

Speech Science

WiSe 2024/2025

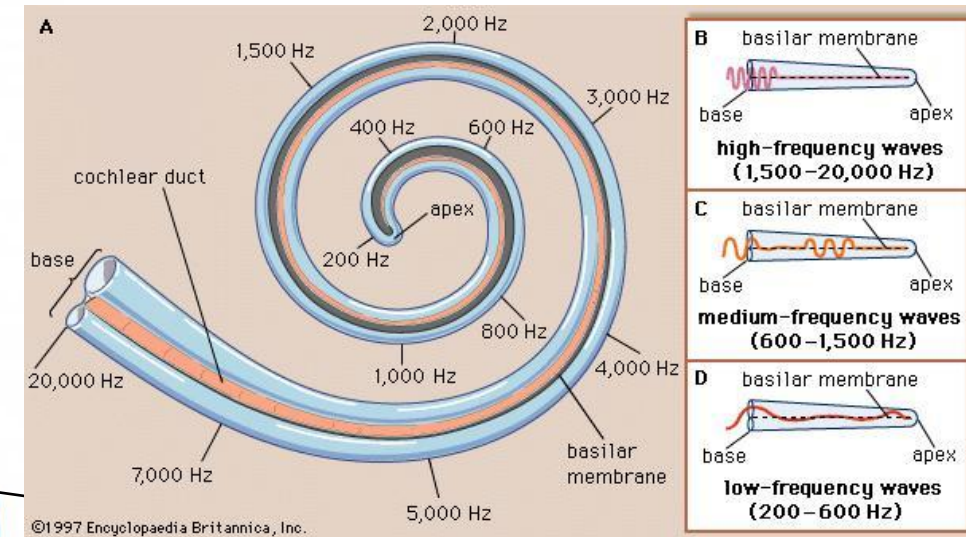
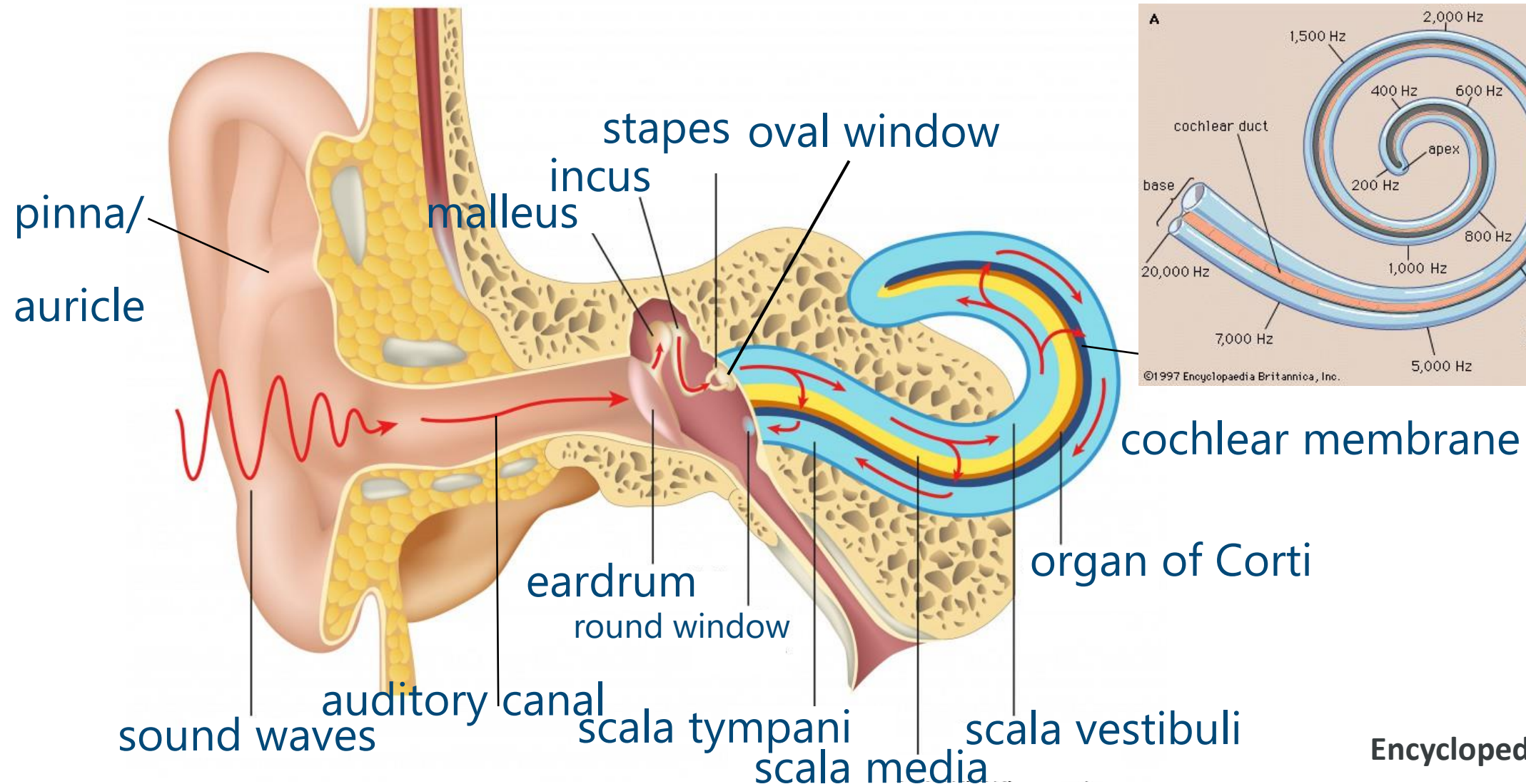
Exercise 10: Speech perception

