

LINGUISTIC PITCH IN DEPTH, PART I

YU / LAMONT
FEBRUARY 6, 2018

Work on the RQ linked from
the course webpage!



UMASS
AMHERST

WHAT IS FUNDAMENTAL FREQUENCY?

FREQUENCY OF THE VOICE

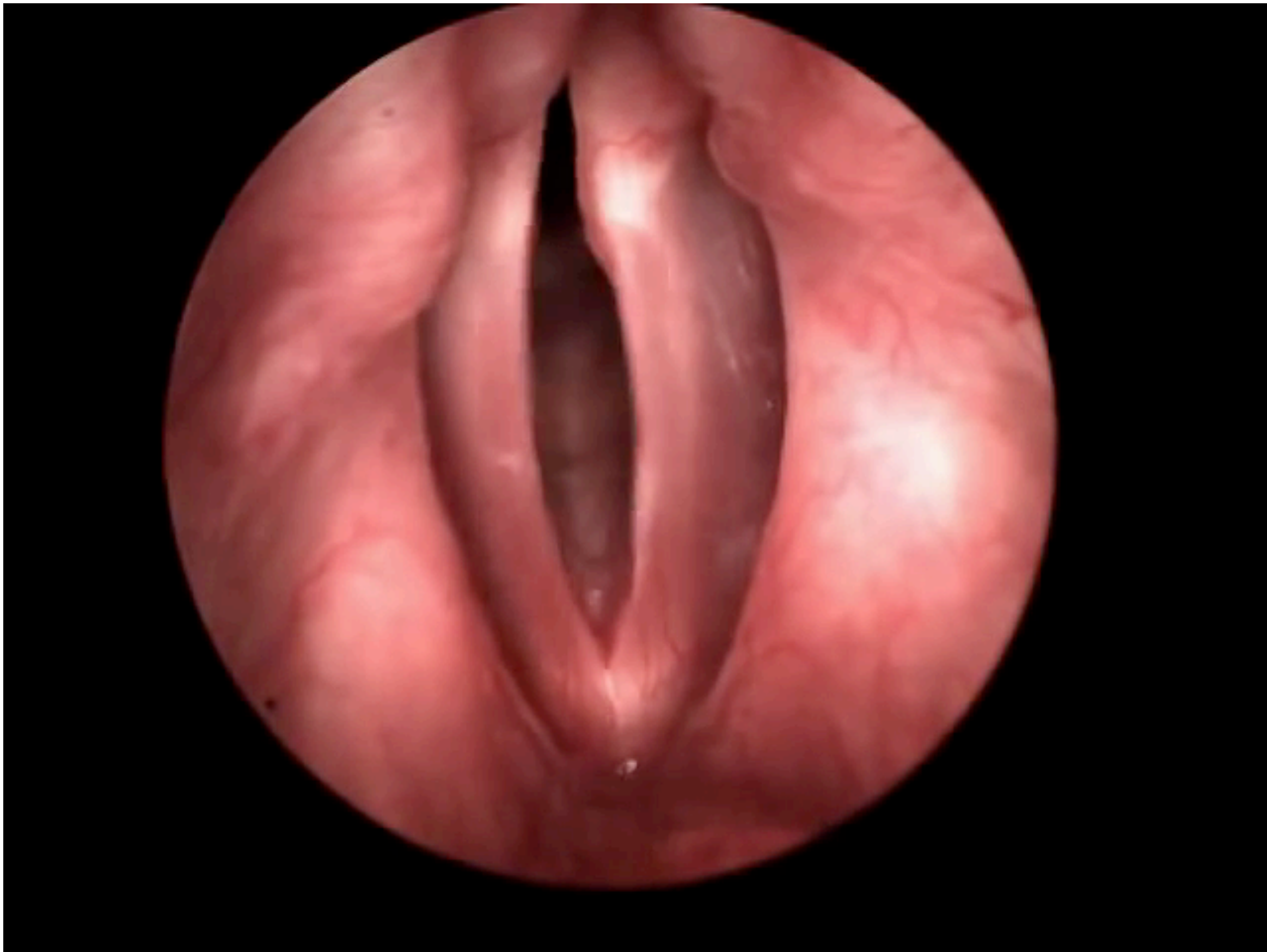
The frequency of the voice is the rate of vocal fold vibration at that timepoint.

- ▶ **Watch what happens to the vocal folds as you hear pitch going up and down**
- ▶ <http://youtu.be/P2pLJfWUjc8?t=3m53s>
- ▶ <http://www.youtube.com/watch?v=9kHdhibEnhoA>



