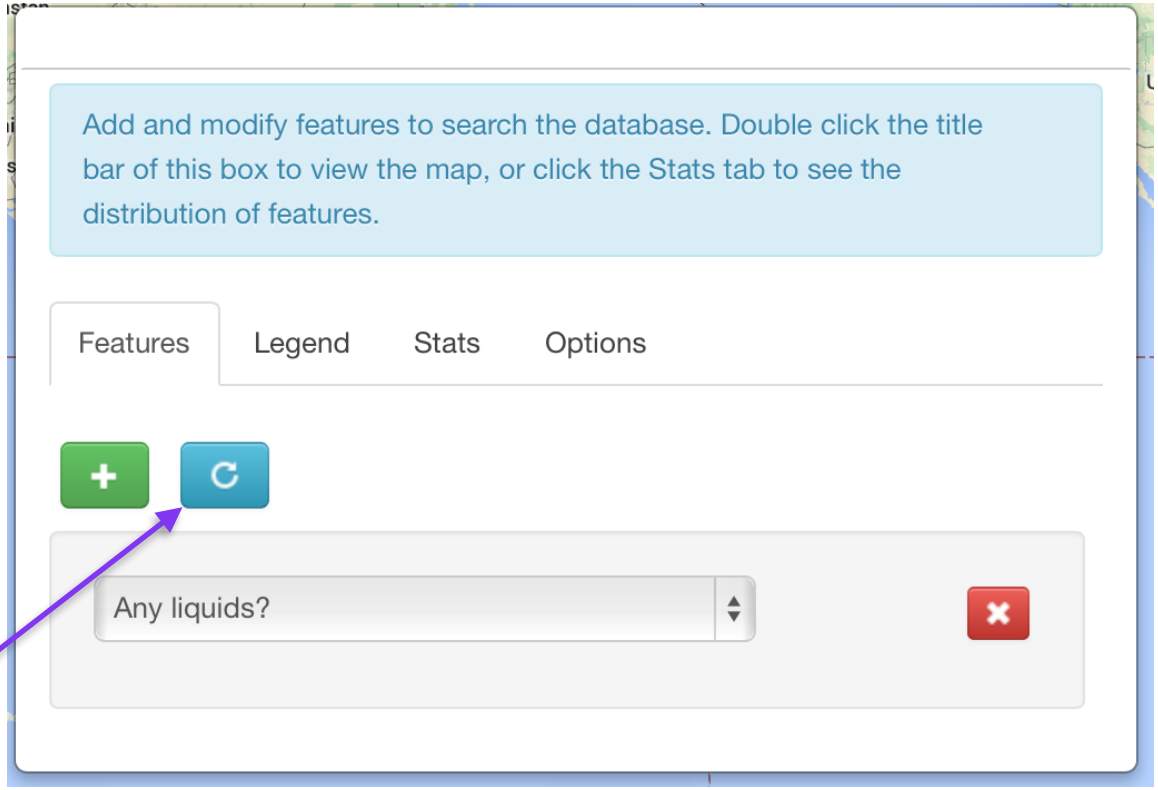
http://phonotactics.anu.edu.au/index.php



Select something of interest

Cross-linguistic variation in sounds (called segments)

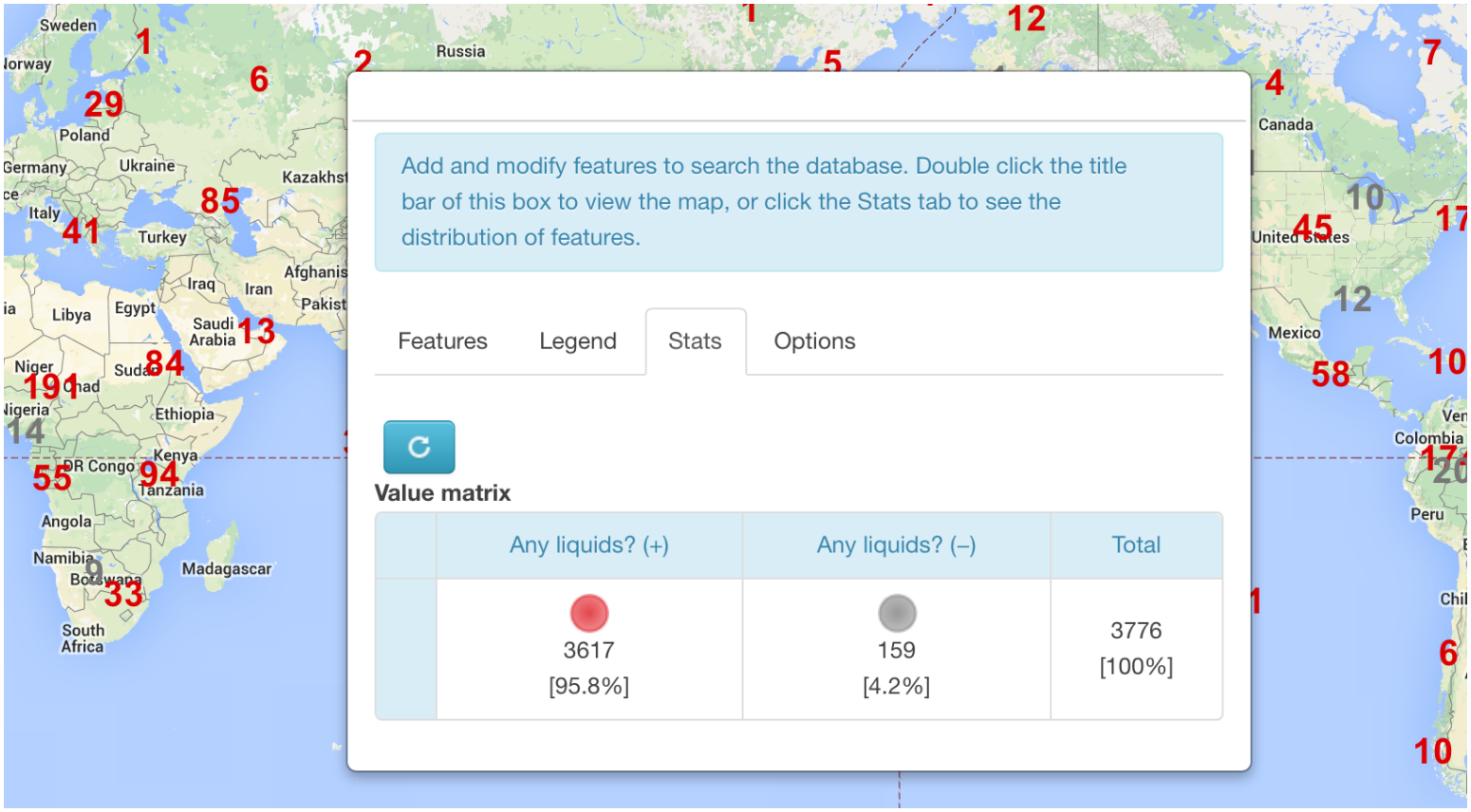
http://phonotactics.anu.edu.au/index.php



And see how the languages of the world look

Cross-linguistic variation in sounds (called segments)

http://phonotactics.anu.edu.au/index.php



The world's languages are full of lots of fun variation when it comes to the sounds they use.

Cross-linguistic variation in sounds

https://richardbeare.github.io/marijatabain/ipa_illustrations_all.html

Click on the pin on the map to identify the language and follow the link to the publication and recordings, where available. Languages marked with * have multiple pins.

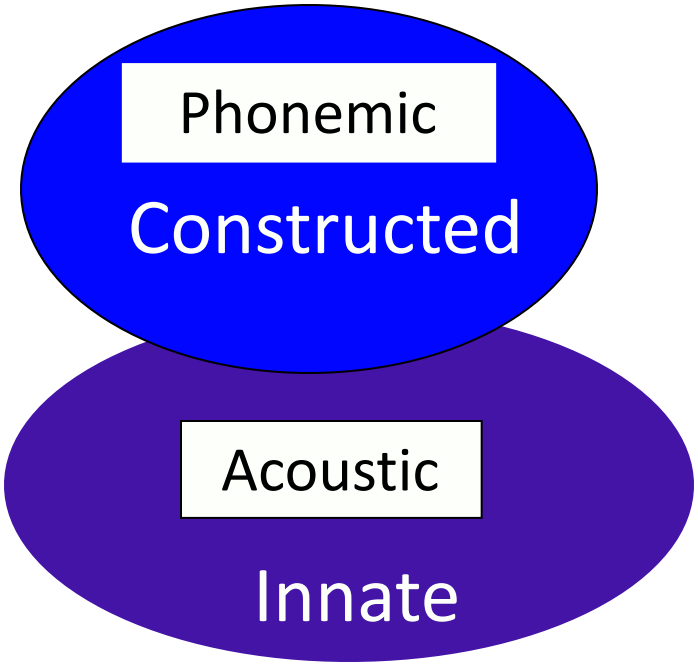
The world's languages are full of lots of fun variation when it comes to the sounds they use.

About speech perception

Important: Not all languages use the same contrastive sounds.

Children's task: Figure out what sounds their native language uses contrastively.

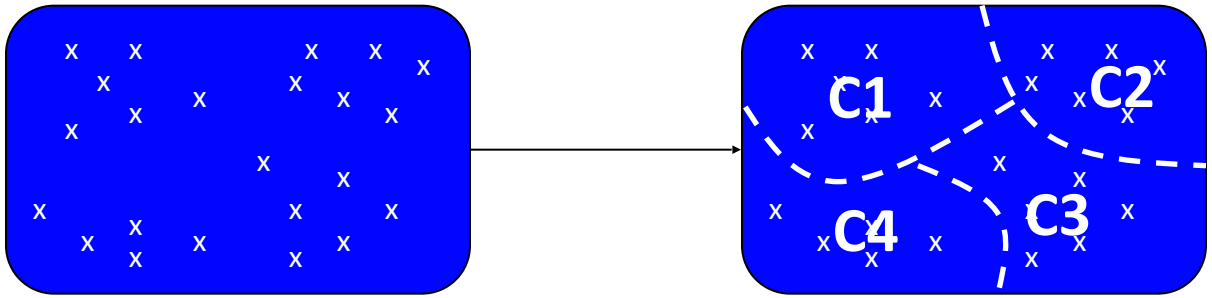
meaningful sounds in the language: "contrastive sounds" or phonemic contrasts



Speech perception: Computational problem

Divide sounds into contrastive categories (phonemes)

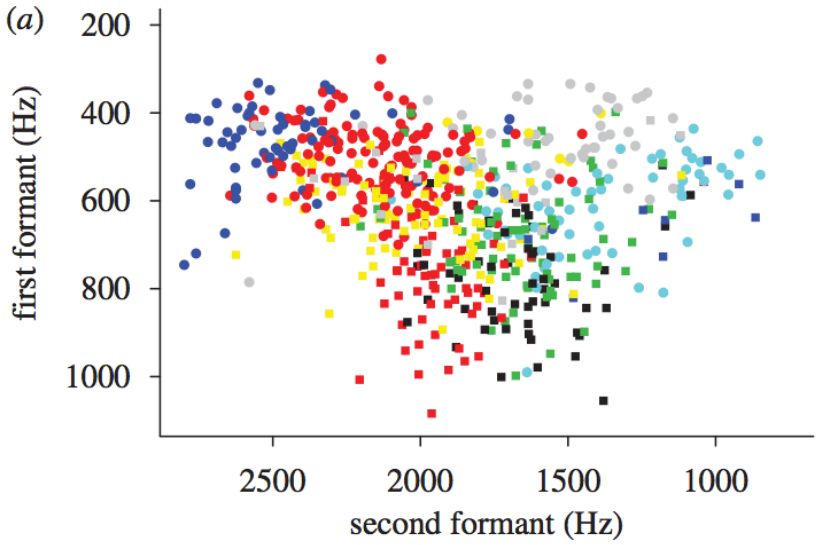
Here, 23 acoustically-different sounds are clustered into 4 contrastive categories.



Speech perception: Computational problem

Note:

Real life sounds are actually much harder because categories overlap.



Each color represents one vowel (that is, a sound perceived by native speakers as one vowel, like “oo” or “ee”).