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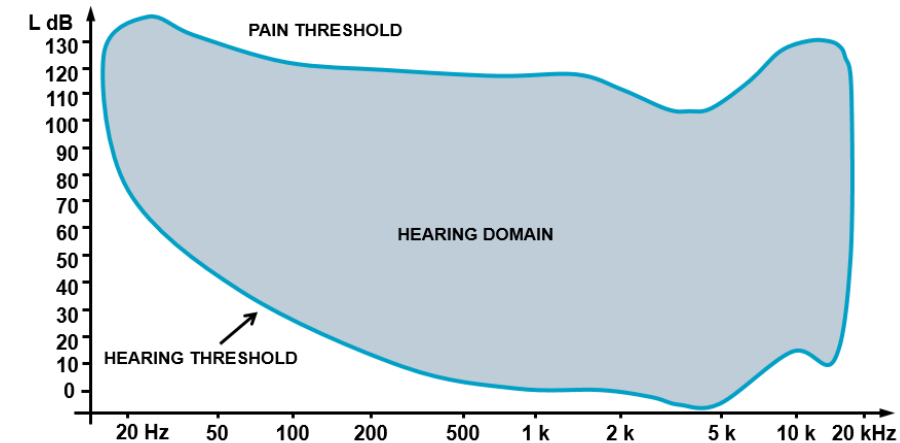
Recap: Auditory system



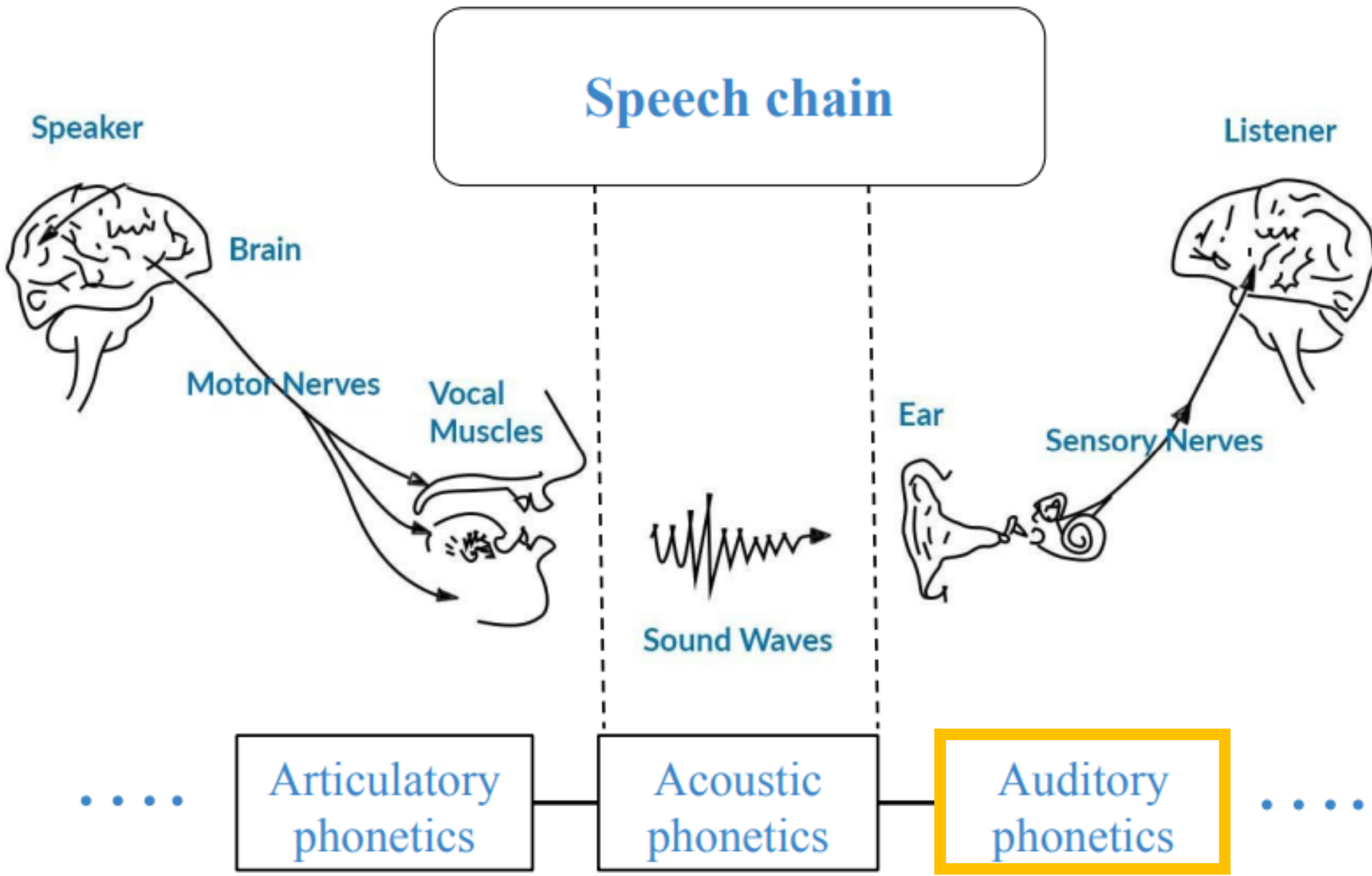
Encyclopedia Britannica, 1997

Recap: Pitch perception

- Just Noticeable Difference: How much must a frequency change for the ear to notice the change in frequency? → about 0.5%, no absolute difference
- **Perceptual** measure of pitch and loudness: Mel, Bark, Phon
- Correlation between pitch and loudness



Speech perception



Categorical Perception

- How many colors are there in a rainbow?