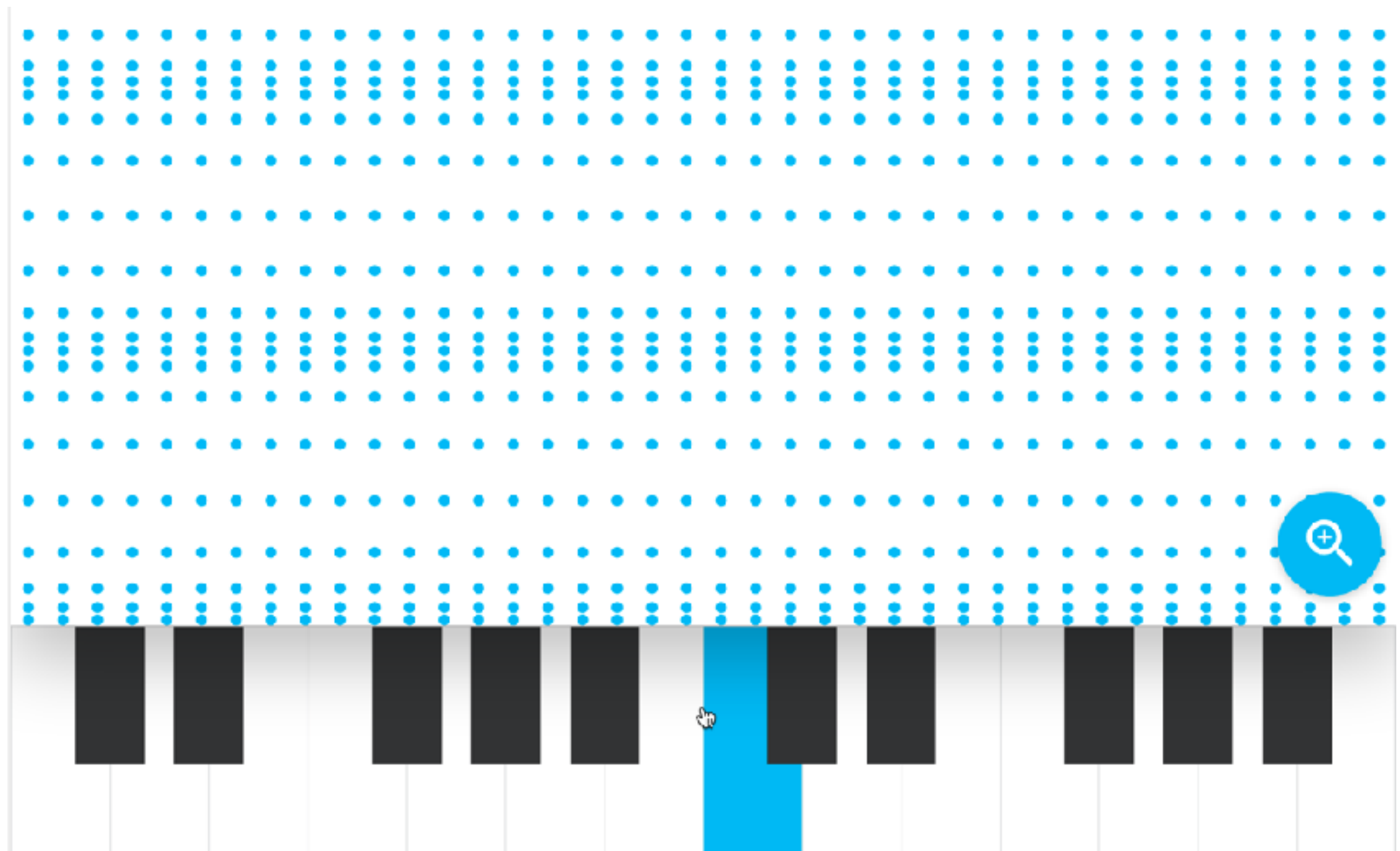
Female Vocal Cords
on a low note

Vocal Cords attached in the front of neck



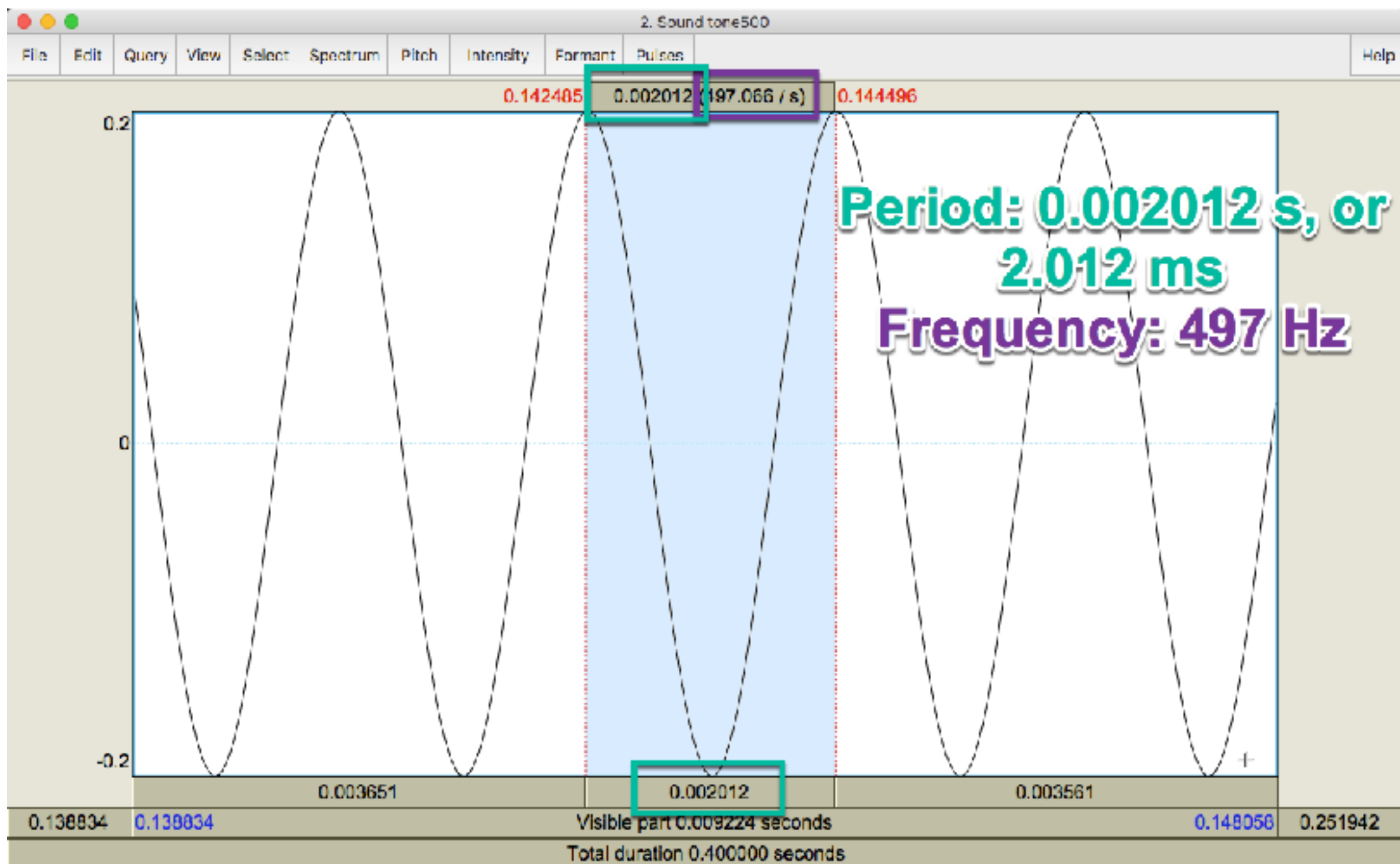
FREQUENCY OF SOUND WAVES (ACOUSTICS)