Speech perception: Computational problem

Note:

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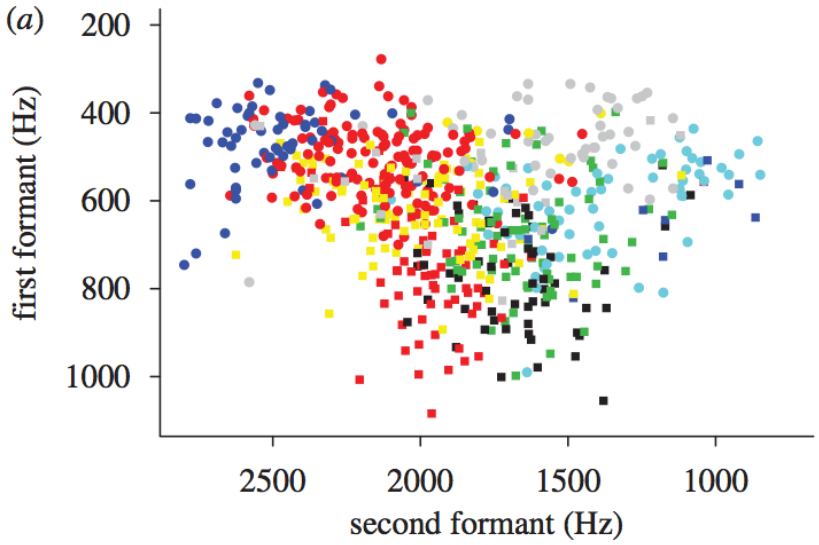

If you didn't know beforehand that this is how the sounds were divided out, it would be really hard to tell what category a sound belonged to!

Speech perception: Computational problem

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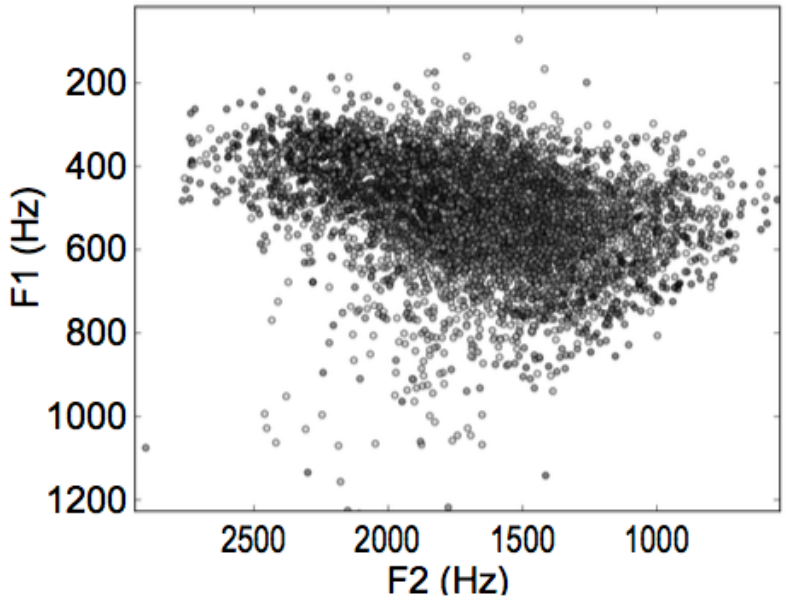

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Categorical perception

http://www.thelingspace.com/episode-4

https://www.youtube.com/watch?v=dtf8zGQj9GY

5:39-6:59

Categorical perception

Categorical perception occurs when a range of stimuli that differ continuously are perceived as belonging to only a few categories, with no degrees of difference within a given category.

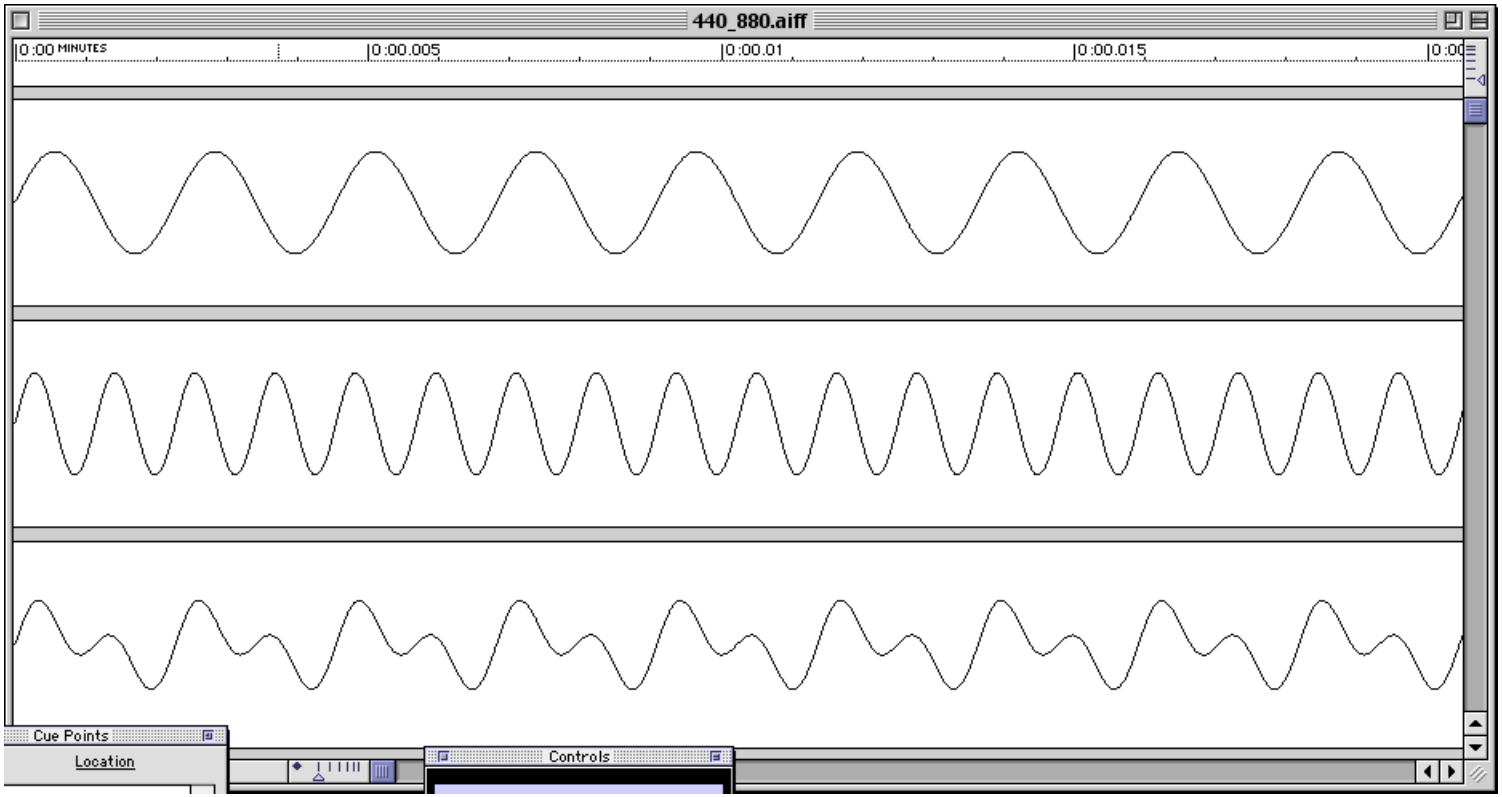
Actual stimuli

Perception of stimuli

Acoustic-level information

Includes: timing and frequency

Tones: frequency (close-up)

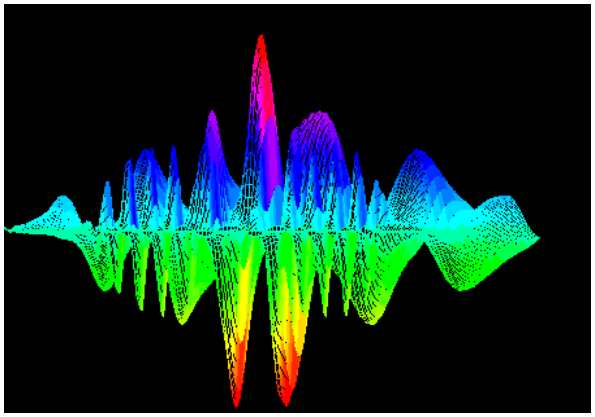


Acoustic-level information

Vowels combine acoustic energy at a number of different frequencies

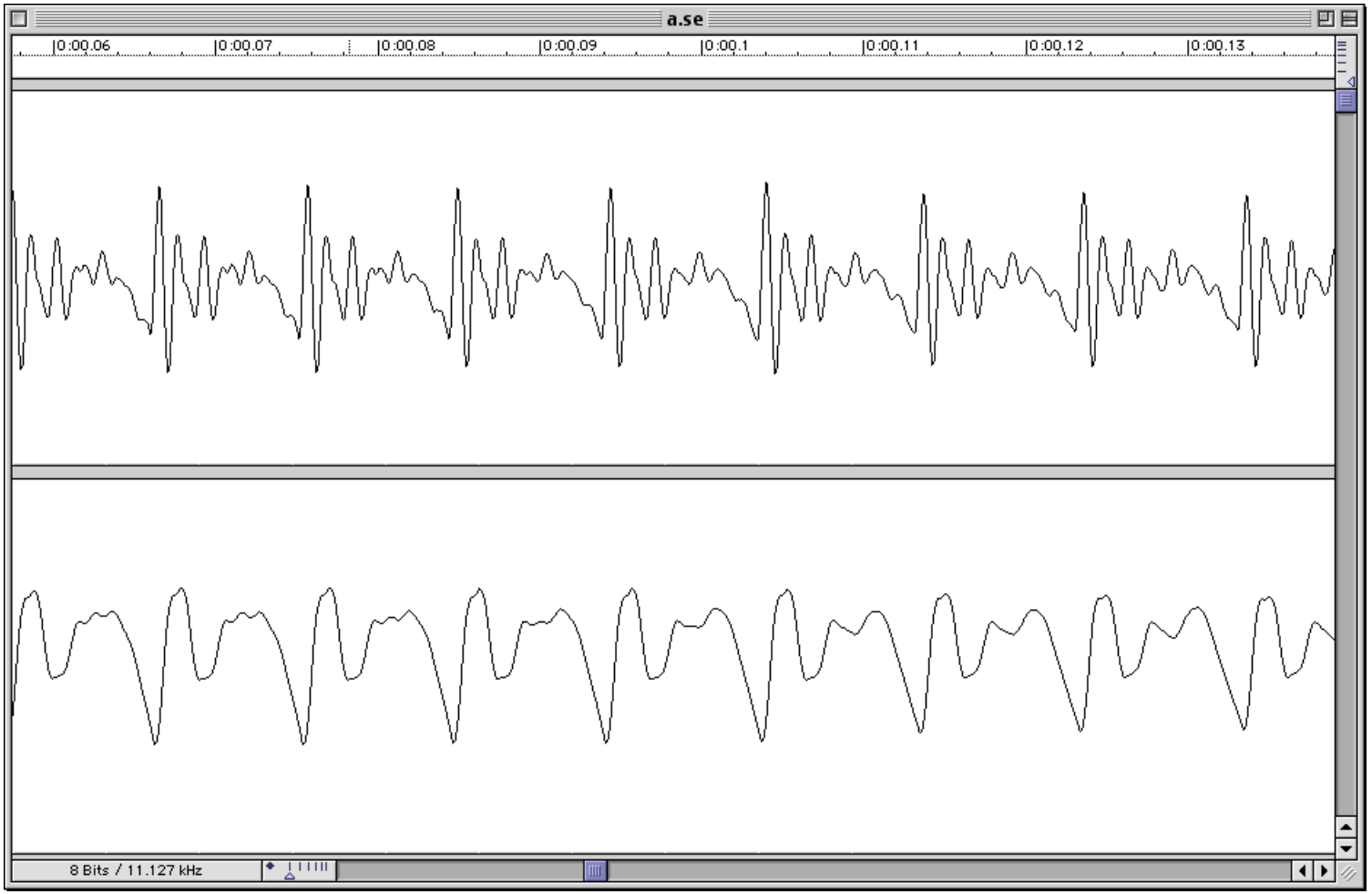
Different vowels ([a] “ah”, [i] “ee”, [u] “oo” etc.) contain acoustic energy at different frequencies

Listeners must (unconsciously) perform a ‘frequency analysis’ of vowels in order to identify them (*Fourier Analysis*)



