

Where am I?

- **HUL242: Fundamentals of Language Sciences**
- **Phonetics (Lecture-3)**
- Monday, Jan 13

Announcements

- Tutorial
 - Thursday, 6:30-7:30 pm, in two parallel sessions, LH318 & LH316
 - Wednesday, 1:00-2:00 pm in LH604
- This Thursday, Jan 16, will work as per the Tuesday timetable. So, there is no class and Tutorial this Thursday.

Recap: Sounds of (standard) American English

- **The consonants of American English**

- Core sounds: 22 : [p b t d k ɡ ʔ m n ŋ ɾ f v θ ð s z ʃ ʒ h ɹ l]
- Affricate: 2: [tʃ dʒ]

- **The vowels of American English**

- Simple vowel/monophthong: 10: [i ɪ u ʊ ε æ ə ʌ ɔ ɑ]
- Diphthongs: 3: [aj ɔj aw]

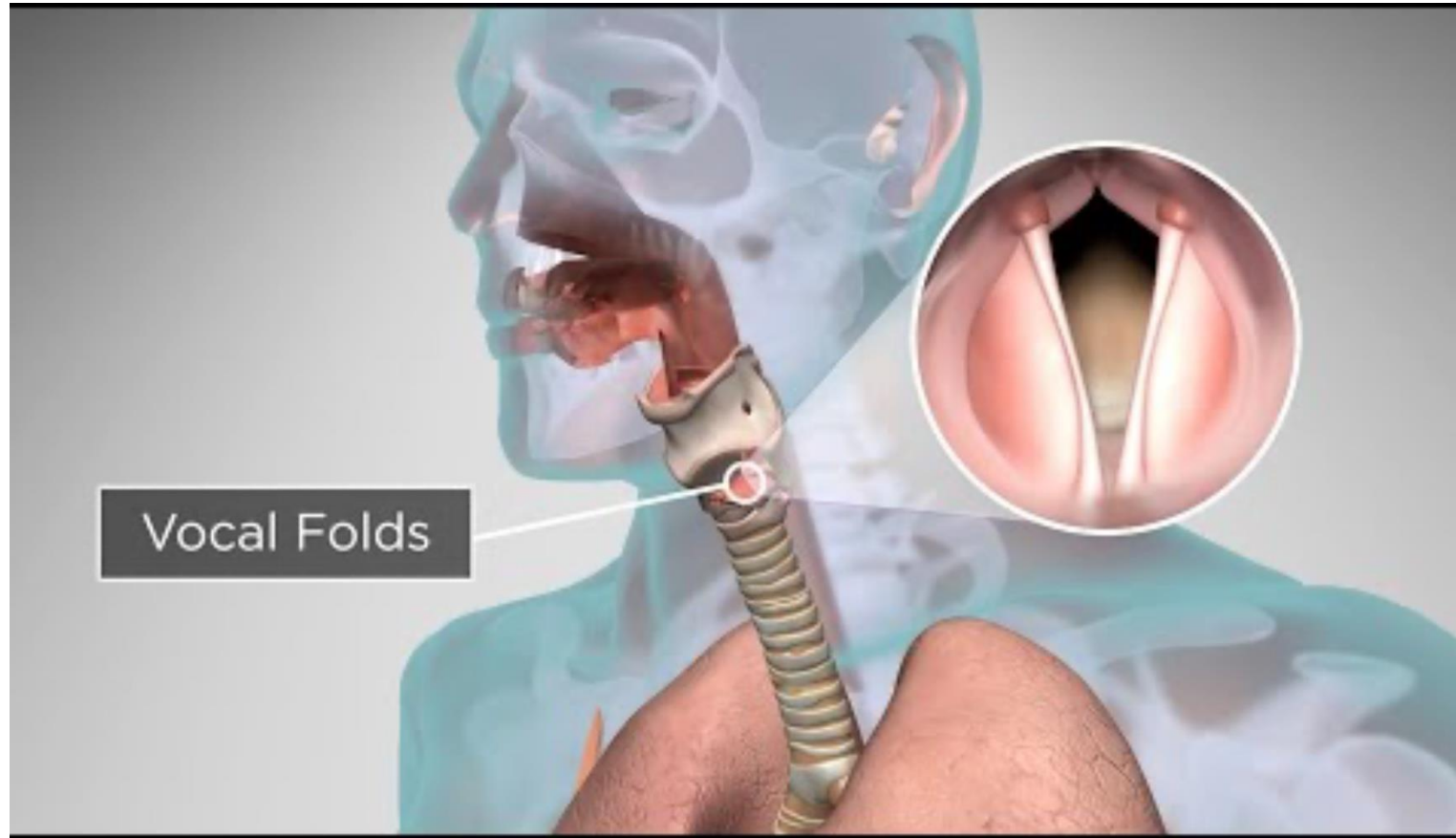
- **The Glides of American English**

[j w]