- We perceive colors in categories
- Color spectrum of rainbow is continuous

Red

Orange

Yellow

Green

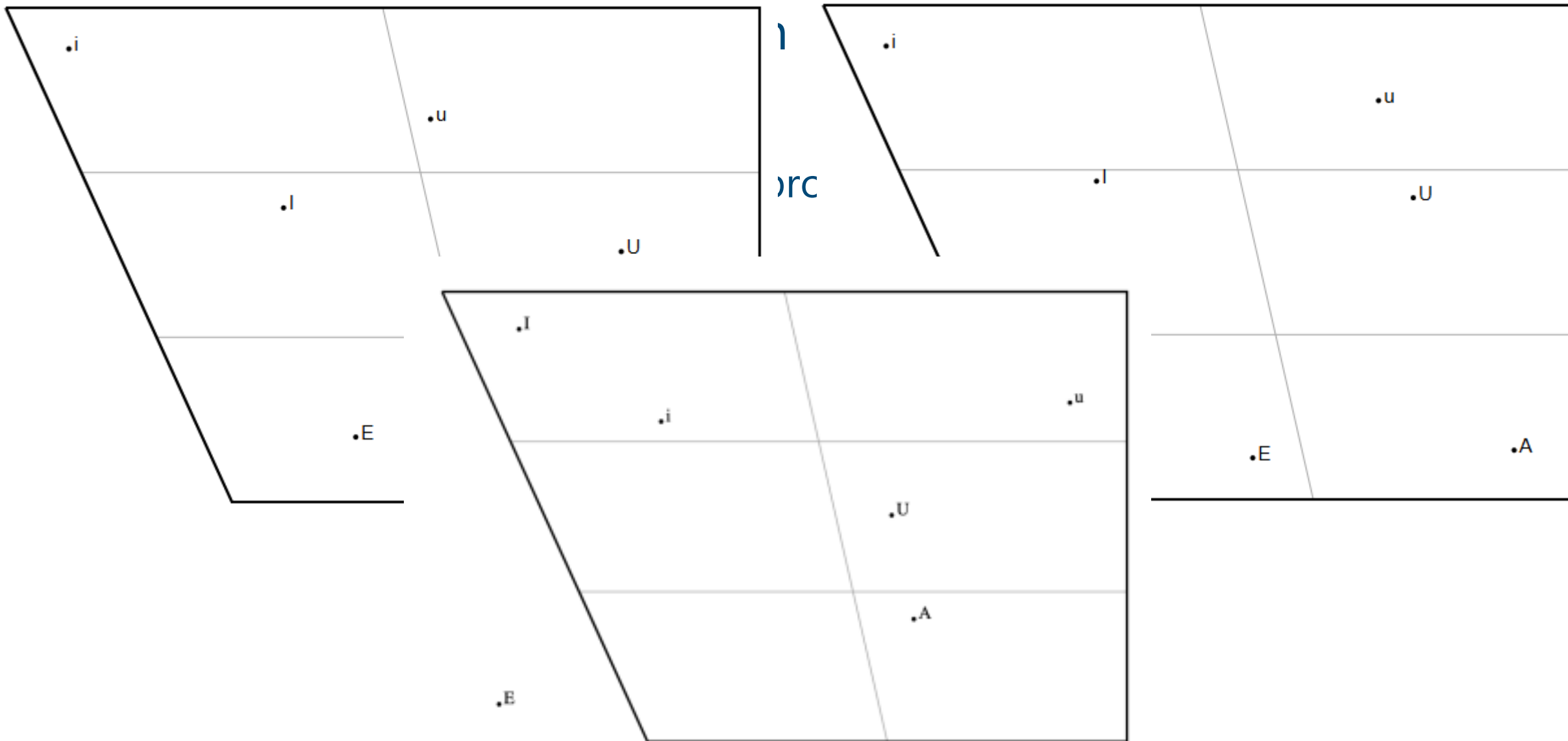
Blue

Indigo

Violet

Categorical perception in speech

- Individual differences in our produced sounds
 - No two sounds will be exactly the same
- Still: We understand each other



Categorical Perception – Experiment Types

- Identification: "Do you hear 'town' or 'down'?"
- Discrimination: "Do you hear the difference between two stimuli?"