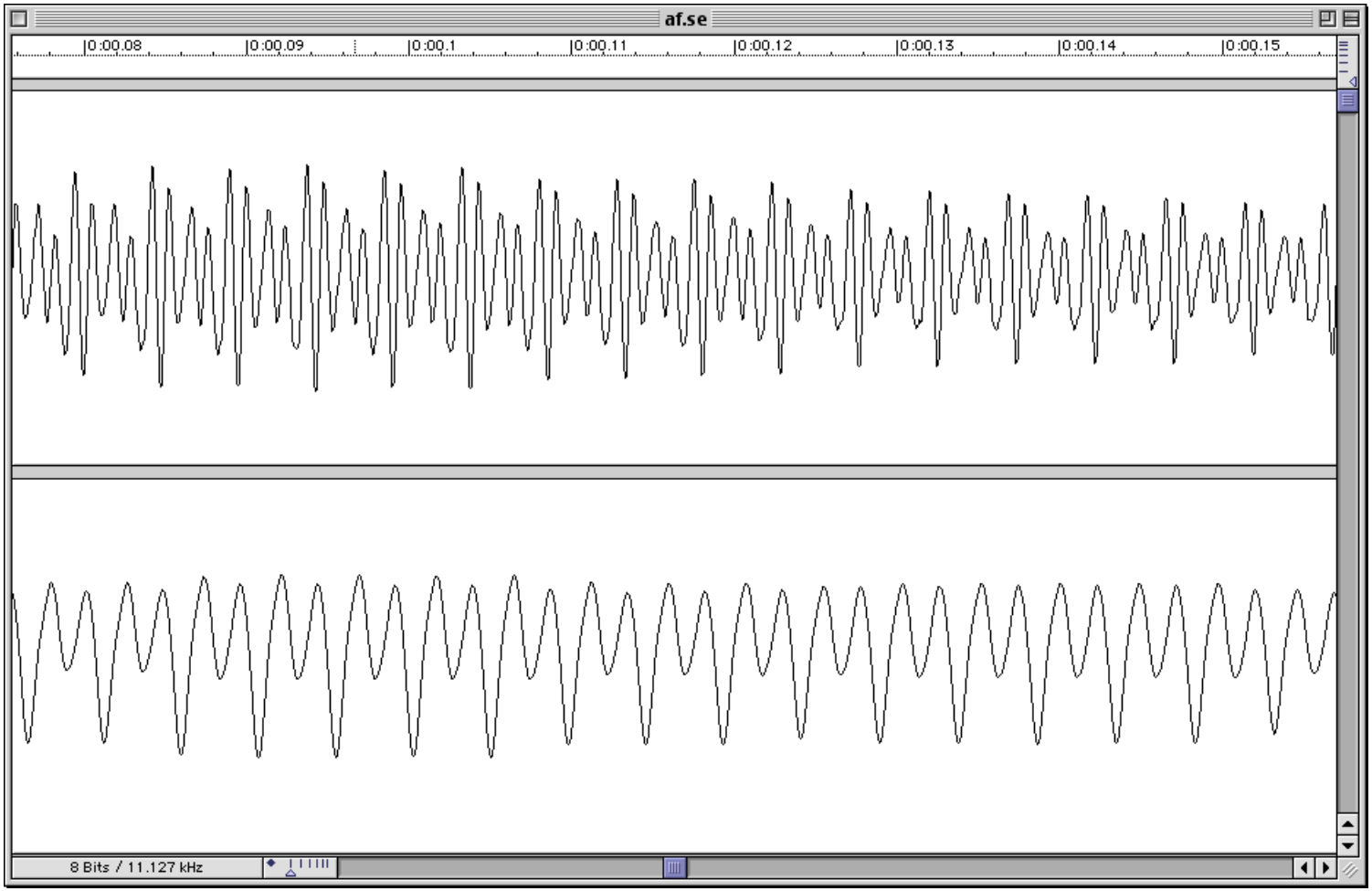
Acoustic-level information

Male Vowels (close up)



Acoustic-level information

Female Vowels (close up)

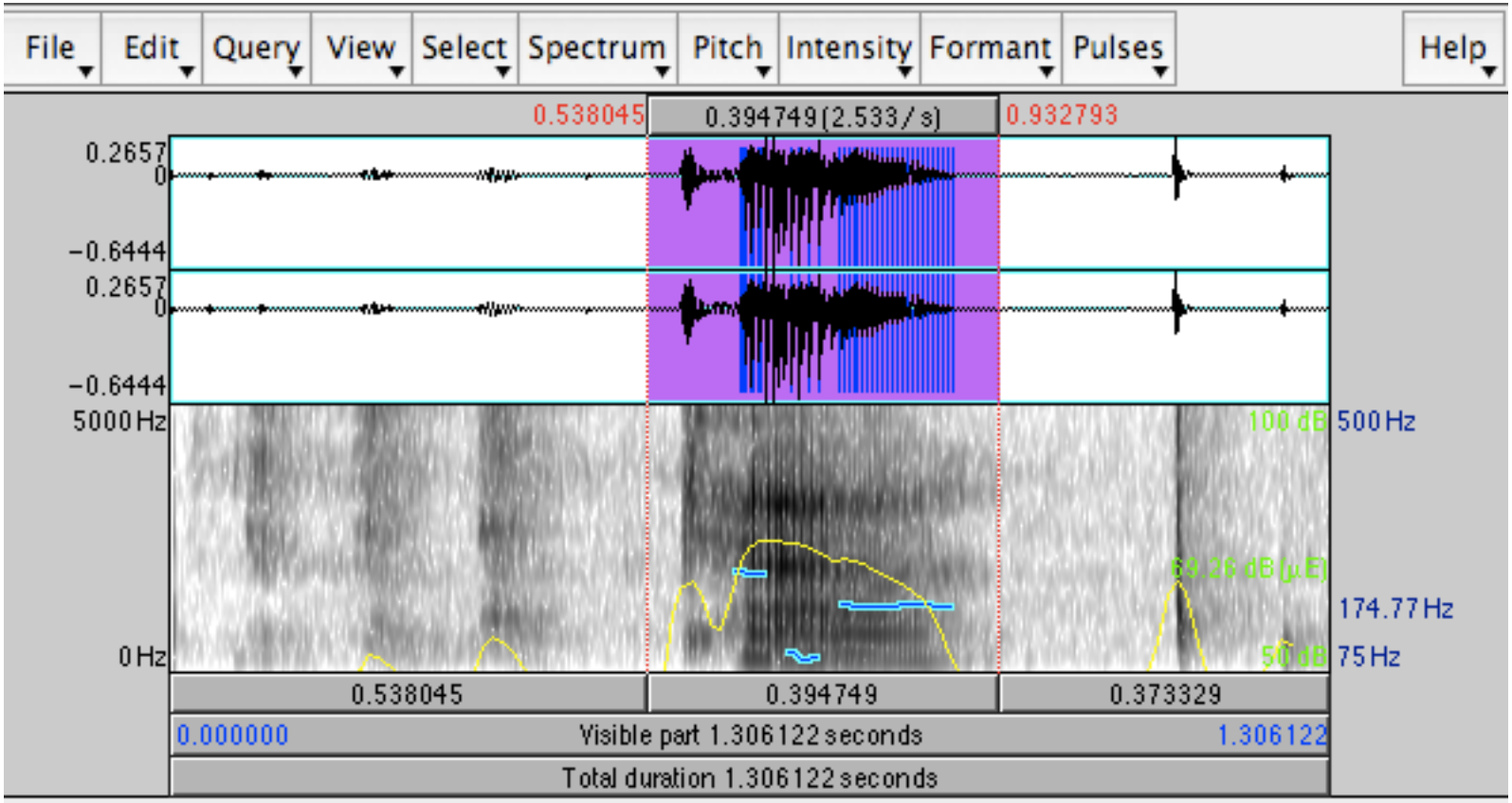


Synthesized speech

Allows for precise control of sounds

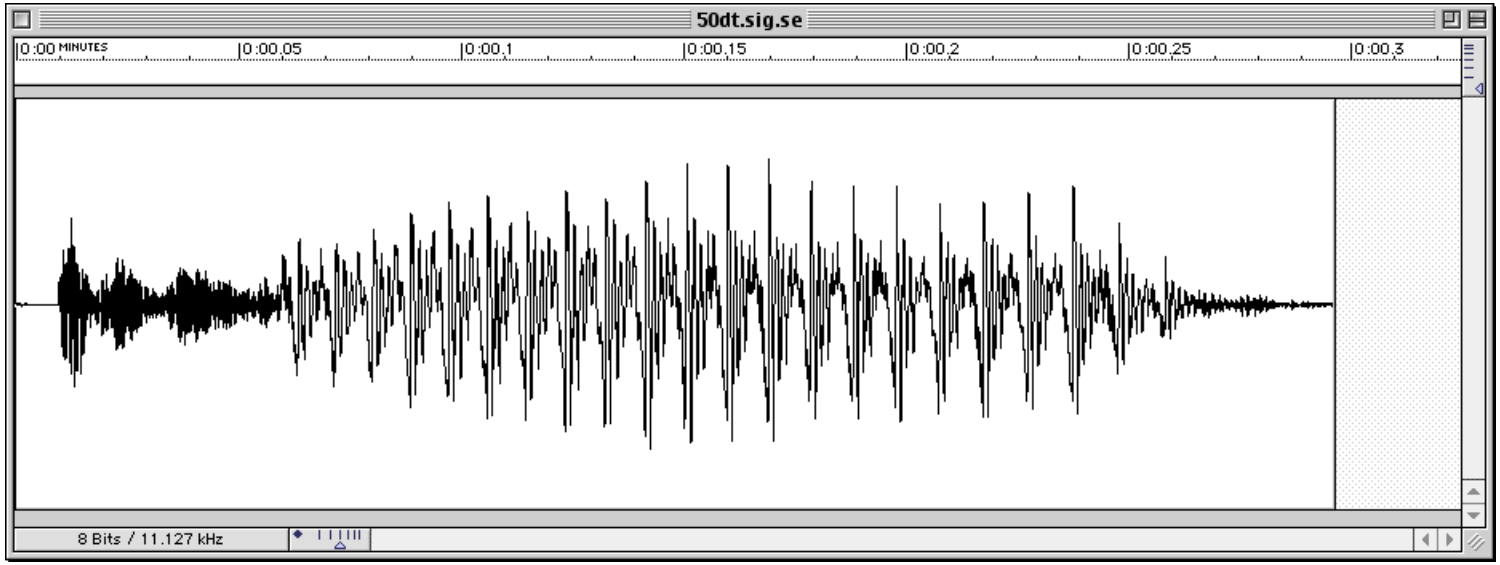
http://www.fon.hum.uva.nl/praat/
www.praat.org