Recap: Phonological/articulatory processes

- Assimilation
- Dissimilation
- Deletion
- Epenthesis
- Metathesis

Recap: Sound producing system

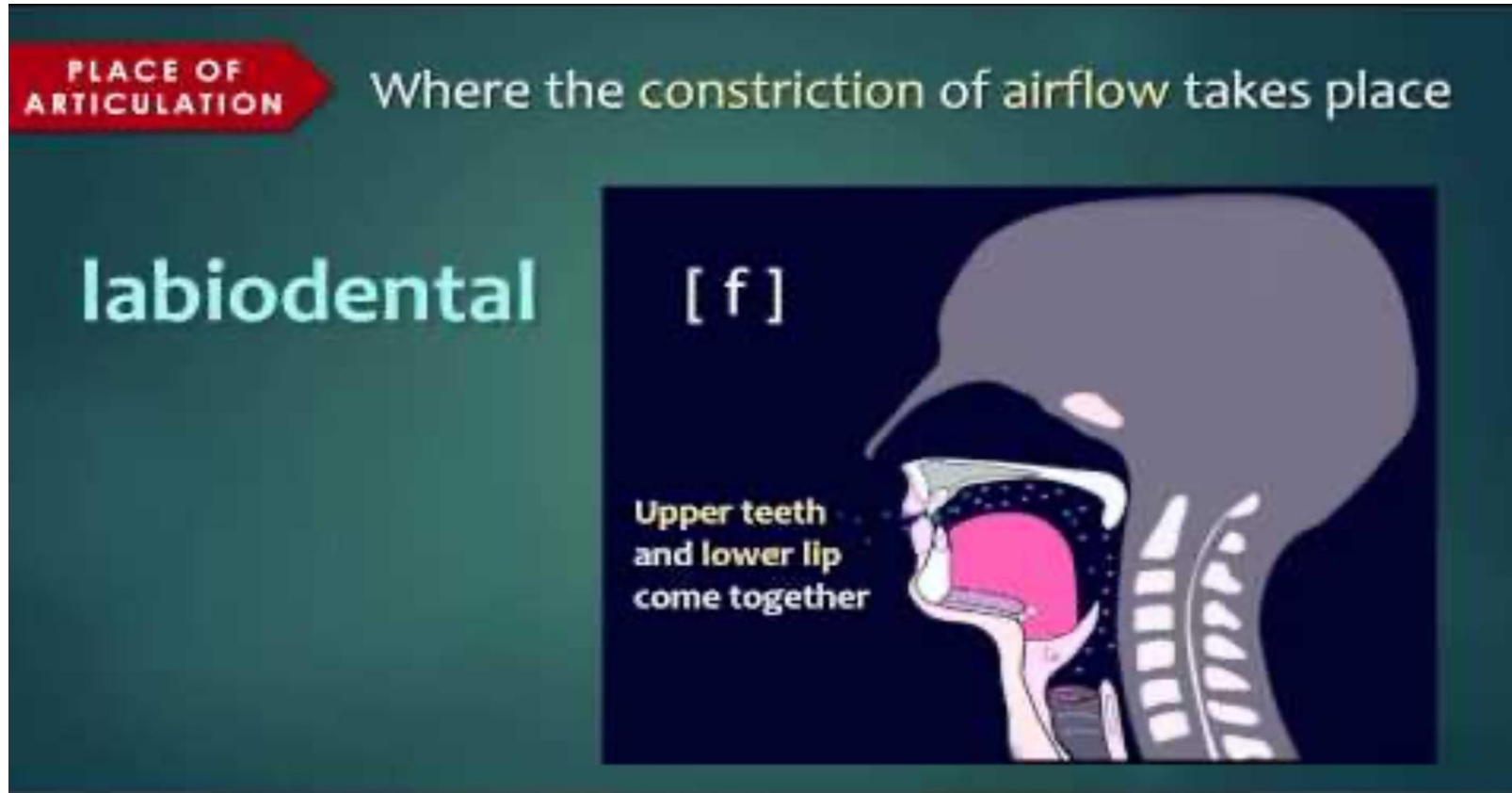


Today: Suprasegmentals

- In addition to the articulatory properties