<https://musiclab.chromeexperiments.com/Sound-Waves>



EXERCISE: DETERMINE PERIOD/FREQUENCY

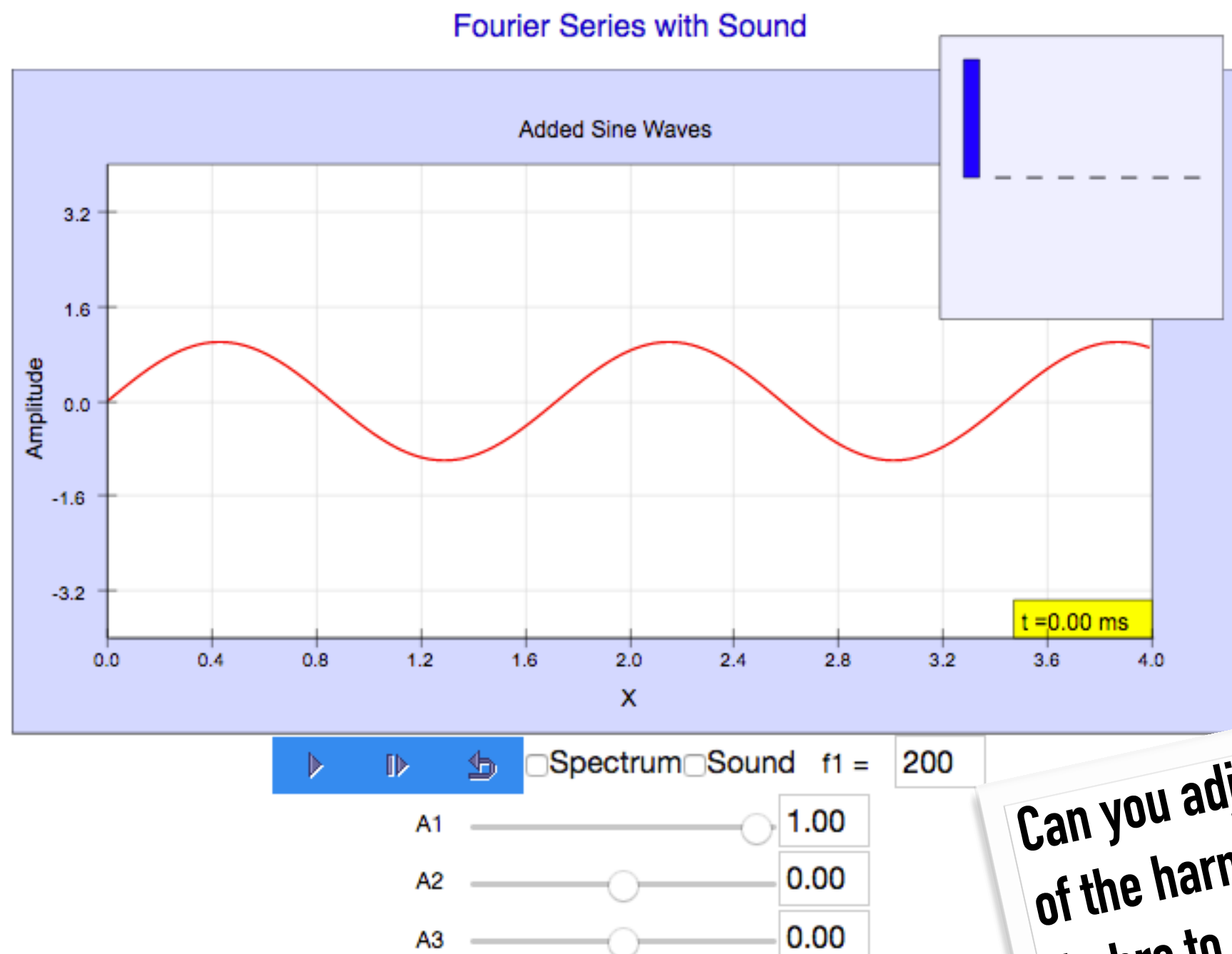
- ▶ Let's determine what the period and frequency of each of our generated sounds are from the waveform





COMPLEX WAVES ("TONE COMPLEXES")

EXERCISE: SOUND OF ADDING IN HARMONICS

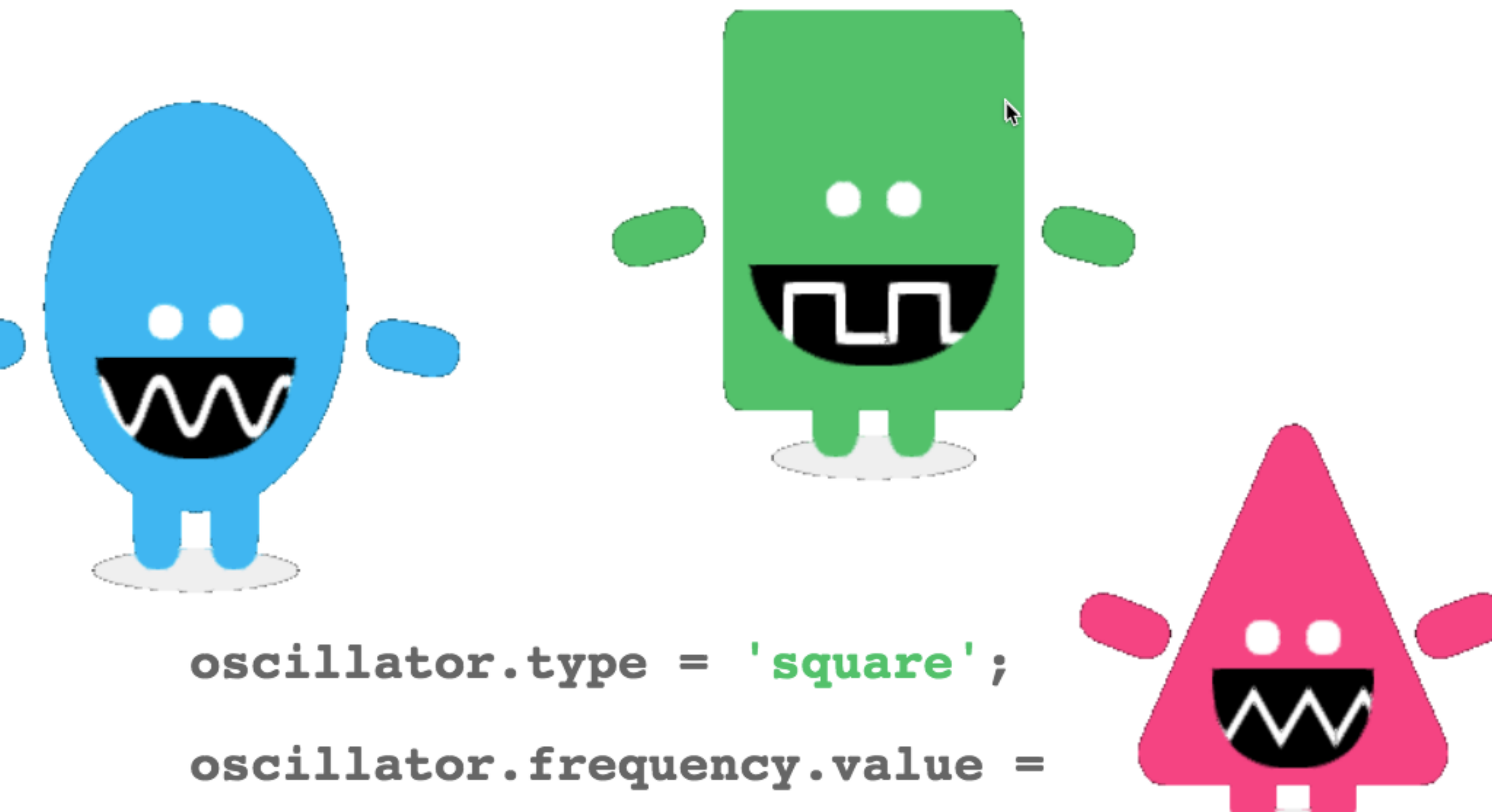


Can you adjust the amplitudes of the harmonics to get the timbre to sound like some instrument you like?