Exercise 1: Perception Experiments

Made

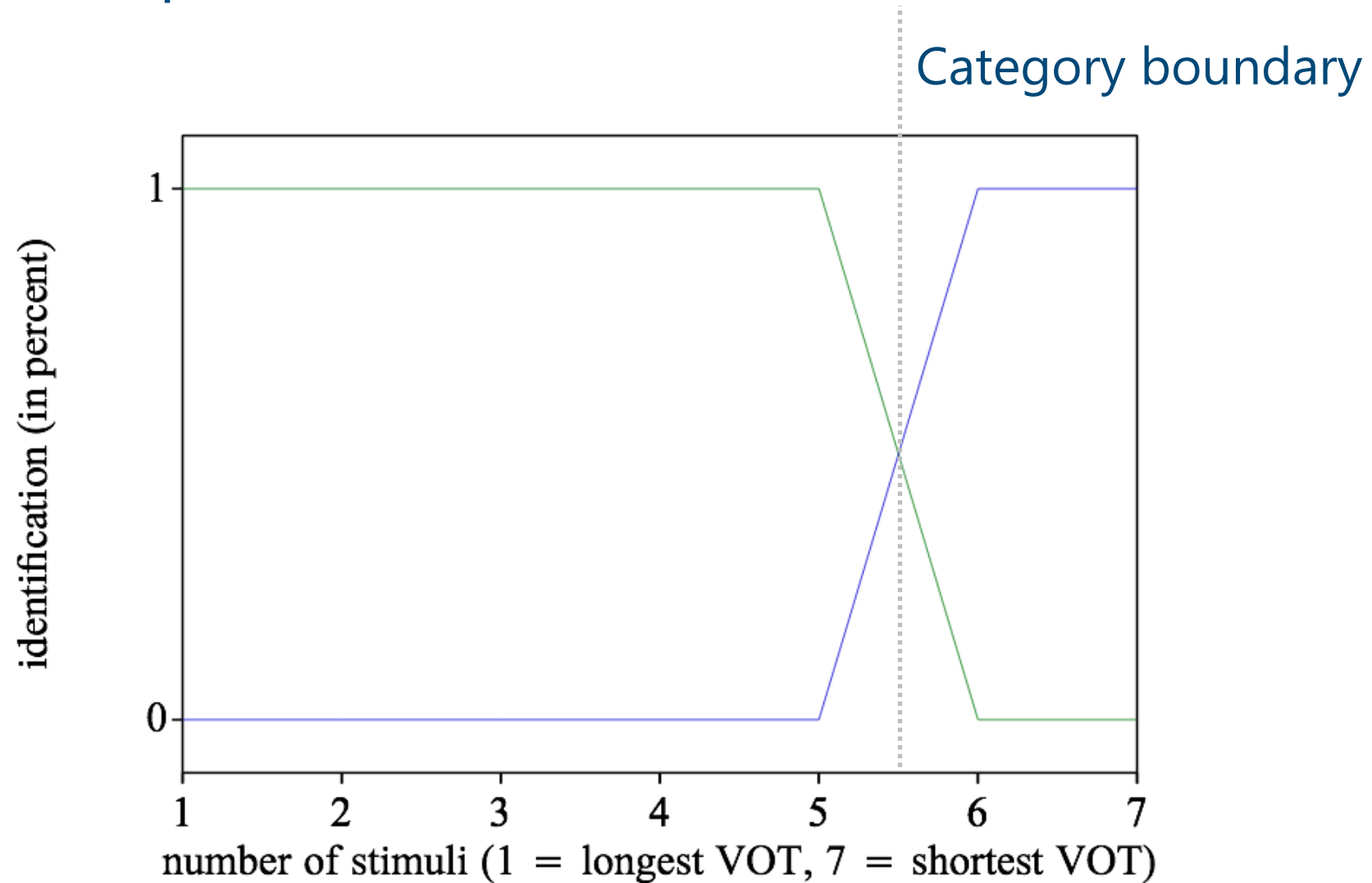


Mate

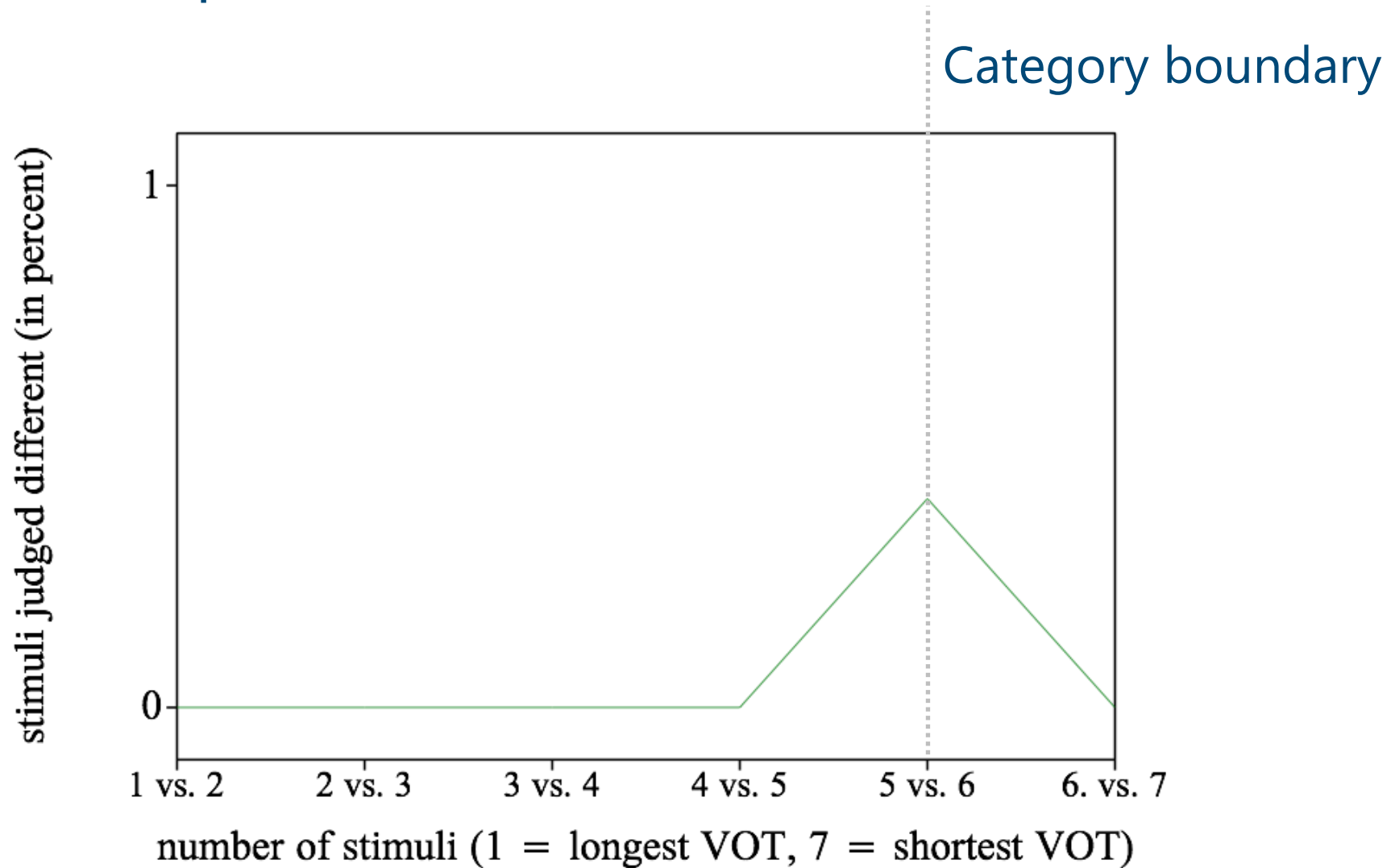


- 1) Open **catPercep_identification.txt** in Praat and click *Run*
- 2) Open the script **identification.praat** in Praat, click *Run* and save the graphic
- 3) Repeat with **catPercep_discrimination.txt** and the script **discrimination.praat**