Valuable tool for investigating perception: **Praat**



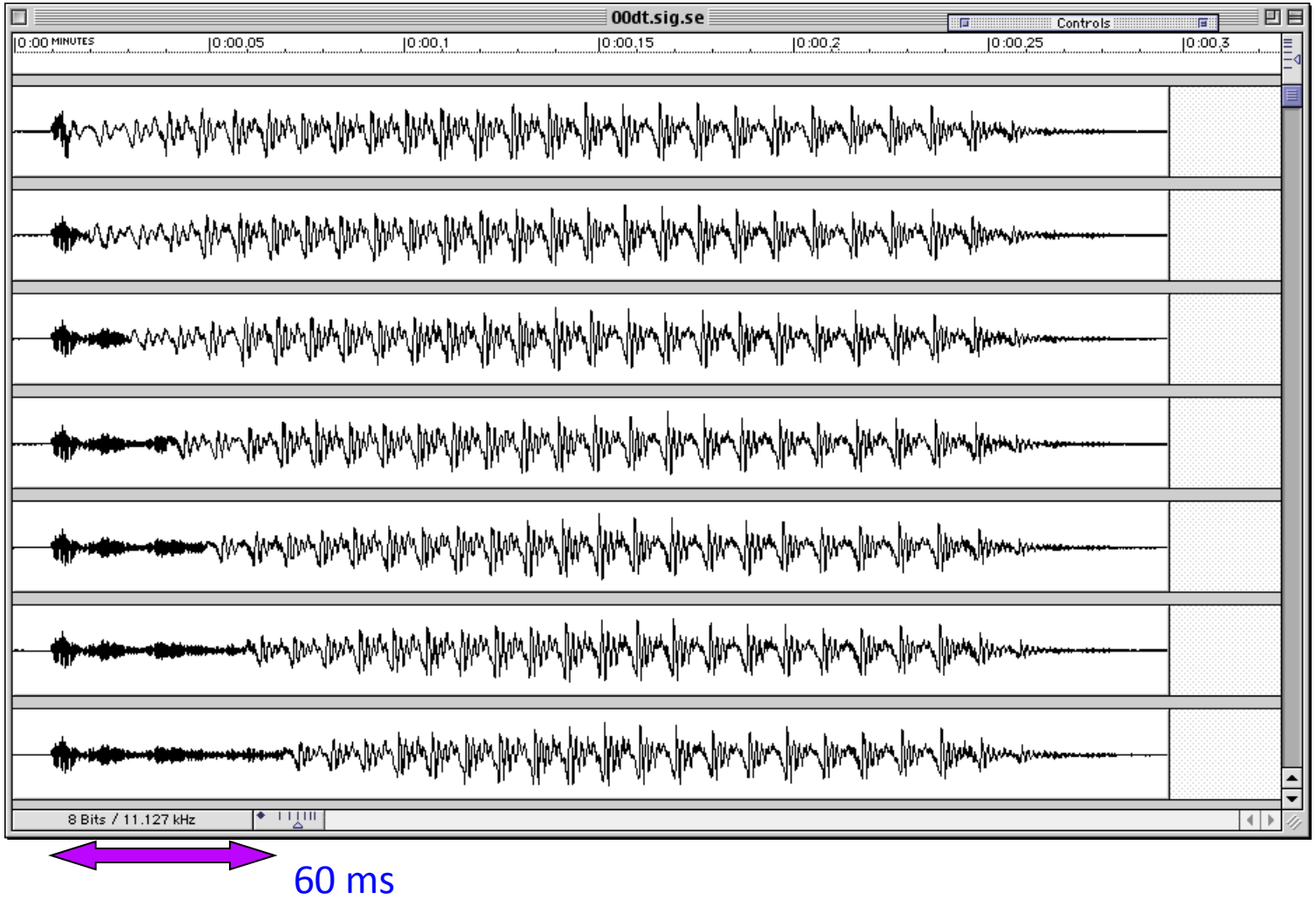
Acoustic-level information

Timing: Voicing



Acoustic-level information

Timing: Voice Onset Time (VOT)



English VOT production

Not uniform - there are 2 categories (distribution is bimodal)

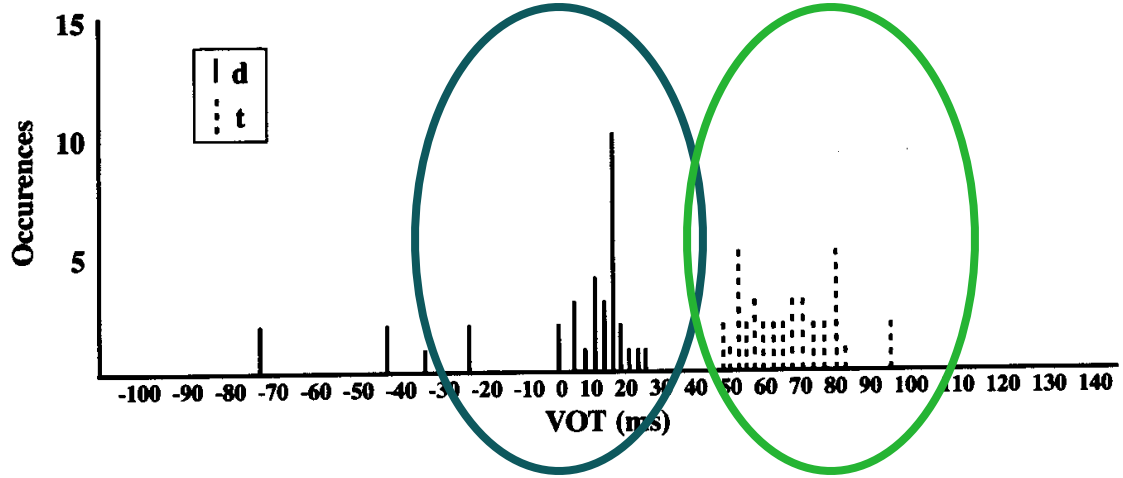
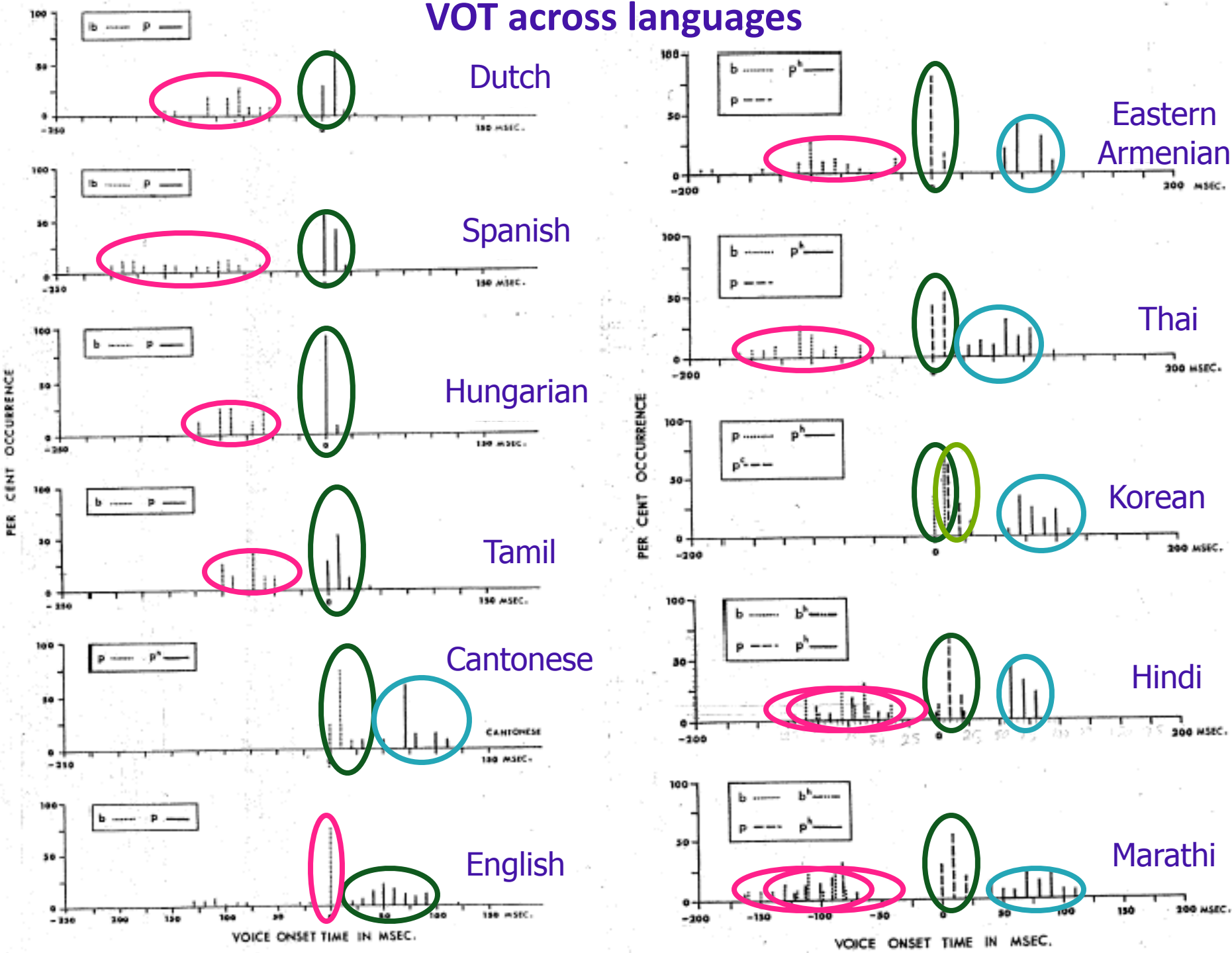


Figure 5–3. VOT productions of a single normal adult speaker of American English for words beginning with /d/ and /t/. (Figure adapted with permission from Blumstein, Cooper, Goodglass, Statlender, & Gottlieb, [1980]. Production Deficits in Aphasia: A Voice Onset-Time Analysis. *Brain and Language, 9*, 153–170. Copyright 1980 by Academic Press.)

Perception of stimuli: 2 categories

VOT across languages



Perceiving VOT:
Forced Choice Identification Task

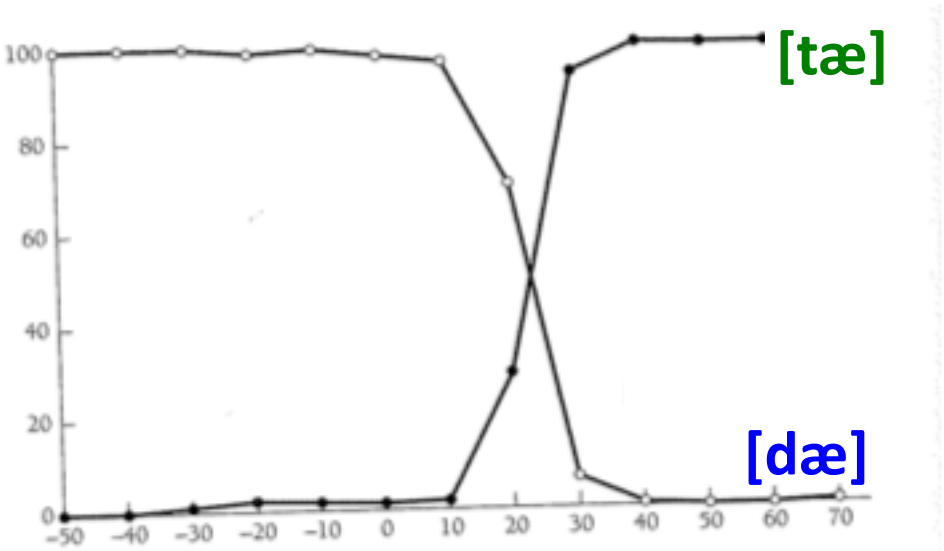
Forced choice identification is one common way to test for categorical perception: Have people listen to many examples of speech sounds and indicate which one of two categories each sound represents. (This is a two-way forced choice.)

Ex: “Is this sound a /dæ/ or a /tæ/?”

Categorical perception

Adult categorical perception: Voice Onset Time (VOT)

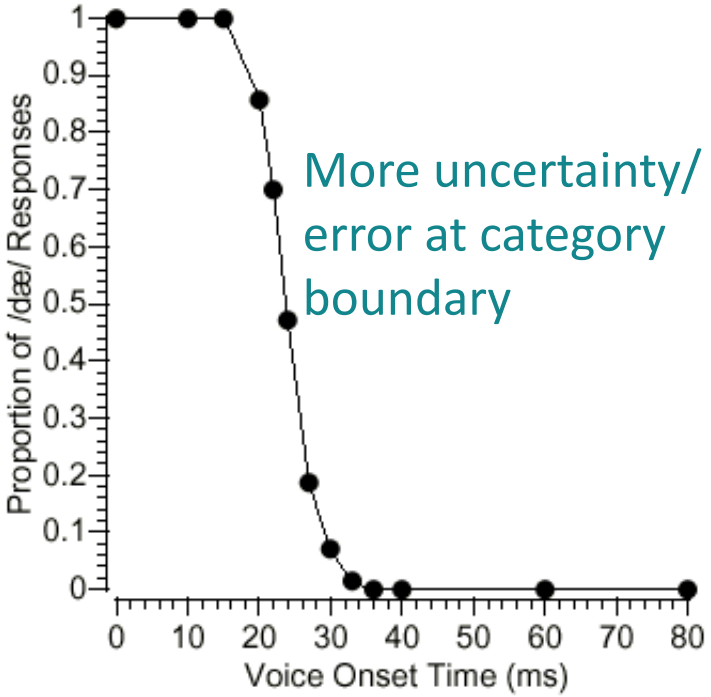
% of responses as either /tæ/ or /dæ/



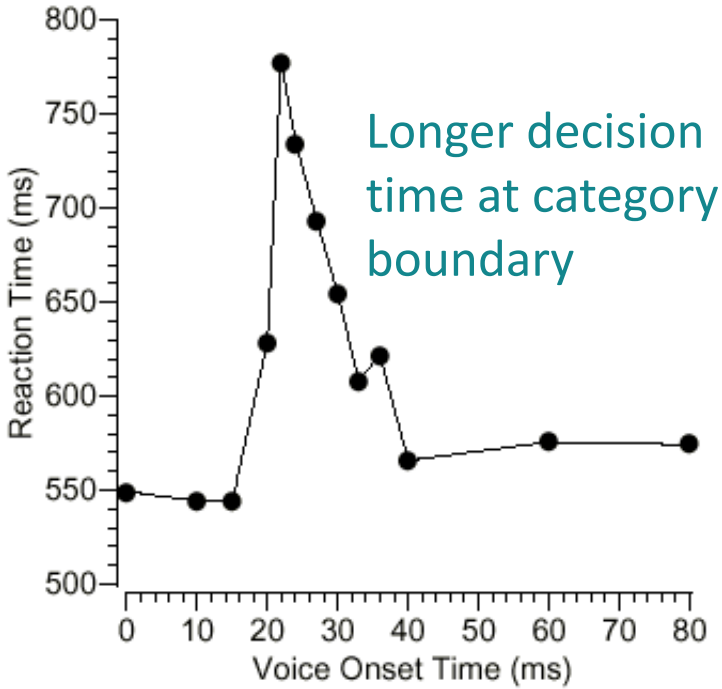
Even though the sounds change acoustically, it seems easy to decide which kind of sound is being heard, except in a few cases.