https://soundphysics.ius.edu/?page_id=949

DEMO: COMPLEX WAVES

<https://musiclab.chromeexperiments.com/Oscillators>



```
oscillator.type = 'square';
```

```
oscillator.frequency.value =
```

BUILDING UP A SQUARE WAVE WITH SINES



$N = 0$

BUILDING UP A SQUARE WAVE



TWO REPRESENTATIONS OF SQUARE WAVE

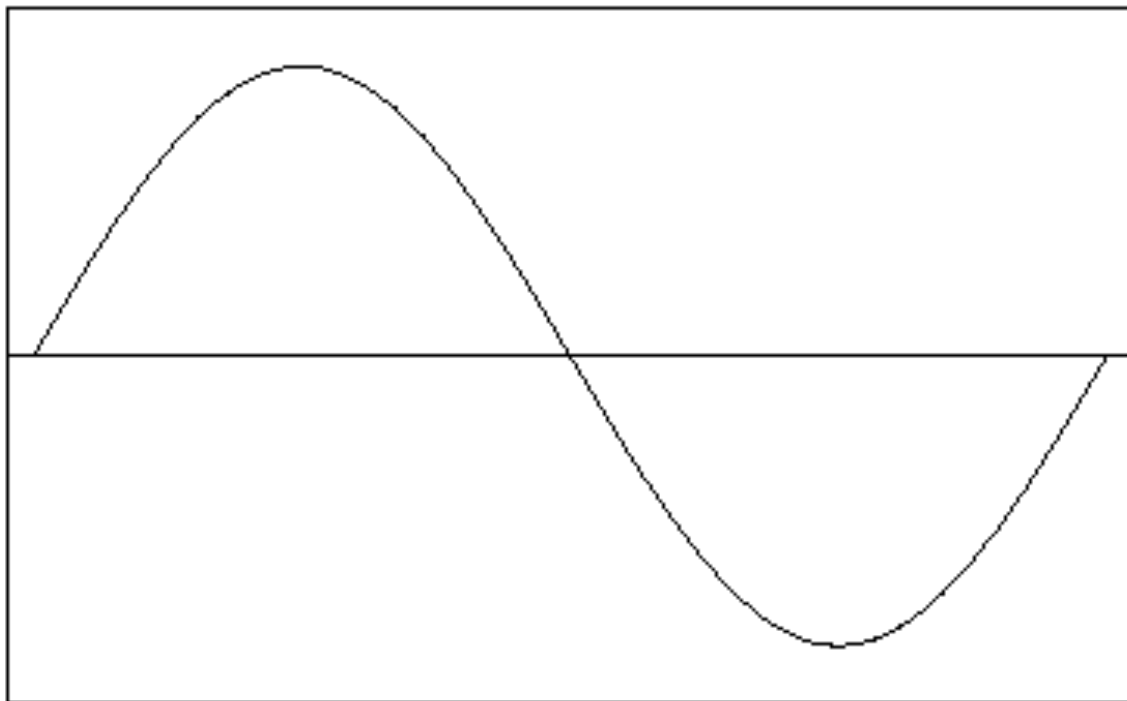


**Time domain:
waveform**



**Frequency domain:
spectrum**

HARMONIC AMPLITUDES

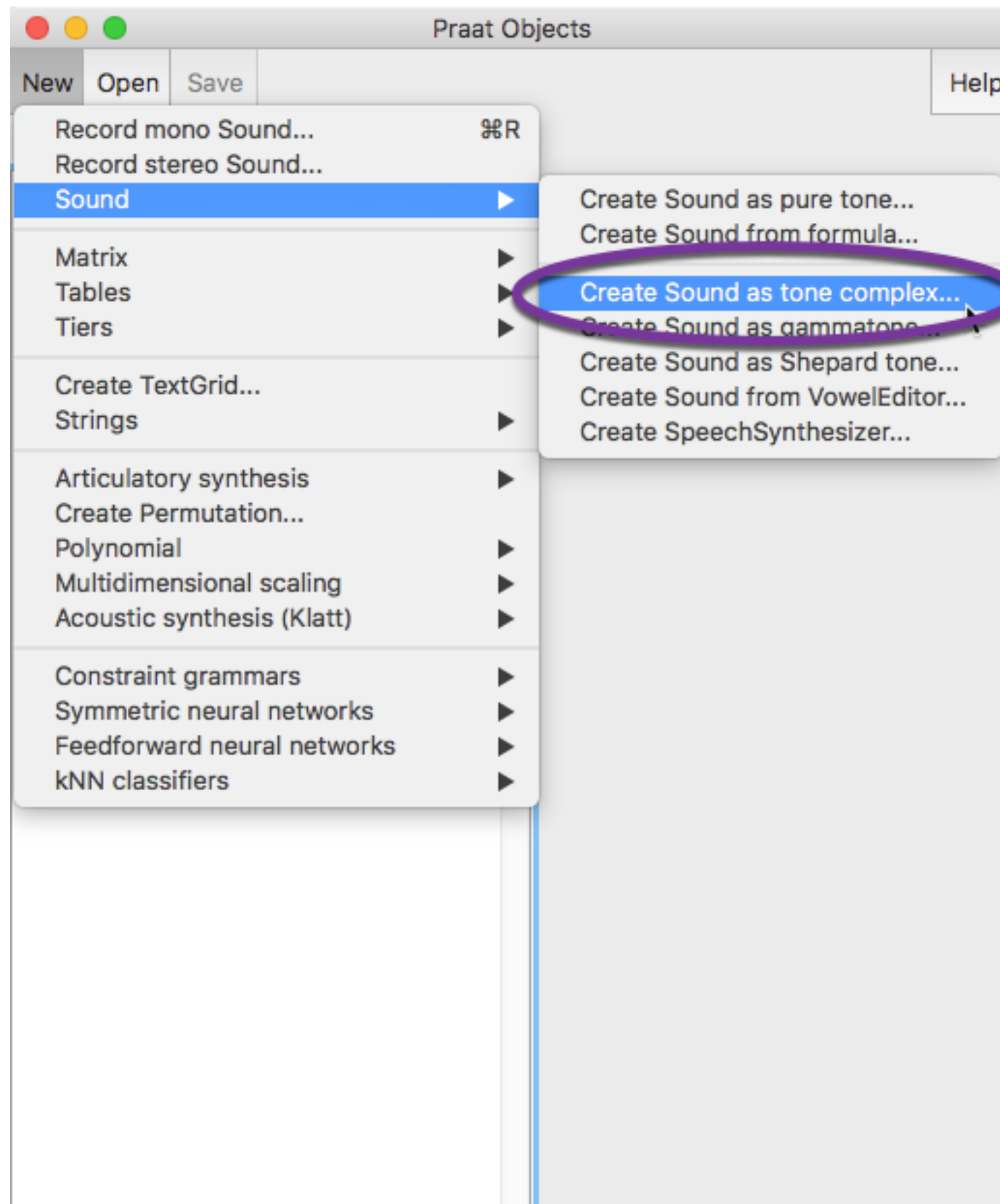


BUILDING UP A TRIANGLE WAVE WITH SINES