of speech sounds, languages also use prosodic properties, which are called *suprasegmental*.
 - Pitch
 - Length
 - Loudness
 - Stress

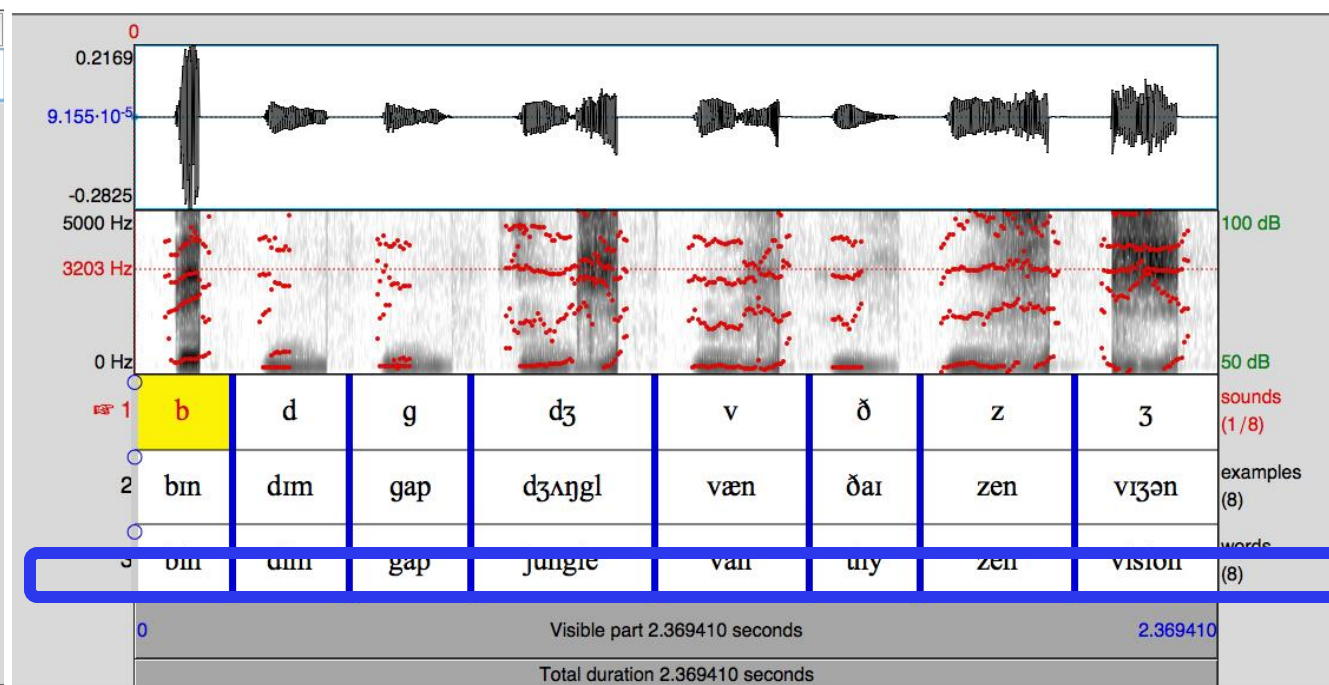
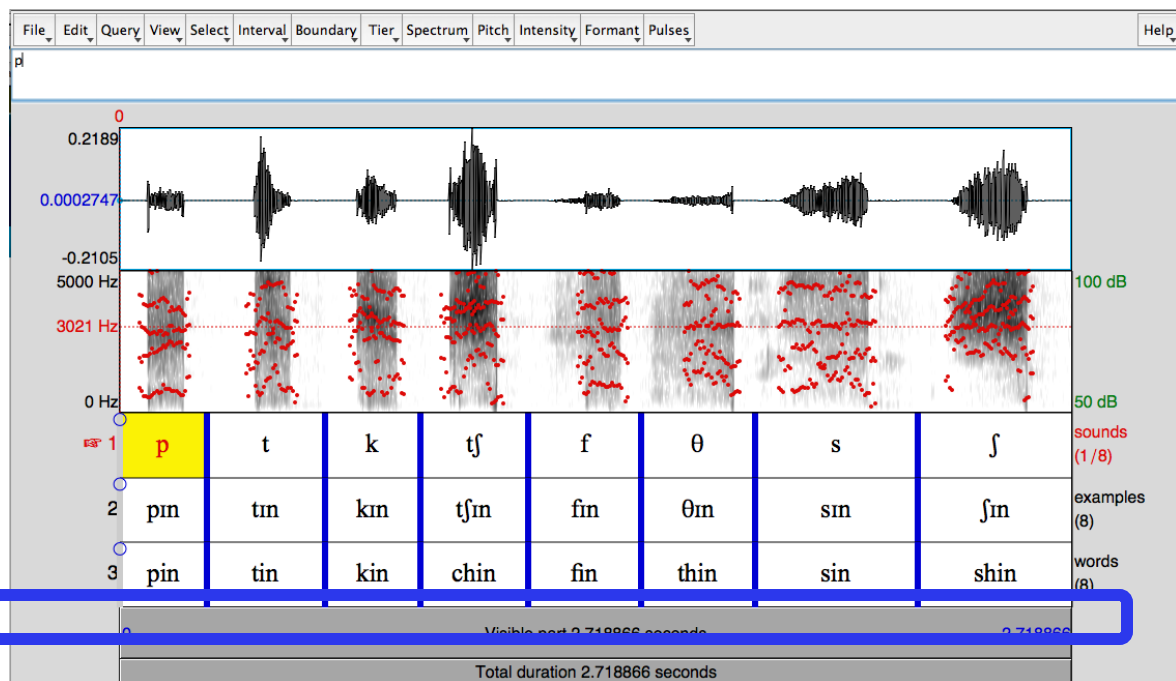
Note: Speech Sound Analysis