Perceiving VOT

'Categorical Perception': dæ **vs.** tæ



More uncertainty/ error at category boundary



Longer decision time at category boundary

Decision between d/t

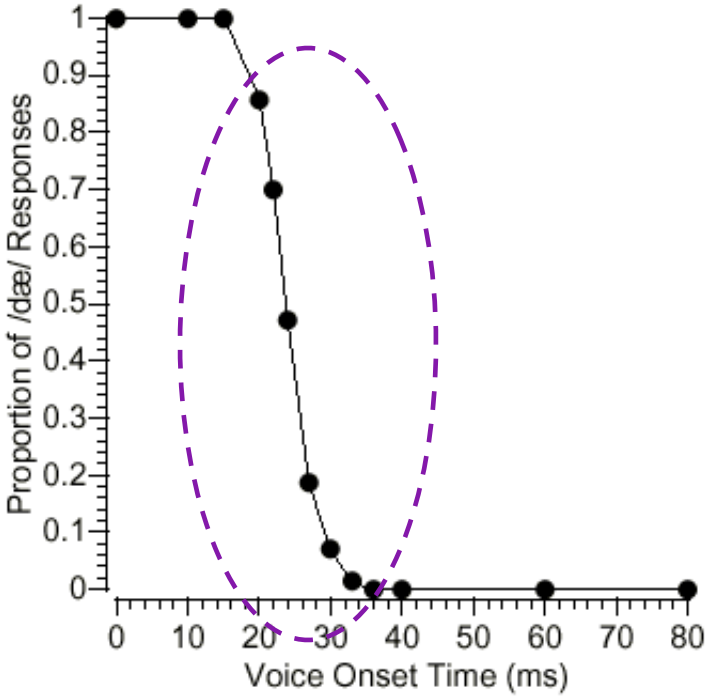
Time to make decision

Identification task:"Is this sound dæ **or** tæ **?"**

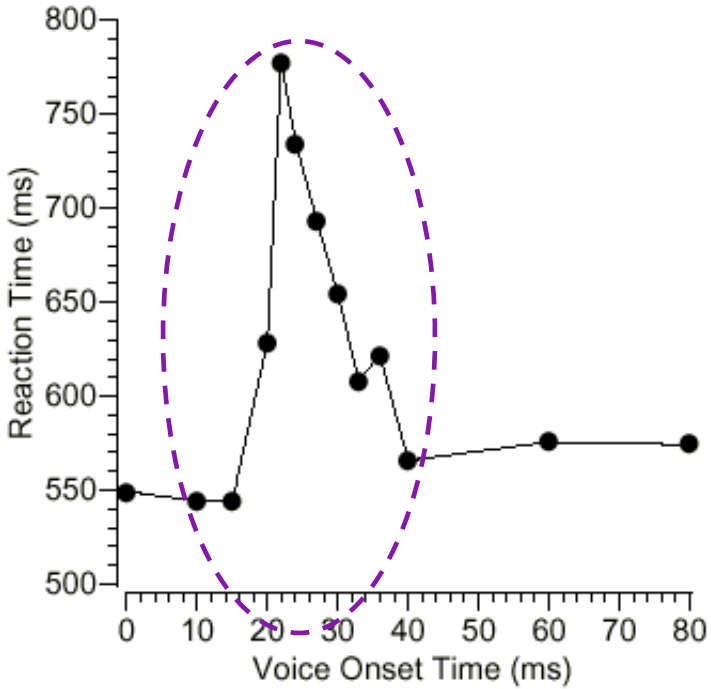
Categorical perception

Adult categorical perception: Voice Onset Time (VOT)

Uncertainty at category boundary



Decision between dæ/tæ



Time to make decision

Categorical perception

Other places where we don't seem to have categorical perception: pitch, intensity

http://sites.sinauer.com/languageinmind/wa04.07.html

Audio 1: Voice onset time (VOT)

The synthesized sounds in this clip illustrate VOT values at 0, 10, 20, 30, and 40.

Audio 2: Pitch

Each of the five sounds is a semitone lower in pitch than the sound immediately following it.

Audio 3: Intensity

The five sounds are separated by increments of 3 decibels.

Discrimination task
"Are these two sounds the same or different?"

Same/Different
0ms 60ms

Same/Different
0ms 10ms

Why is this pair difficult?

(i) Acoustically similar?

(ii) Same Category?

Same/Different
40ms 40ms

Discrimination task

"Are these two sounds the same or different?"

D	0ms	20ms	D
D	20ms	40ms	T
T	40ms	60ms	T

Across-category discrimination is easy

Within-category discrimination is hard

Cross-language differences

R L

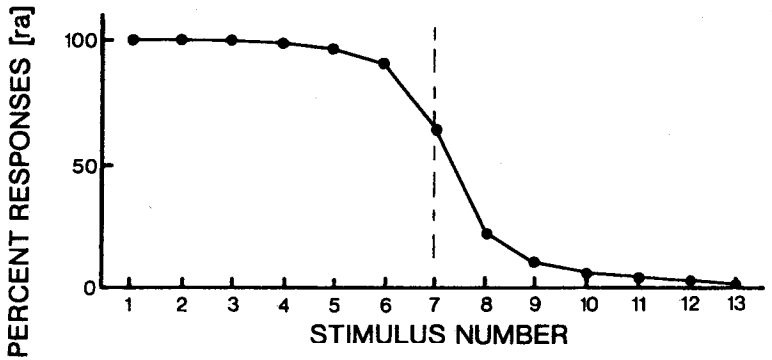
R L

Cross-language differences

Identification task:
"Which sound is this?"

English speakers can discriminate r and l, and seem to show a similar pattern of categorical perception to what we saw for d vs. t

Miyawaki et al. 1975



R ----------> L

Cross-language differences

Discrimination task: “Are these sounds the same or different?”

English speakers have higher performance at the r/l category boundary, where one sound is perceived as r and one sound is perceived as l. Japanese speakers generally perform poorly (at chance), no matter what sounds are compared because r and l are not contrastive for them.

Miyawaki et al. 1975

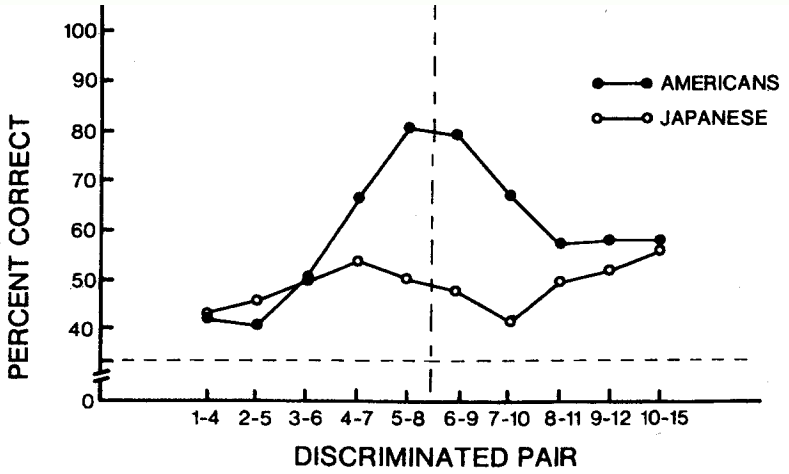


Figure 12.2. Test of the categorical perception of /ra/ and /la/ by American and Japanese adults. American listeners show the characteristic peak in discrimination at the phonetic boundary; Japanese listeners do not. (From Miyawaki et al., 1975.)

Cross-language differences

Hindi

dental [d]

(tip of tongue touches back of teeth)

retroflex [D]

(tongue curled so tip is behind alveolar ridge)

English [d] is usually somewhere between these

?

Cross-language differences

Salish
(Native North American language):
glotalized voiceless stops

Uvular – tongue is raised against the velum

Velar – tongue is raised behind the velum

(they are actually ejectives - ejectives are produced by obstructing the airflow by raising the back of the tongue against or behind the velum)

Perceiving sound contrasts

Kids…

This ability to distinguish sound contrasts extends to phonemic contrasts that are non-native. (Japanese infants can discriminate contrasts used in English but that are not used in Japanese, like r/l.) This goes for both vowels and consonants.

…vs. adults

Adults generally can't, especially without training - even if the difference is quite acoustically strong.

So when is this ability lost?

And what changes from childhood to adulthood?

Recap: Speech perception

One task for children is to figure out the contrastive sound categories (phonemes) for their language.

Categorical perception will occur once sounds are grouped into these contrastive sound categories - even though the sounds within a category differ acoustically, these language sounds will be perceived as being the same.

Children (and infants especially) seem to be much better at this than adults.

Next time: What's going on developmentally?

Questions?

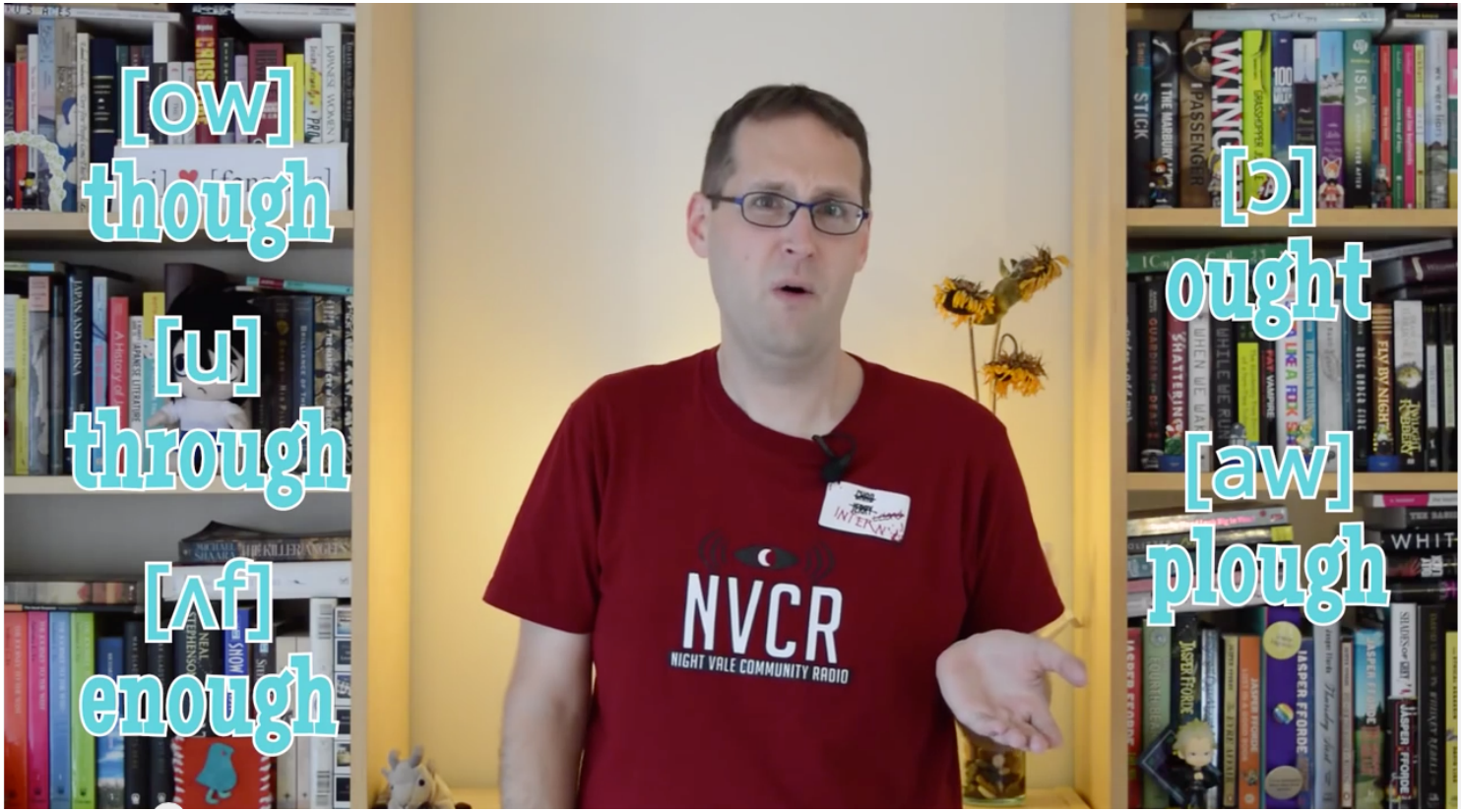
You should be able to do up through question 8 on the sounds review questions, and up through question 1 on HW2.