Categorical Perception - Identification

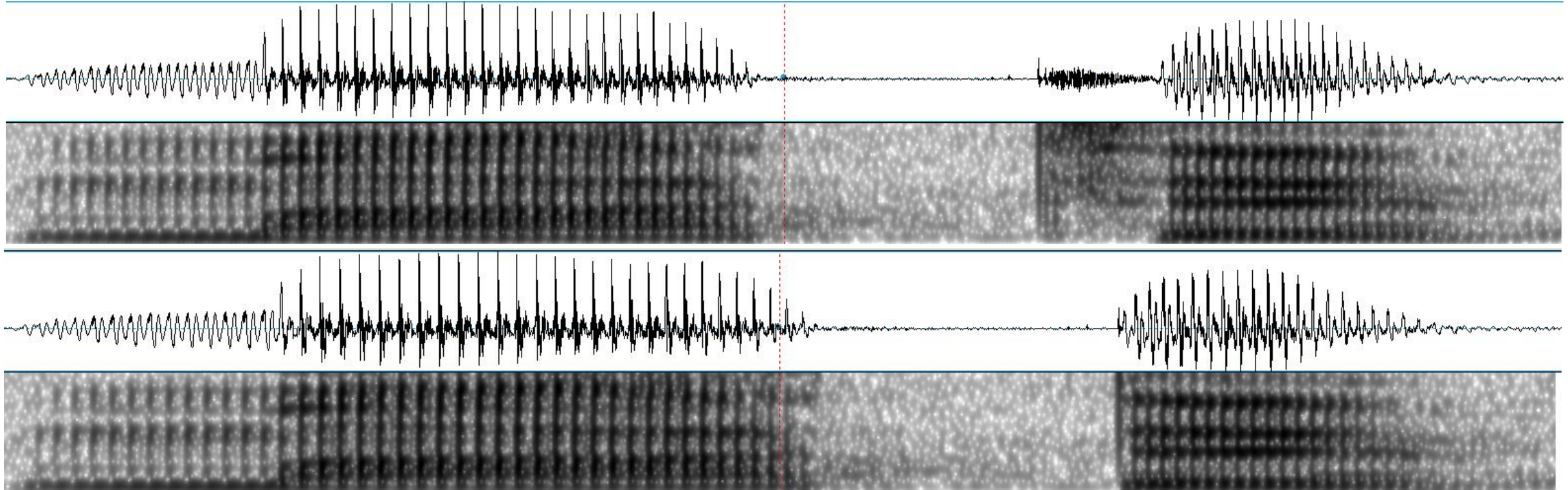


Categorical Perception - Discrimination



Categorical Perception

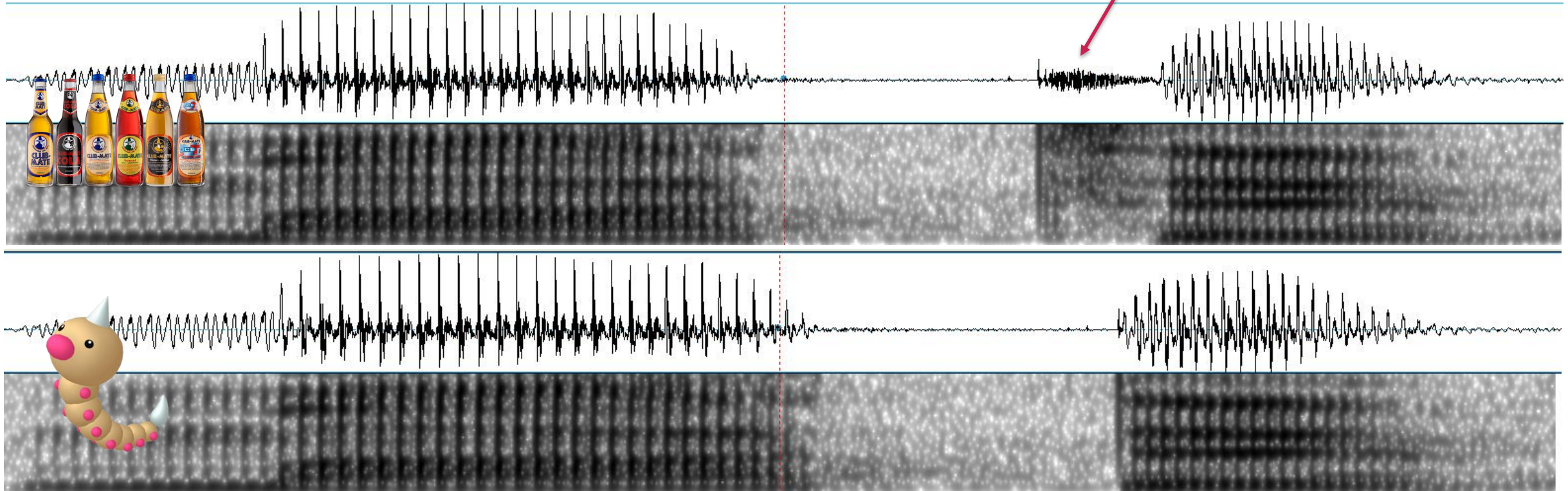
Minimal pair: Made - Mate



Categorical Perception

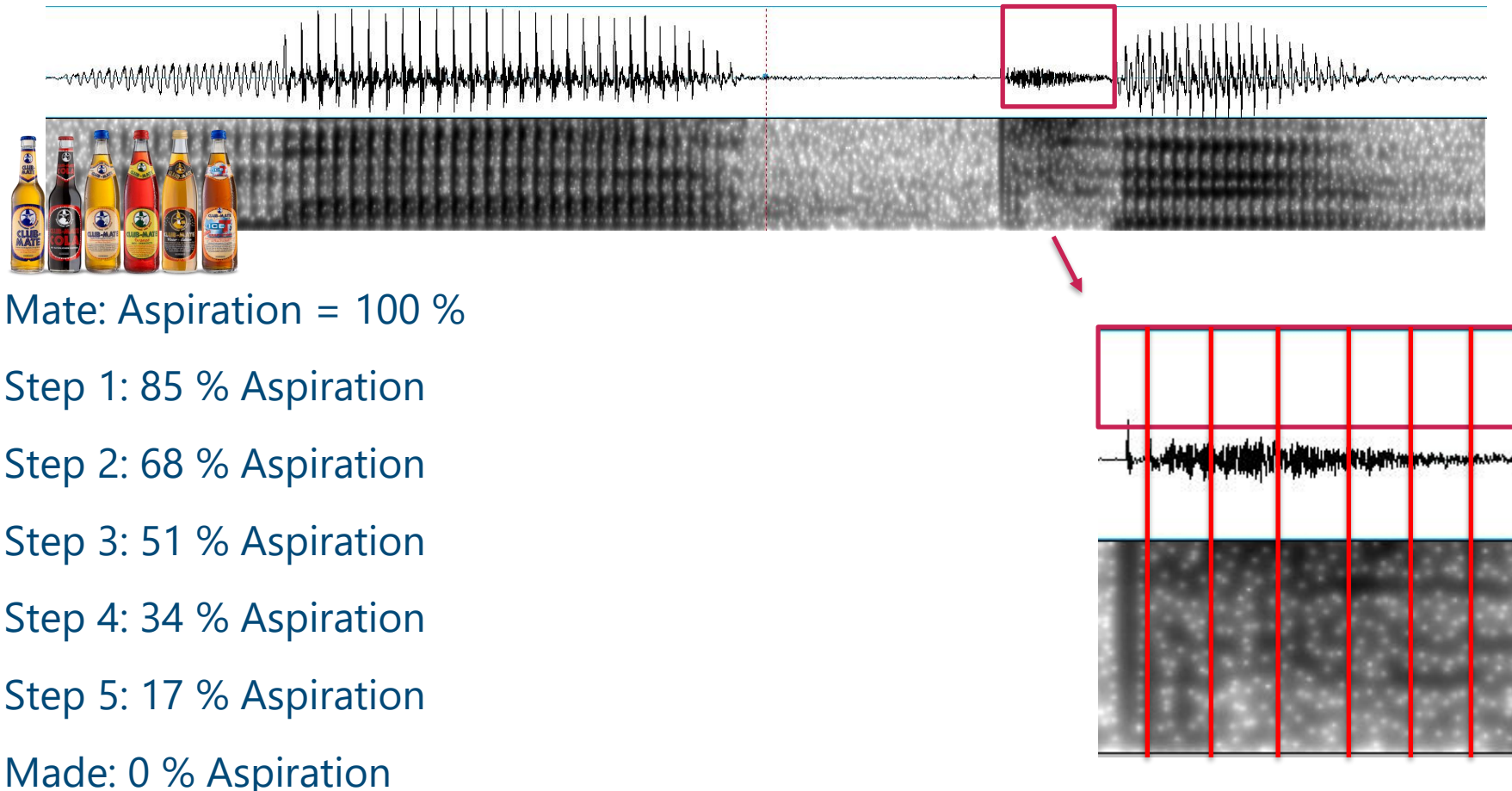
Minimal pair: Made - Mate

Aspiration [t^h]