- Phonetics is NOT an intuition based subjective study; Phoneticians do not judge sound based on intuition or how they hear/perceive. Perception can be deceptive: English speakers cannot differentiate between [p] and [p^h].
- Ultrasound imaging is used to study the shape and movement of the vocal tract.



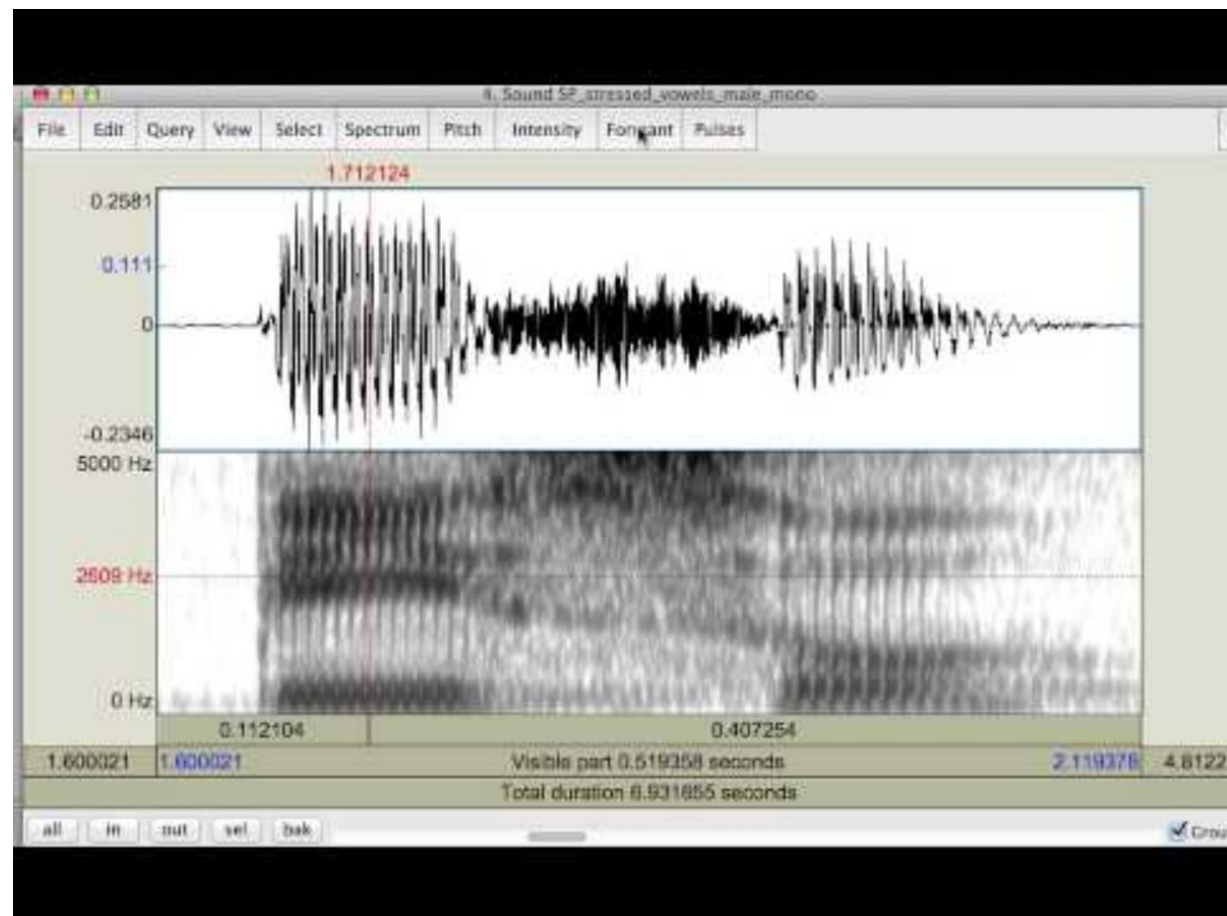
Note: Speech Sound Analysis

- The physical properties of speech sounds, such as frequencies, pitch, intensity, etc, are analysed to decide which sound is being spoken.