Extra Material

Forget spelling

https://www.youtube.com/watch?v=XTzkT3j9pHI
http://www.thelingspace.com/episode-12

beginning through 2:27



Courtesy of http://www.spellingsociety.org/news/media/poems.php

Our Strange Lingo, by Lord Cromer (1902)

When the English tongue we speak.
Why is break not rhymed with freak?
Will you tell me why it's true
We say sew but likewise few?
And the maker of the verse,
Cannot rhyme his horse with worse?
Beard is not the same as heard
Cord is different from word.
Cow is cow but low is low
Shoe is never rhymed with foe.
Think of hose, dose, and lose
And think of goose and yet with choose
…

Courtesy of http://www.spellingsociety.org/news/media/poems.php

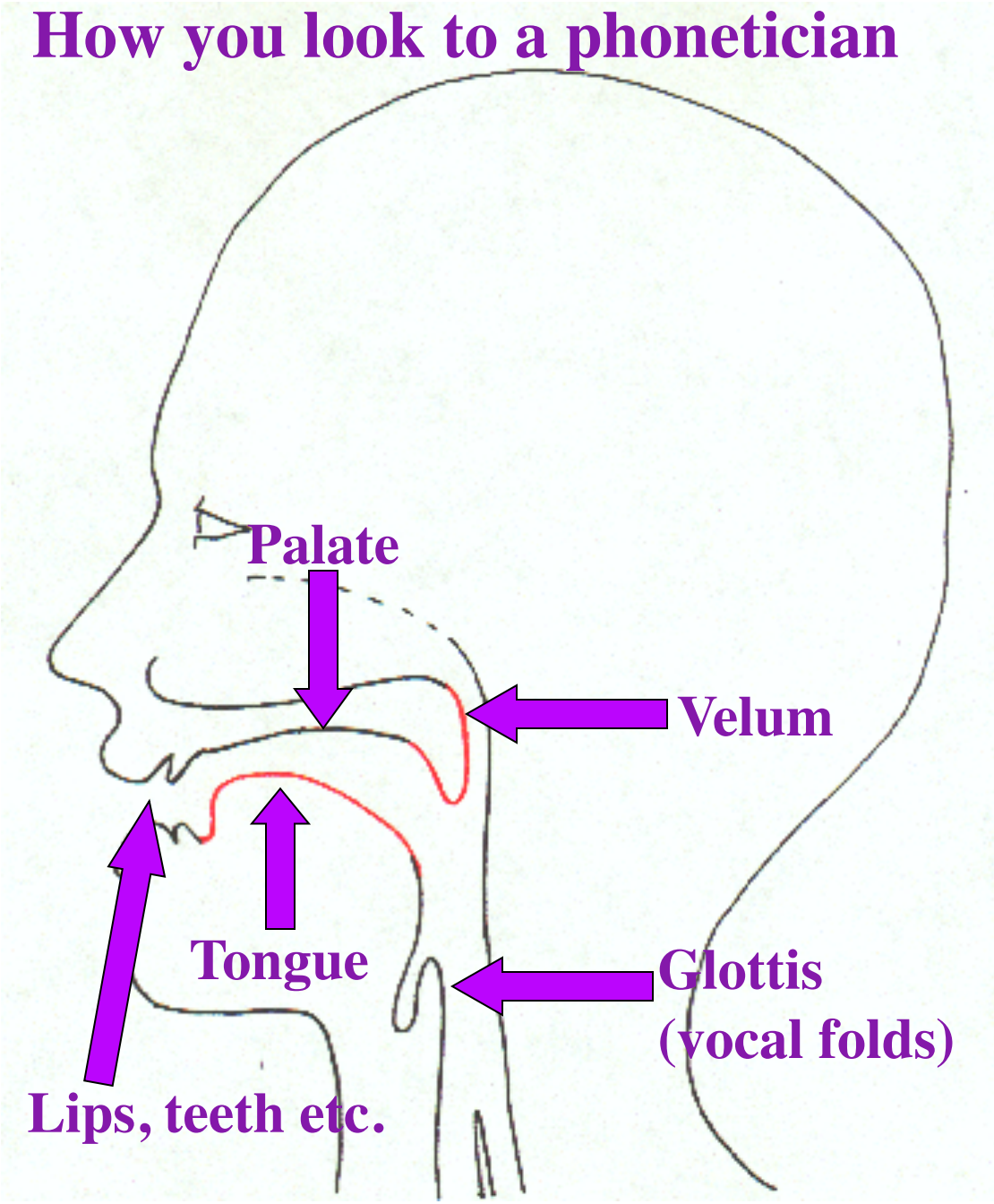
…
Think of comb, tomb and bomb,
Doll and roll or home and some.
Since pay is rhymed with say
Why not paid with said I pray?
Think of blood, food and good.
Mould is not pronounced like could.
Wherefore done, but gone and lone -
Is there any reason known?
To sum up all, it seems to me
Sound and letters don't agree.

Sounds: Vocal tract overview

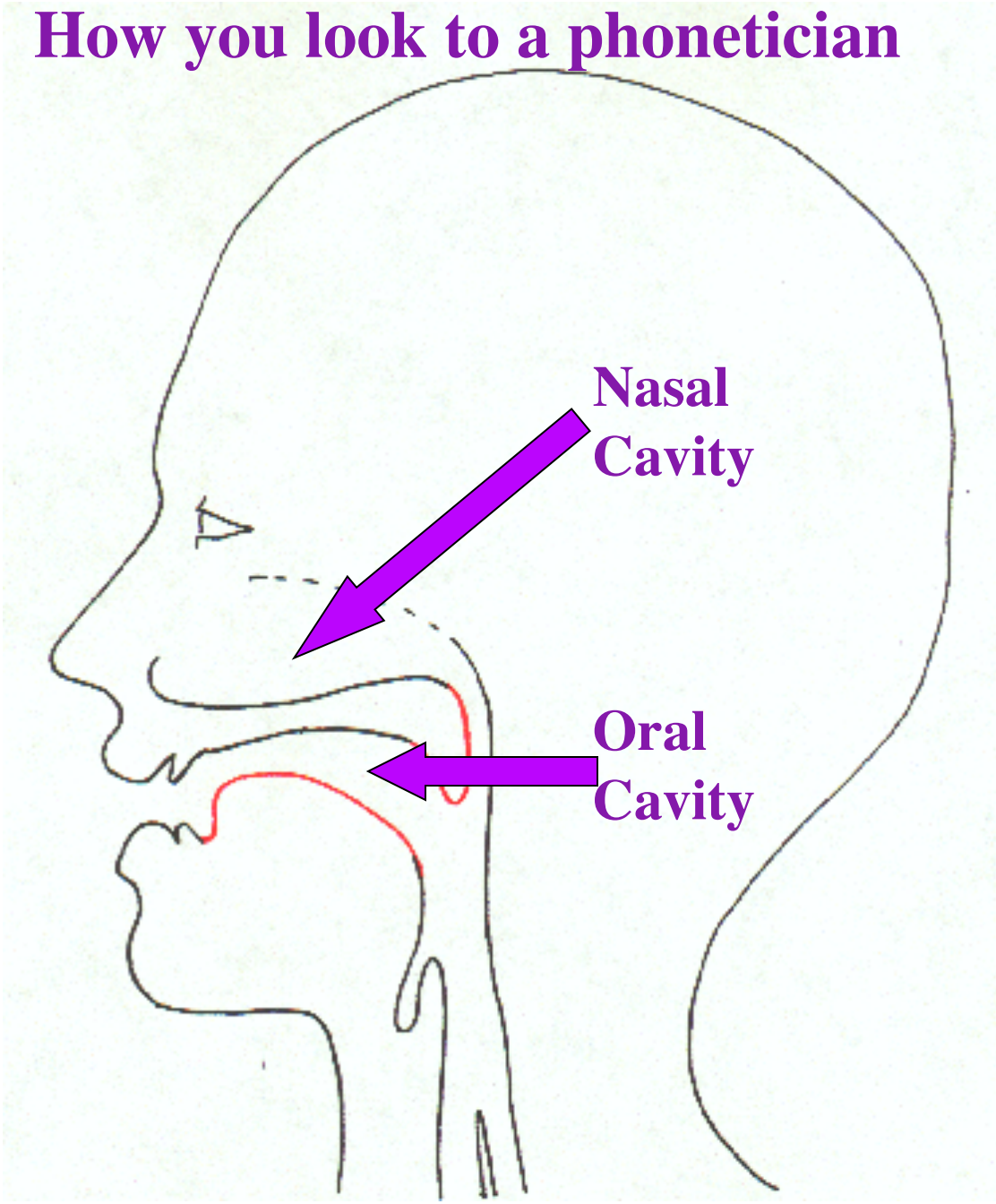
https://www.youtube.com/watch?v=dtf8zGQj9GY
http://www.thelingspace.com/episode-4

0:38 through 1:17

How you look to a phonetician



How you look to a phonetician



Major division: consonants vs vowels

Consonantal sounds: narrow or complete closure somewhere in the vocal tract.

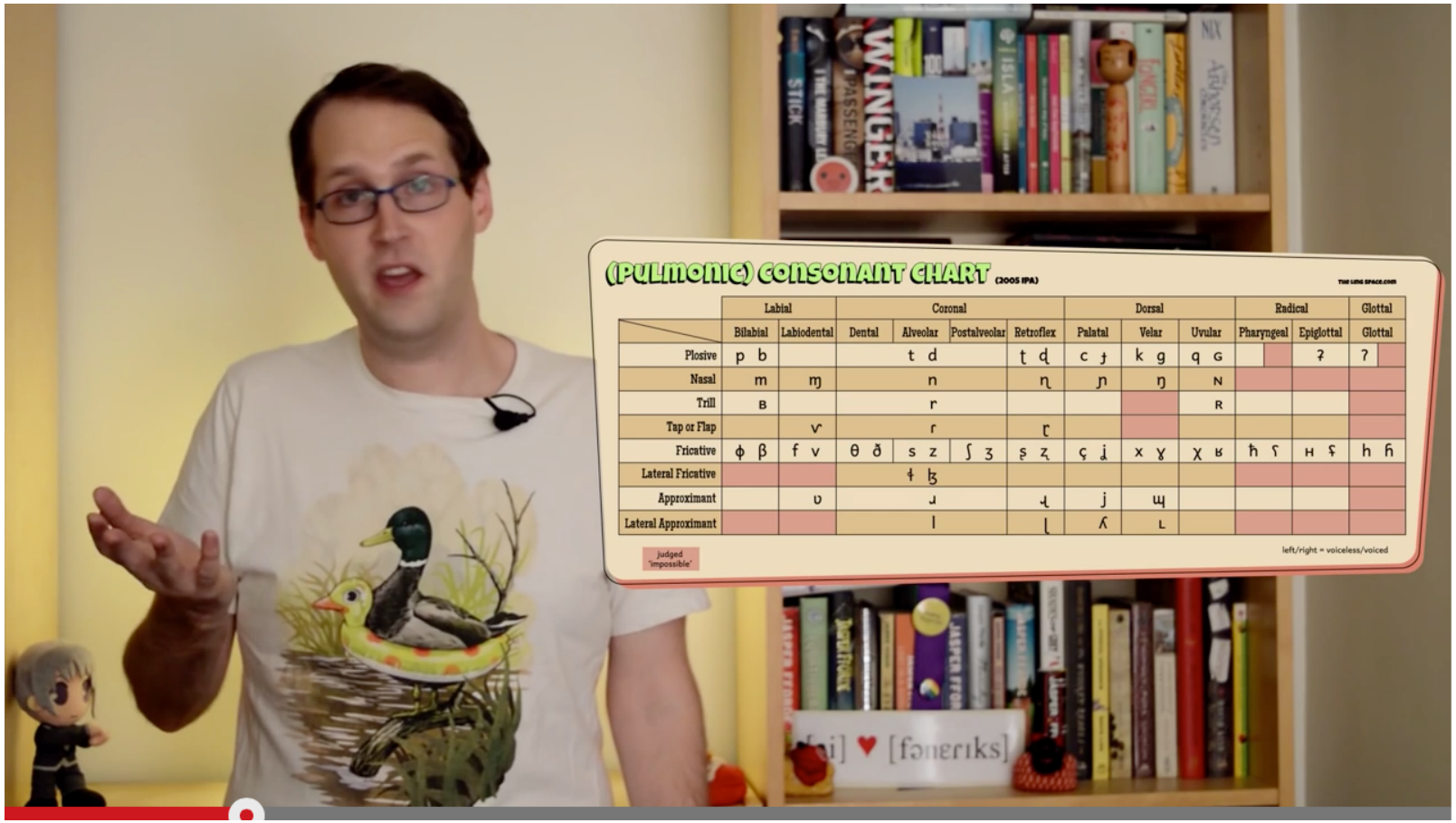
Vowels: very little obstruction in the vocal tract. Can form the basis of syllables (also possible for some consonants).