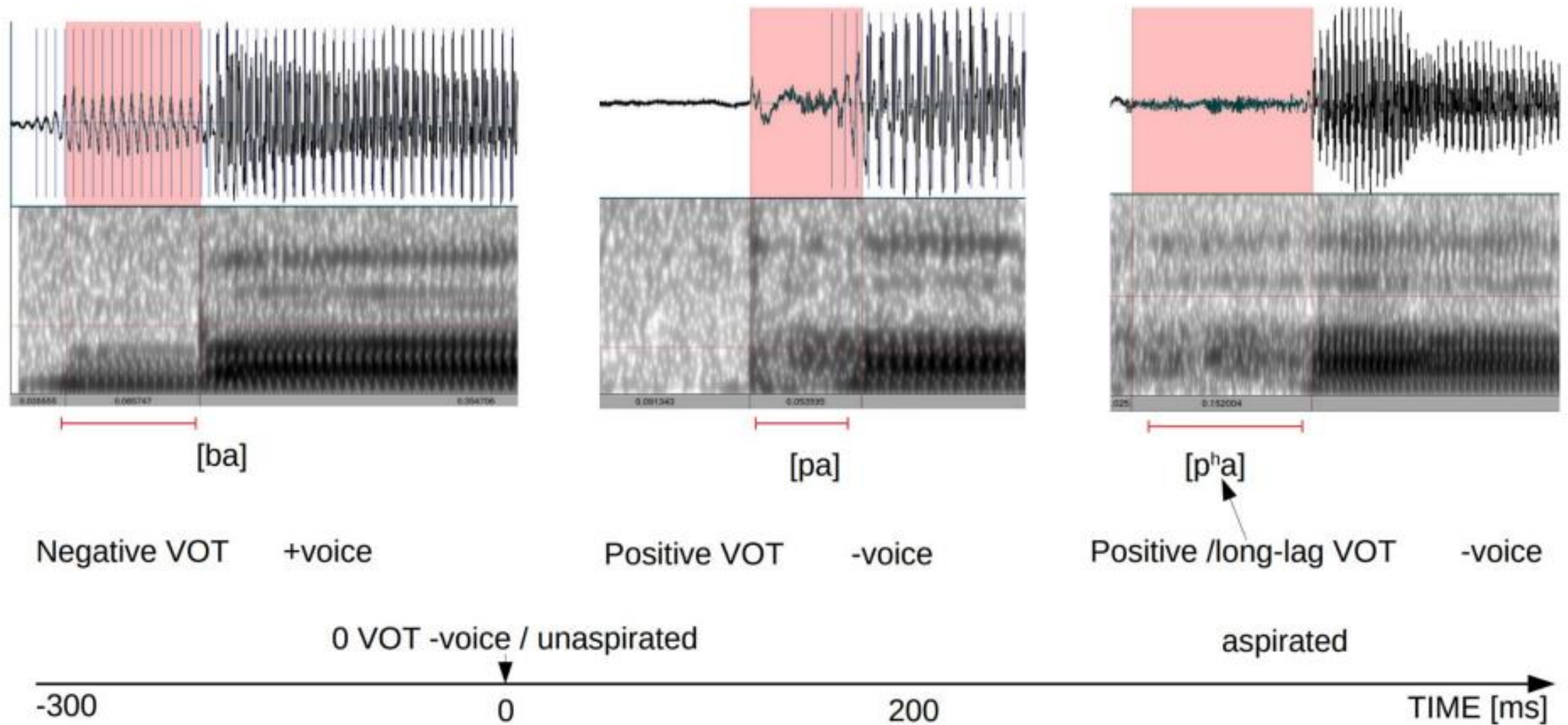


Categorical Perception

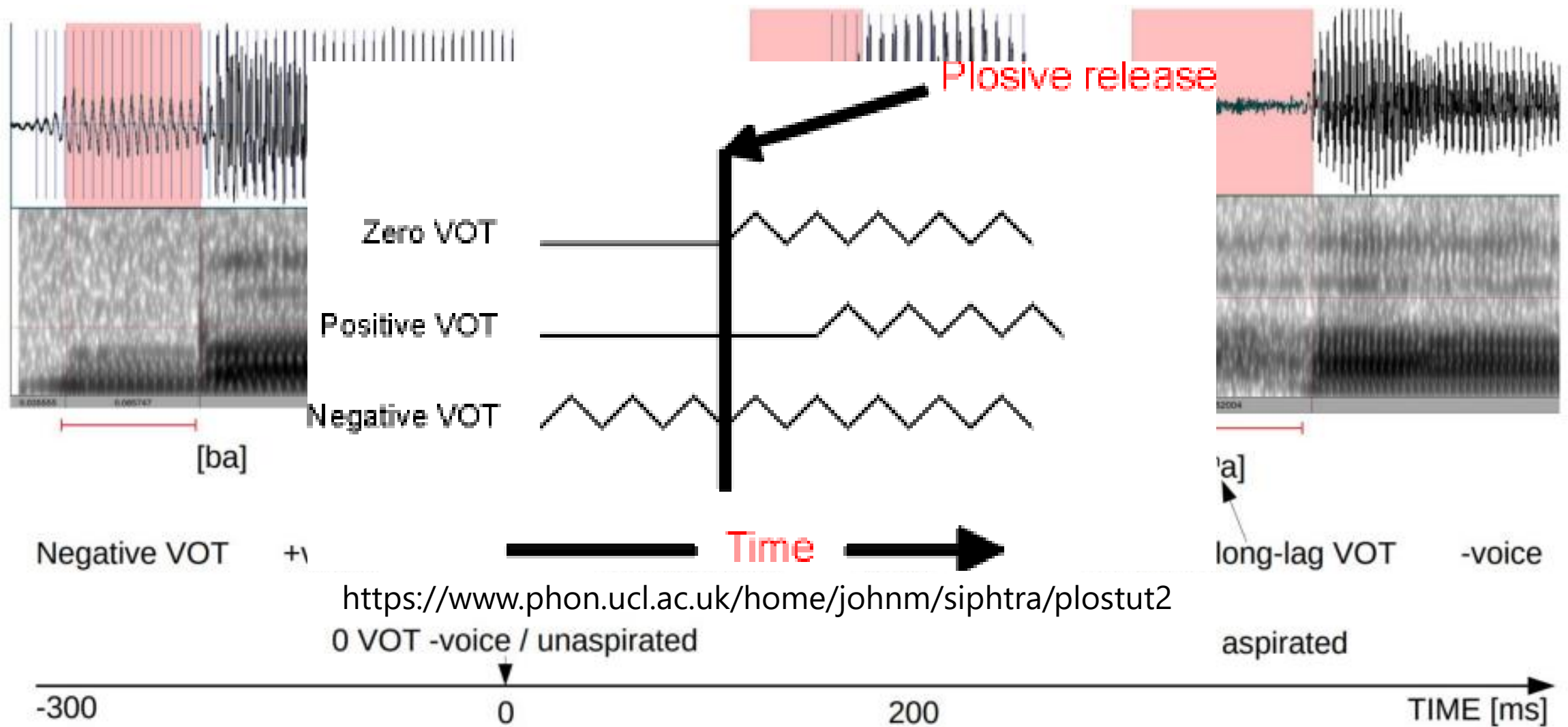
Manipulation: From "Mate" to "Made"



Voice Onset Time (VOT)



Voice Onset Time (VOT)



Exercise 2: Manipulation of VOT

- 1) Use the files "two.wav" and "do.wav"