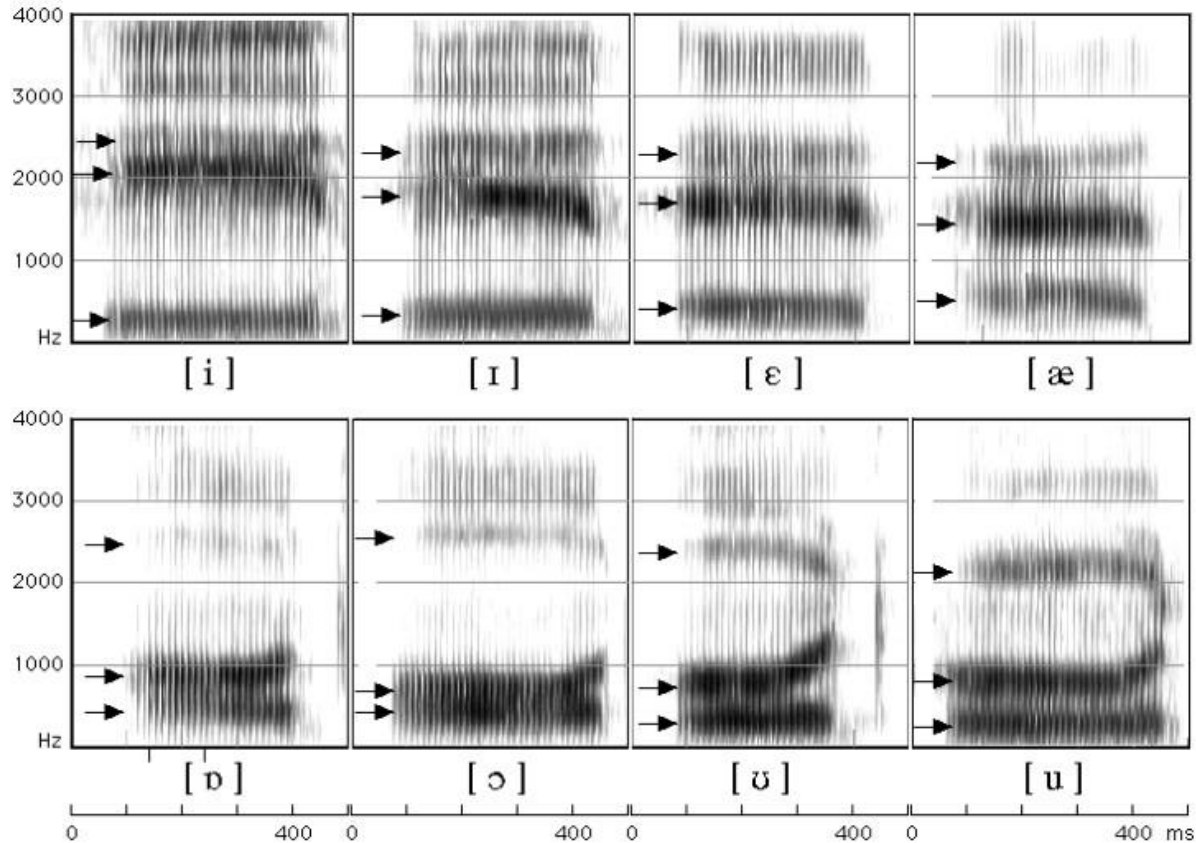


Difference in phonation between voiced and voiceless consonants