Consonants

Place of articulation: Where the airflow is blocked

https://www.youtube.com/watch?v=zEaPQP3pXQc
http://www.thelingspace.com/episode-20

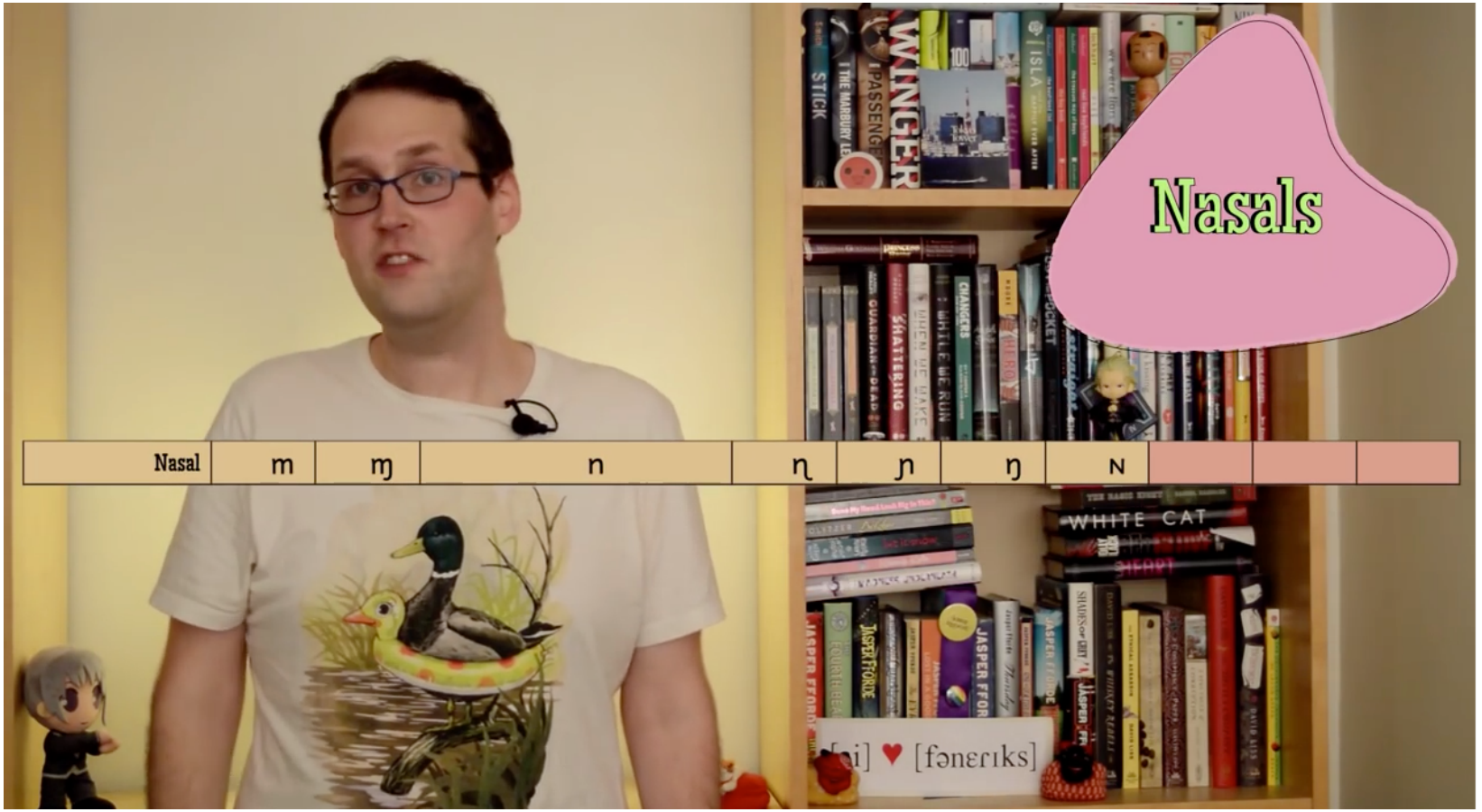
beginning through 5:53



Manner of articulation: How the airflow is blocked

https://www.youtube.com/watch?v=zEaPQP3pXQc
http://www.thelingspace.com/episode-20

beginning through 5:54 - 9:19



Manner: How the air is flowing

Stops (sometimes called plosives)

[p] [t] [k] [b] [d] [g] [m] [n] [ŋ]

Fricatives

[f] [v] [θ] [ð] [s] [z] [ʃ] [ʒ]

Approximants/Glides

[w] [j] (Like in “water” and “you”)

Liquids

[ɹ] [l]

Tap/Flap

[ɾ] (Like in “water” and “butter”)

Fricatives & Affricates

Postalveolar sounds [ʒ] [ʃ] (fricatives)

Palatal sounds [dʒ] [tʃ] (affricates)

Affricates - combination of stop + fricative - [dʒ] [tʃ], as in *judge*, *church*

Ex: affricates in fast speech:

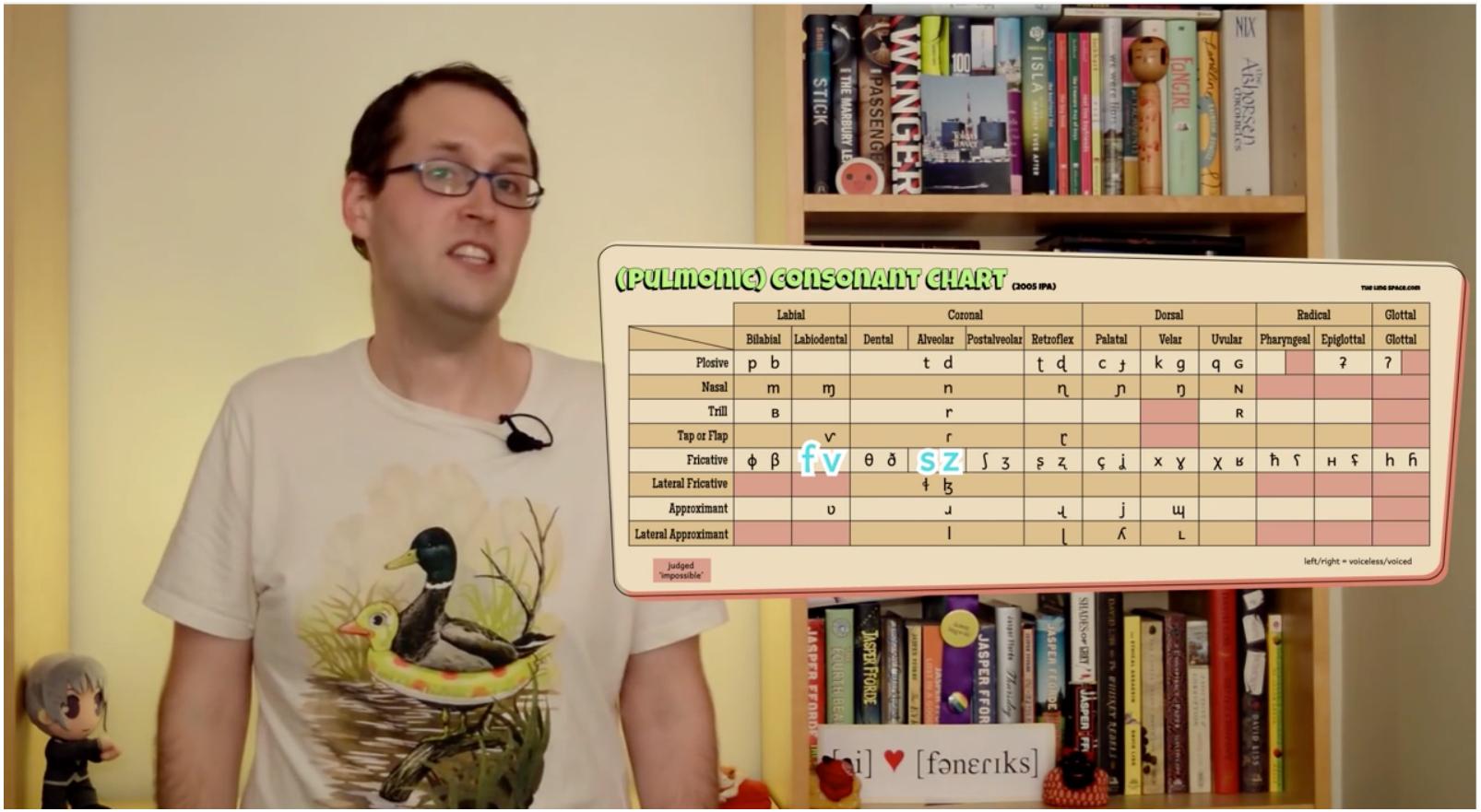
"What should…?"
[t ʃ]
becomes "Whachould…?"

"What did you…?"
[d j]
becomes "What did zha…?"
[d ʒ]
becomes "Whaja…?"

Voicing: What the vocal folds are doing

https://www.youtube.com/watch?v=zEaPQP3pXQc
http://www.thelingspace.com/episode-20

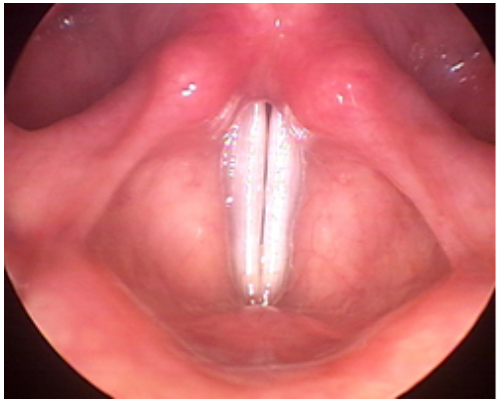
beginning through 9:20 - 9:52



What are the vocal folds doing?

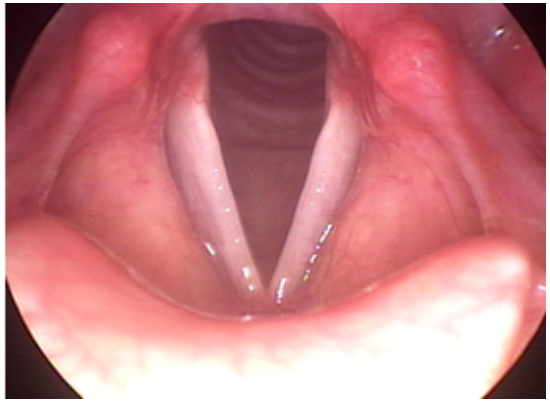
closed

voiced



open

voiceless



"The air leaves the lungs through the trachea (windpipe), which opens into the larynx (the voice-box, visible on the outside as the Adam's apple). The larynx is a valve consisting of an opening (the glottis) covered by two flaps of retractable muscular tissue called the vocal folds…The vocal folds can also be partly stretched over the glottis to produce a buzz as the air rushes past." - Pinker, *The Language Instinct*

Voiced & Voiceless consonants

Consonants are either voiced or voiceless.