$N = 0$

EXERCISE: CREATING TONE COMPLEXES



EXERCISE: CREATING TONE COMPLEXES

Create Sound as tone complex

Name:

Start time (s):

End time (s):

Sampling frequency (Hz):

Phase: ☐ sine ☒ cosine

Frequency step (Hz):

First frequency (Hz):

Ceiling (Hz):

Number of components:

Explore the missing fundamental effect!

FUNDAMENTAL FREQUENCY

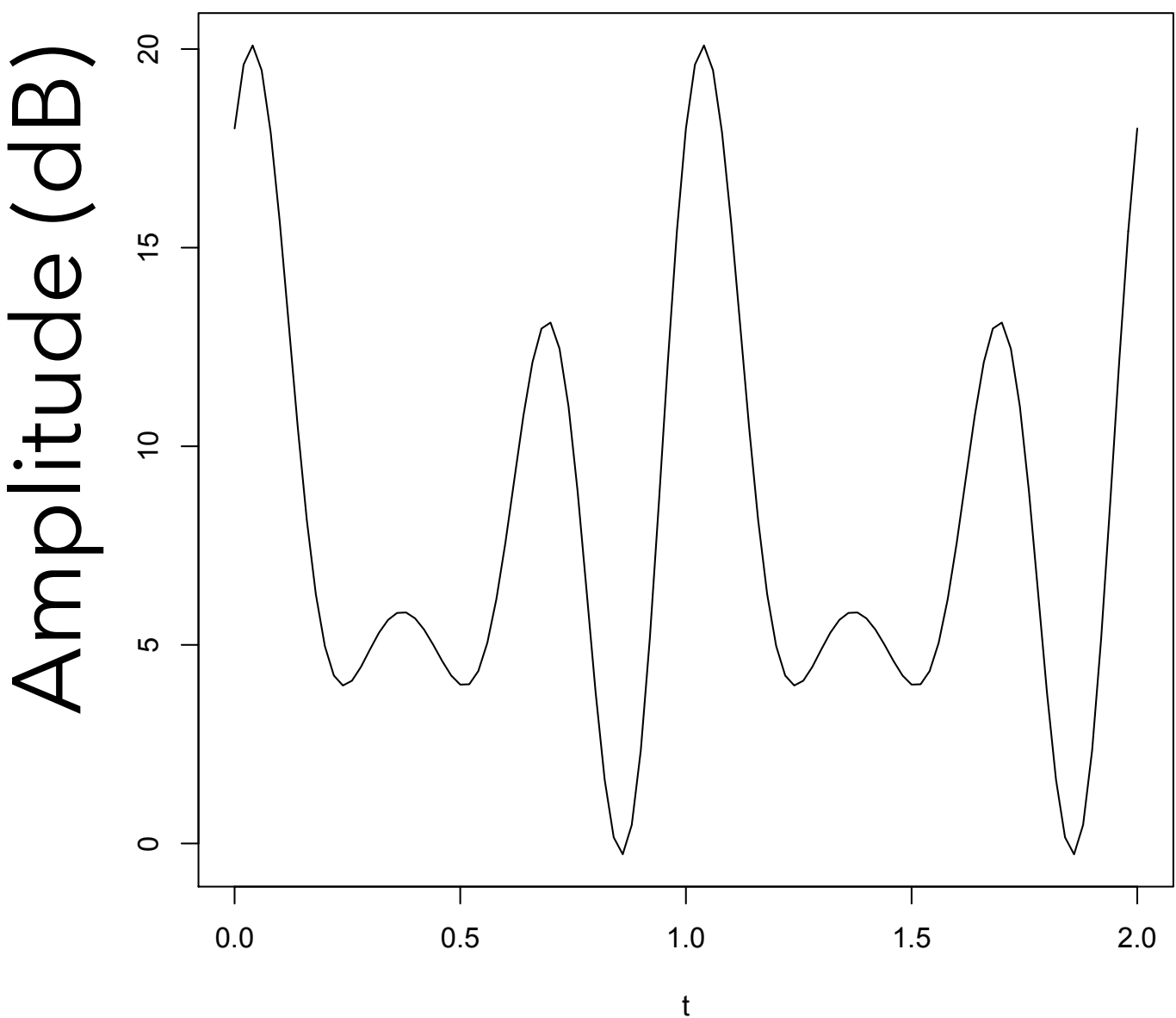
The fundamental frequency (f_0) of a complex wave is defined as the frequency of the lowest frequency component wave. (*simplified!*)