- 2) Open and run Praat script "VOTManipulation.praat"
- 3) Make a VOT continuum
- 4) Decide whether each segment of continuum is "two" or "do"
- 5) Measure VOT of each segment

Laurel or Yanny?



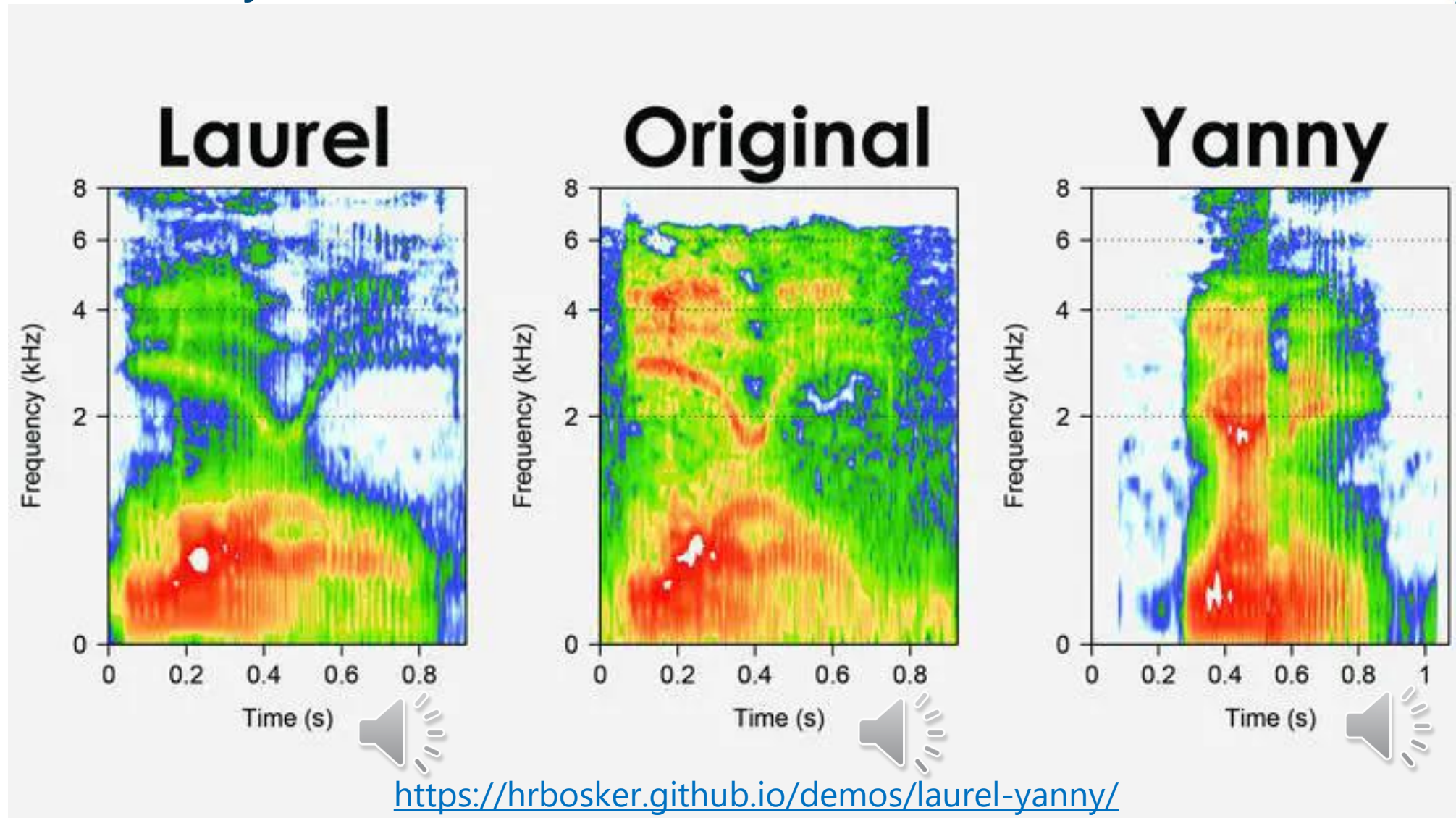
<https://hrbosker.github.io/demos/laurel-yanny/>