English pairs:

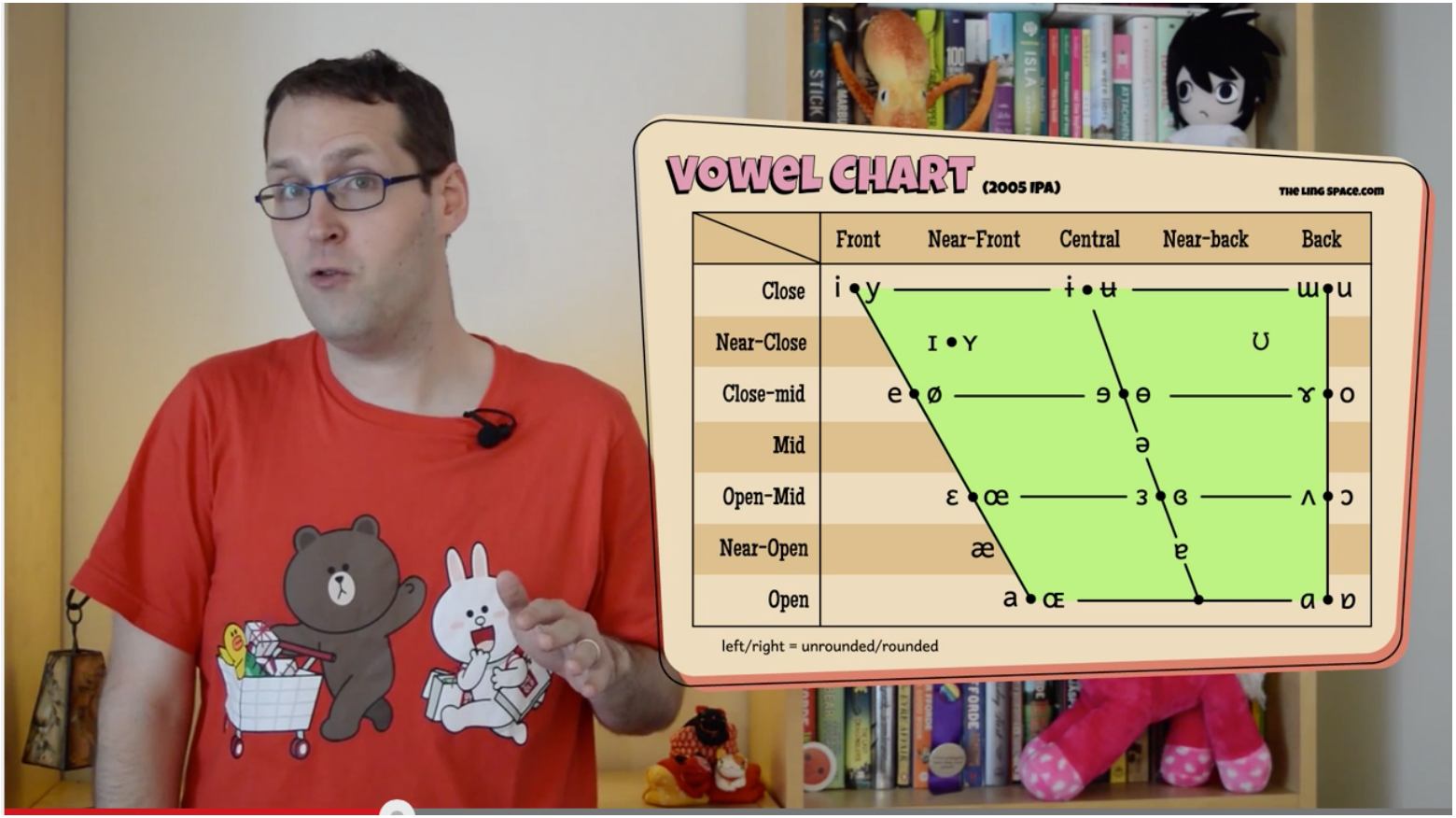
b p	v f	d t	
z s	ð θ	ʃ ʒ	tʃ dʒ

Vowels

Vowels

https://www.youtube.com/watch?v=arMntA15A0s
http://www.thelingspace.com/episode-27

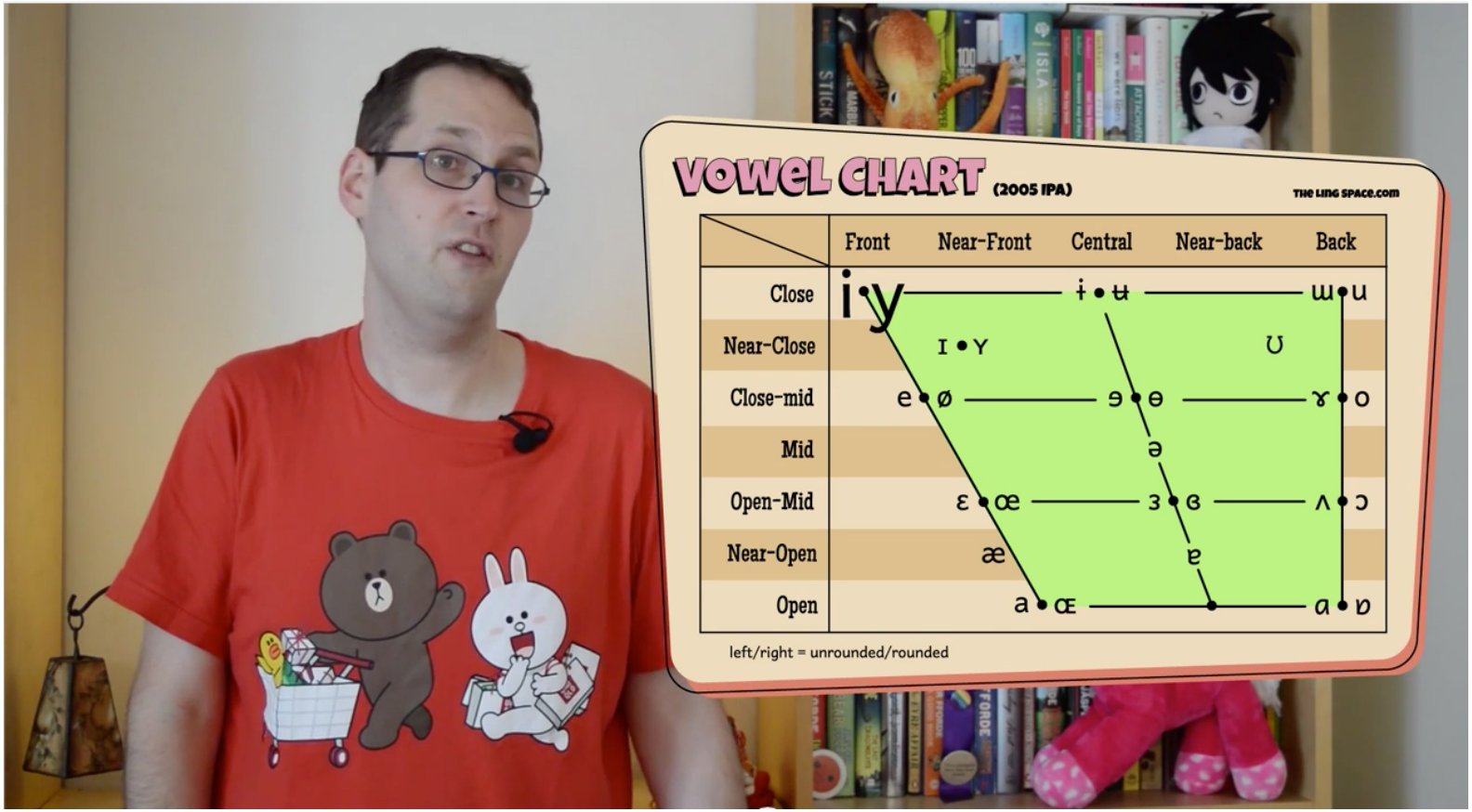
beginning through 4:10



Cross-language differences

https://www.youtube.com/watch?v=arMntA15A0s
http://www.thelingspace.com/episode-27

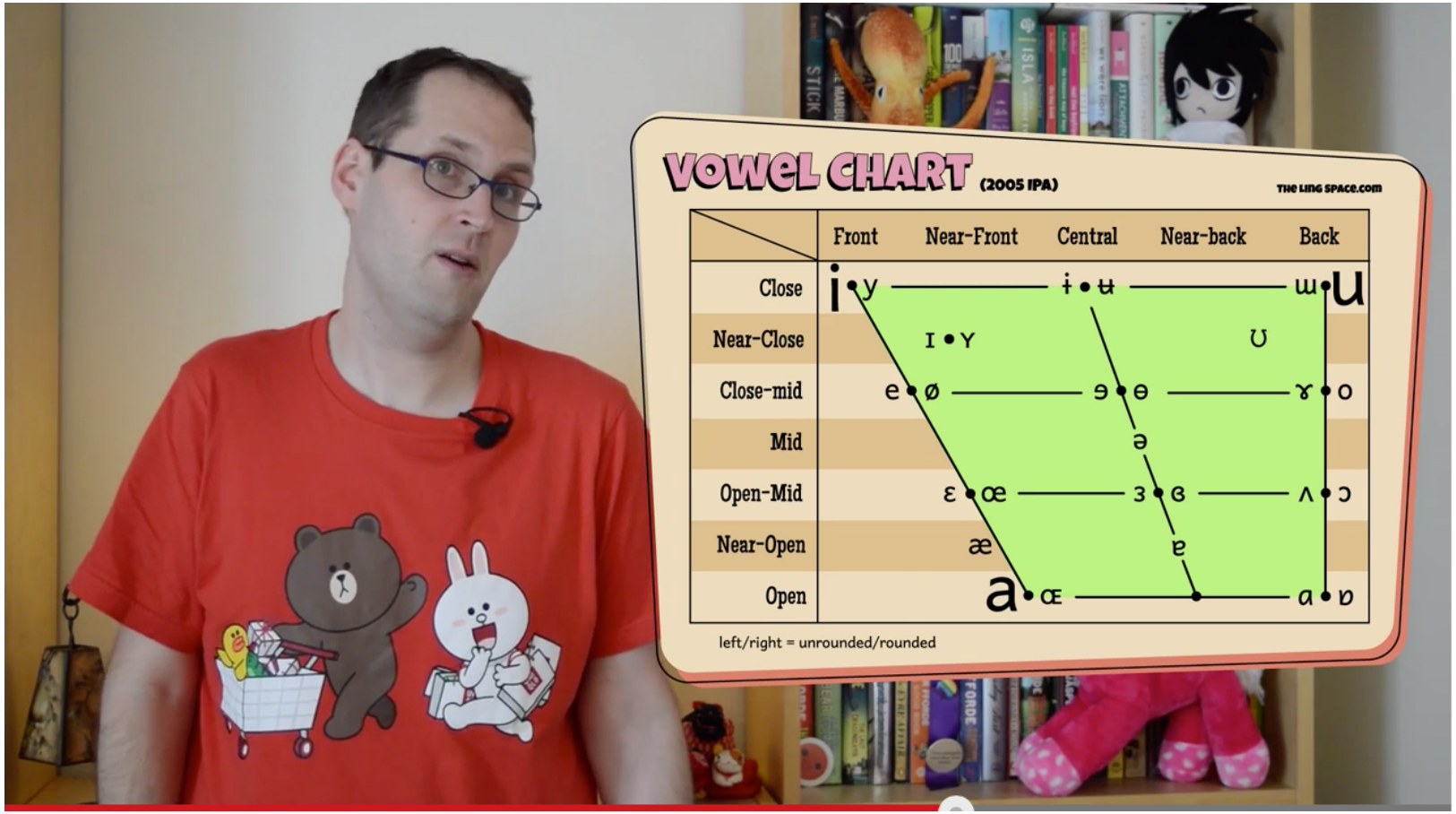
4:10 through 5:08



Cross-language differences

https://www.youtube.com/watch?v=arMntA15A0s
http://www.thelingspace.com/episode-27

5:08 through 7:02



Diphthongs

https://www.youtube.com/watch?v=arMntA15A0s
http://www.thelingspace.com/episode-27

7:02 through 7:38