Acoustics

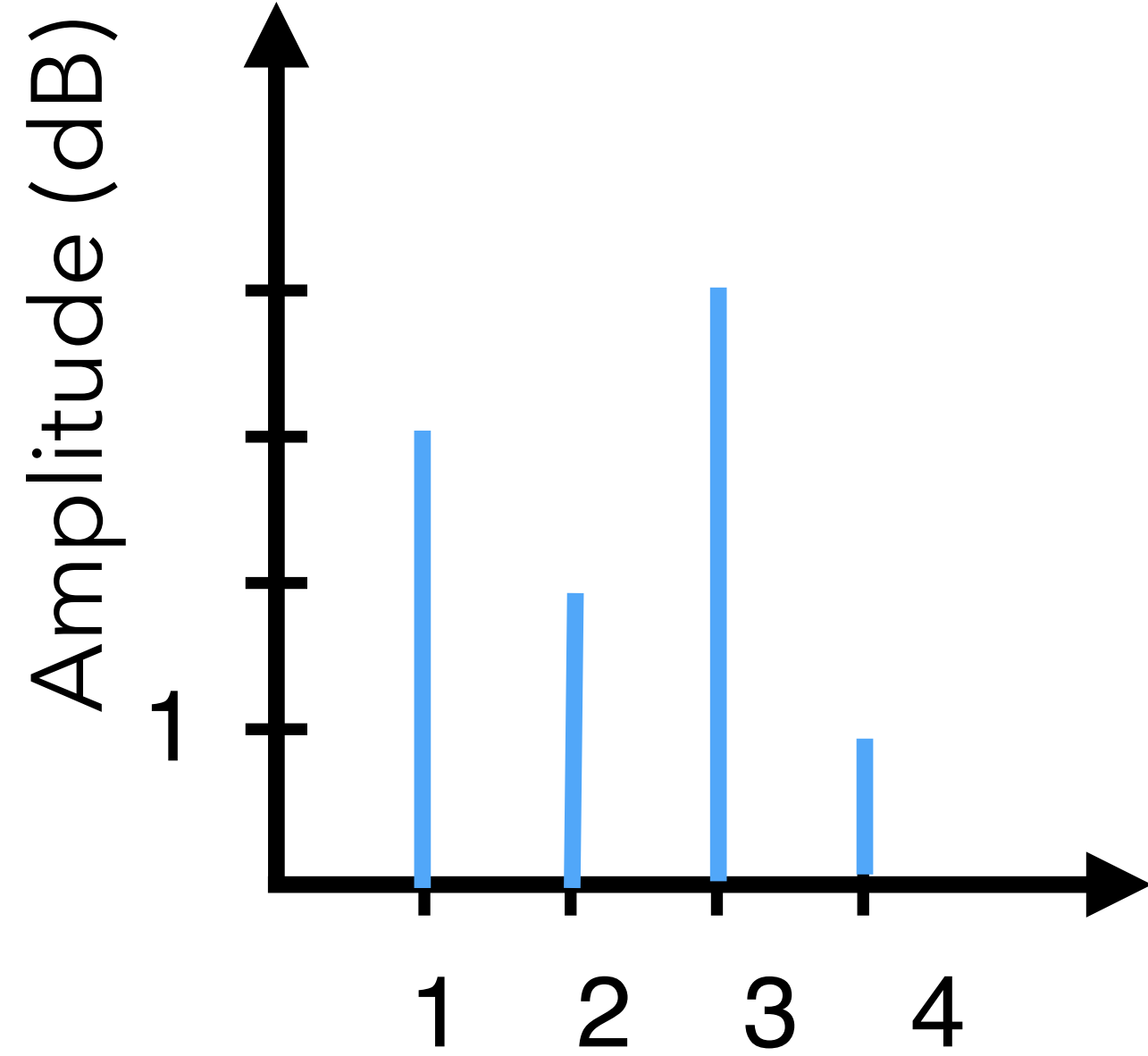
The fundamental frequency of the voice is the rate of vocal fold vibration at that timepoint.

Speech production/
articulation

SPECTRUM OF COMPLEX WAVEFORM

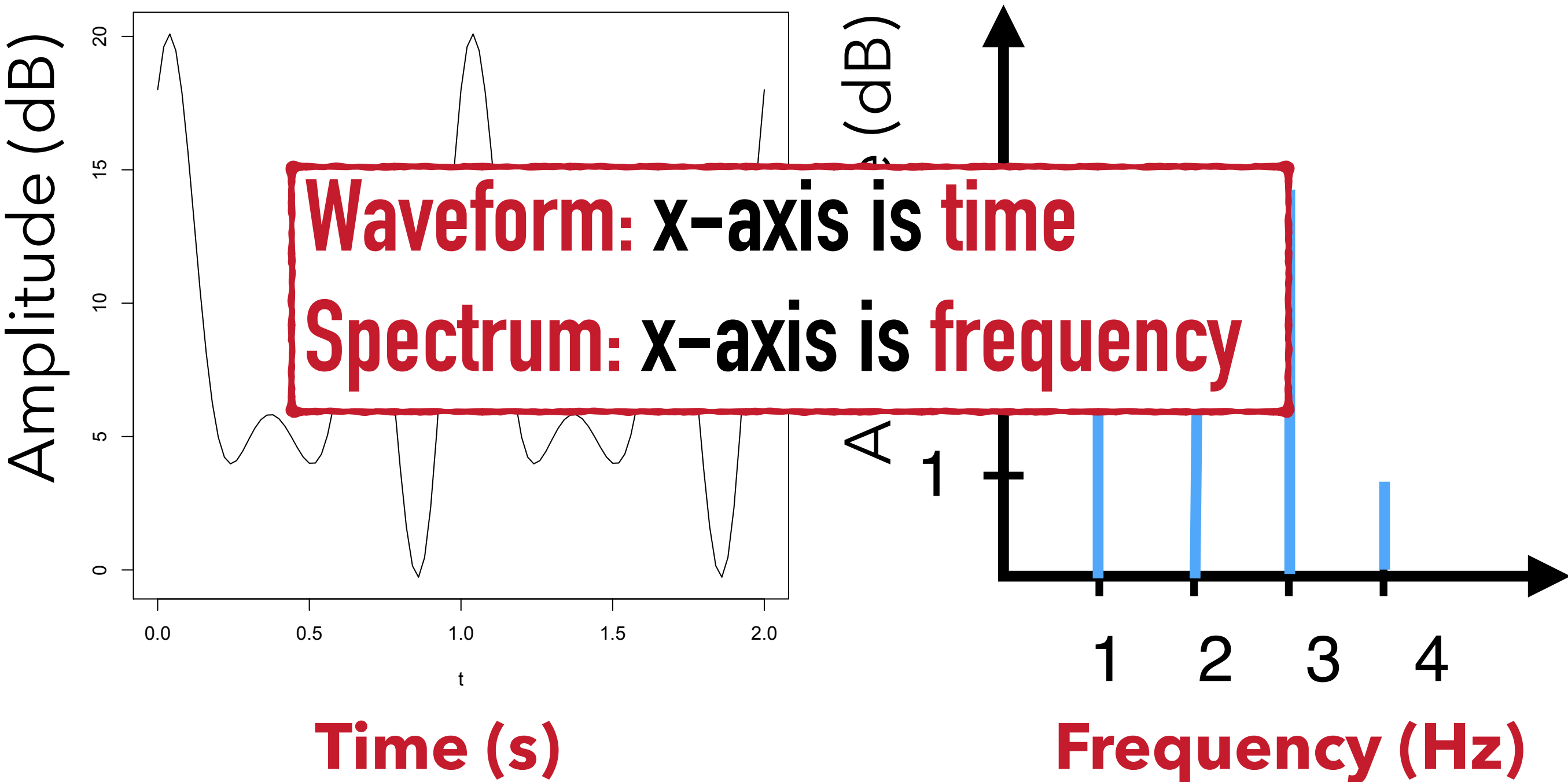


Time (s)