Laurel or Yanny?

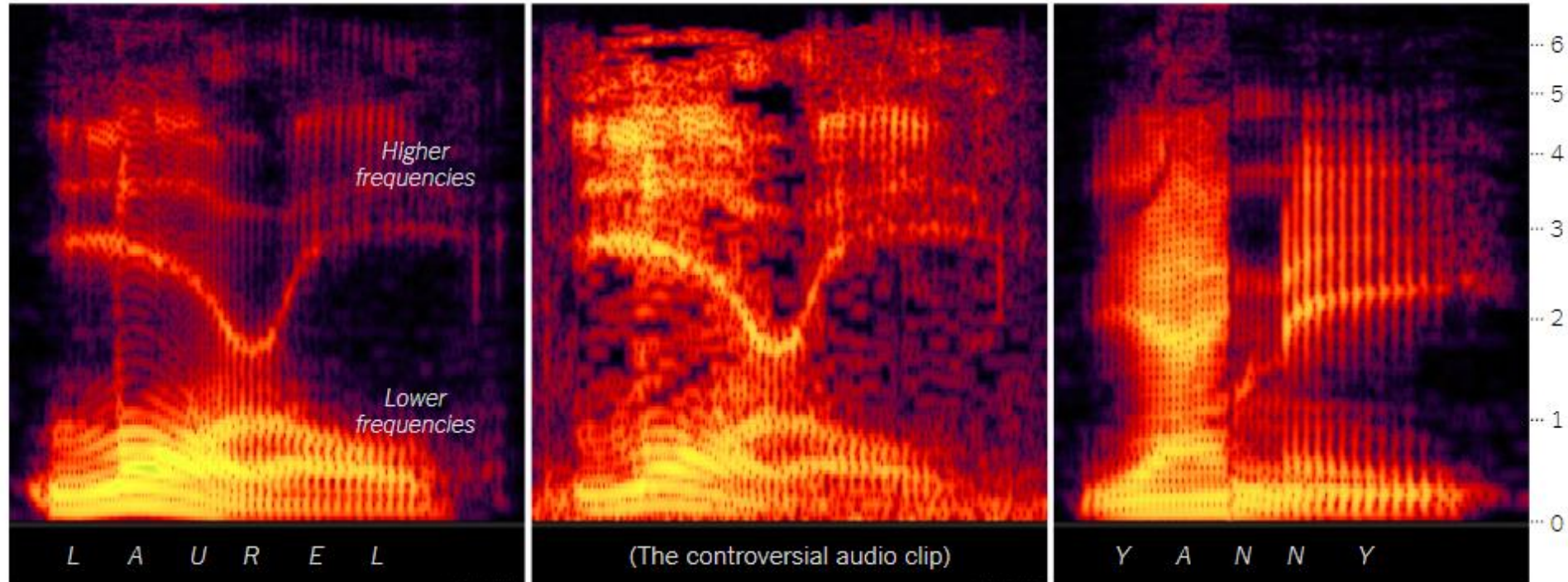


<https://www.mpi.nl/news/laurel-or-yanny>

Laurel or Yanny?



Laurel or Yanny?



The source “laurel”

A spectrogram of a vocabulary.com clip of the word “**laurel**” shows strong lower frequencies and relatively faint higher frequencies.

An ambiguous recording

Playing the “laurel” clip over speakers and re-recording it introduced noise and exaggerated the higher frequencies.

Those higher frequencies may have led to confusion over whether the word was **Laurel** or **Yanny**.

A simulated “Yanny”

For comparison, a spectrogram of the same vocabulary.com voice saying “**Yanny**” shows a similar pattern of strong high frequencies.

The spectrogram was created by merging clips of the voice saying “Yangtze” and “uncanny.”

<https://www.nytimes.com/interactive/2018/05/16/upshot/audio-clip-yanny-laurel-debate.html?smid=pl-share>

Laurel or Yanny?



<https://www.mpi.nl/news/laurel-or-yanny>

Brainstorm or gray needle?

<https://www.youtube.com/watch?v=1okD66RmktA>

McGurk Effect



<https://www.youtube.com/watch?v=2k8fHR9jKVM>

What we perceive does not solely depend on the input signal, but also on:

- the context:
 - preceding sounds
 - following sounds
 - our expectations
 - who is speaking?
- individual preferences
- physiological differences

Additional Resources

- Speech Perception:
<https://www.youtube.com/watch?v=8-fMLs-xCaA>
- Categorical Perception:
<https://www.youtube.com/watch?v=nNYhCP6NiUg>
- Manipulate VOT:
<https://www.youtube.com/watch?v=rk-q3rnN828>
<https://www.youtube.com/watch?v=TpRPIB8Zu8I>
- McGurk Effect:
<https://www.youtube.com/watch?v=h5LVO-7BlqM>

Assignment 9

- Please prepare some questions / topics you want to discuss in our last session
- Please email me the questions / topics early this week, so I can include them in the slides

Thank you for your perception!