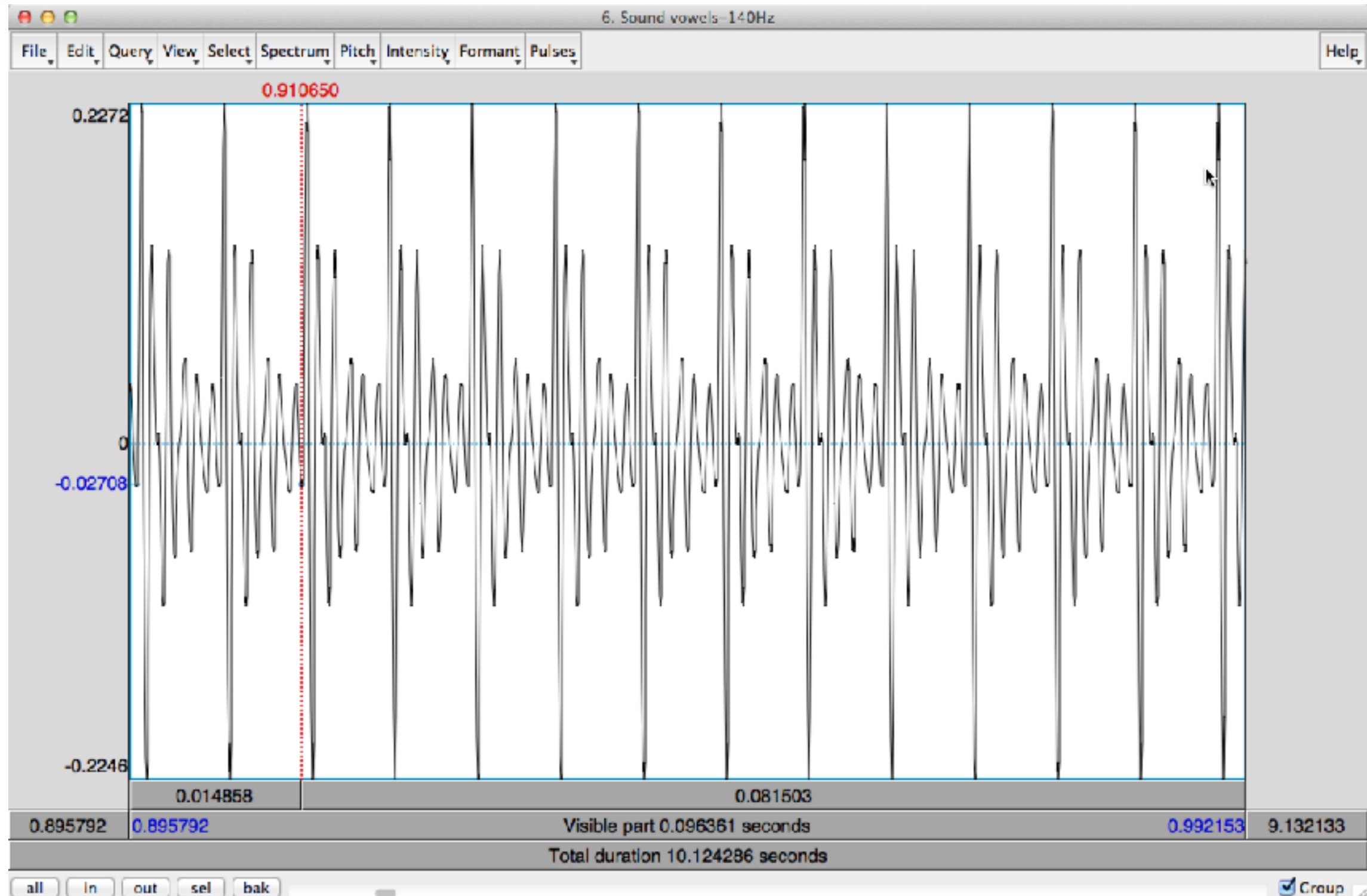


Frequency (Hz)

SPECTRUM OF COMPLEX WAVEFORM



IN PRAAT: FROM WAVEFORM...



tone languages of the world

<http://wals.info/chapter/13>

<http://wals.info/feature/13A#2/5.5/141.8>

CONTOUR TONES

RUSS SCHUH (UCLA)



<http://www.linguistics.ucla.edu/people/schuh/schuh.htm>

CANTONESE TONES

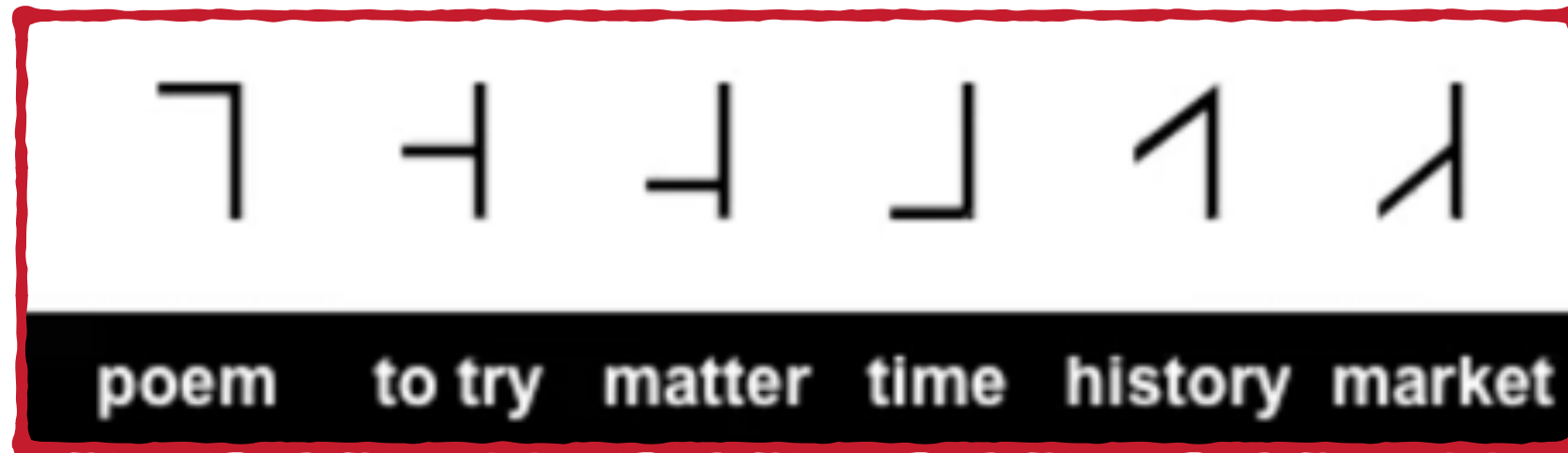
What do the funny symbols mean?



˧ ˨˩˦ ˨˩˨ ˨˩˨˩ ˨˩˨˩˨ ˨˩˨˩˨˩

poem to try matter time history market

INTERNATIONAL PHONETIC ALPHABET



Tones and Accents

Level		Contour	
ẽ or 7	Extra high	ě or 77	Rising
é 7	High	ê 77	Falling
ē 7	Mid	77	High rising
è 7	Low	77	Low rising
ě 7	Extra low	777	Rising-falling
↓	Downstep	↗	Global rise
↑	Upstep	↘	Global fall

CANTONESE TONES: YOUR TURN!

˩ ˨˩˨ ˨˩˨˩ ˩˨˩˩ ˩˨˩˩˩ ˩˨˩˩˩˩

poem to try matter time history market

Listen to and examine (in Praat) the Cantonese audio files linked below. Can you figure out which audio file corresponds to which tone category?

<http://www.ling197m.krisyu.org/media/3/cant/>

MORE PRACTICE ON LISTENING TO TONES

<http://www.linguistics.ucla.edu/people/hayes/103/TonePractice/>

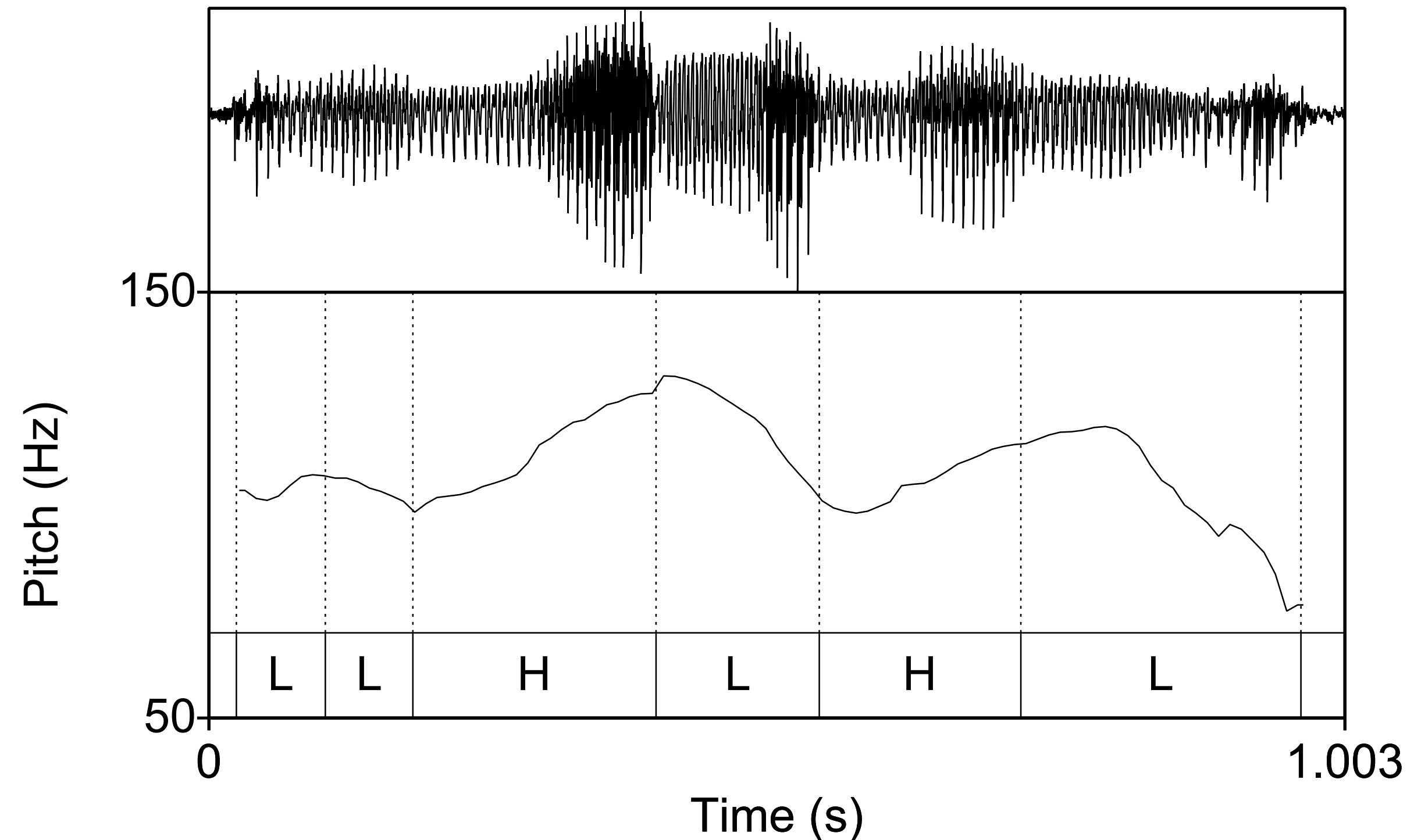
LEVEL TONES

BOLE TONES (CHADIC LANGUAGE. NIGERIA)



Bole
Tones

WHAT LEVEL TONES ACTUALLY “LOOK LIKE”



http://www.ling197m.krisyu.org/media/3/bole_m2_36_b5.wav

TALKING DRUMS



<http://www.youtube.com/watch?v=kpVS0-6yMIQ>

YORUBA TONES: DO RE MI

Listen to and examine (in Praat) the Yoruba audio files linked below.

<http://www.ling197m.krisyu.org/media/3/yoruba/>



<http://www.youtube.com/watch?v=kpVS0-6yMIQ>