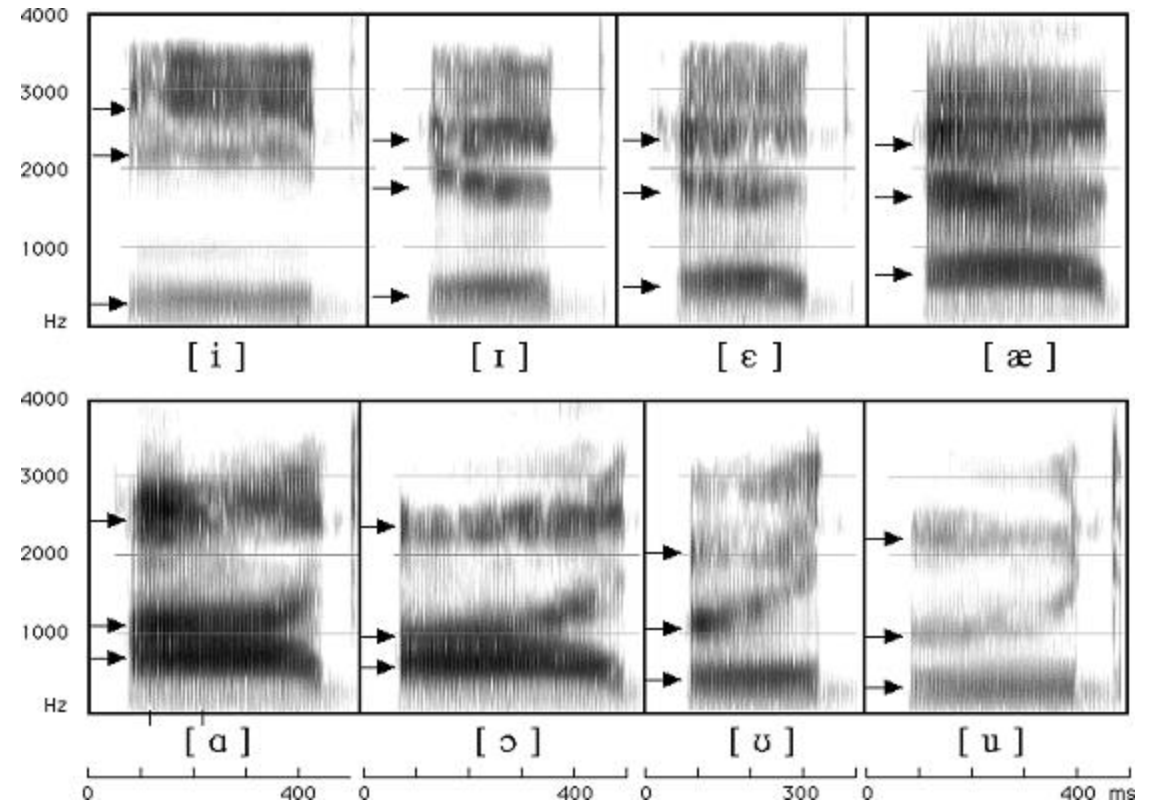
Using PRAAT to analyse speech sounds



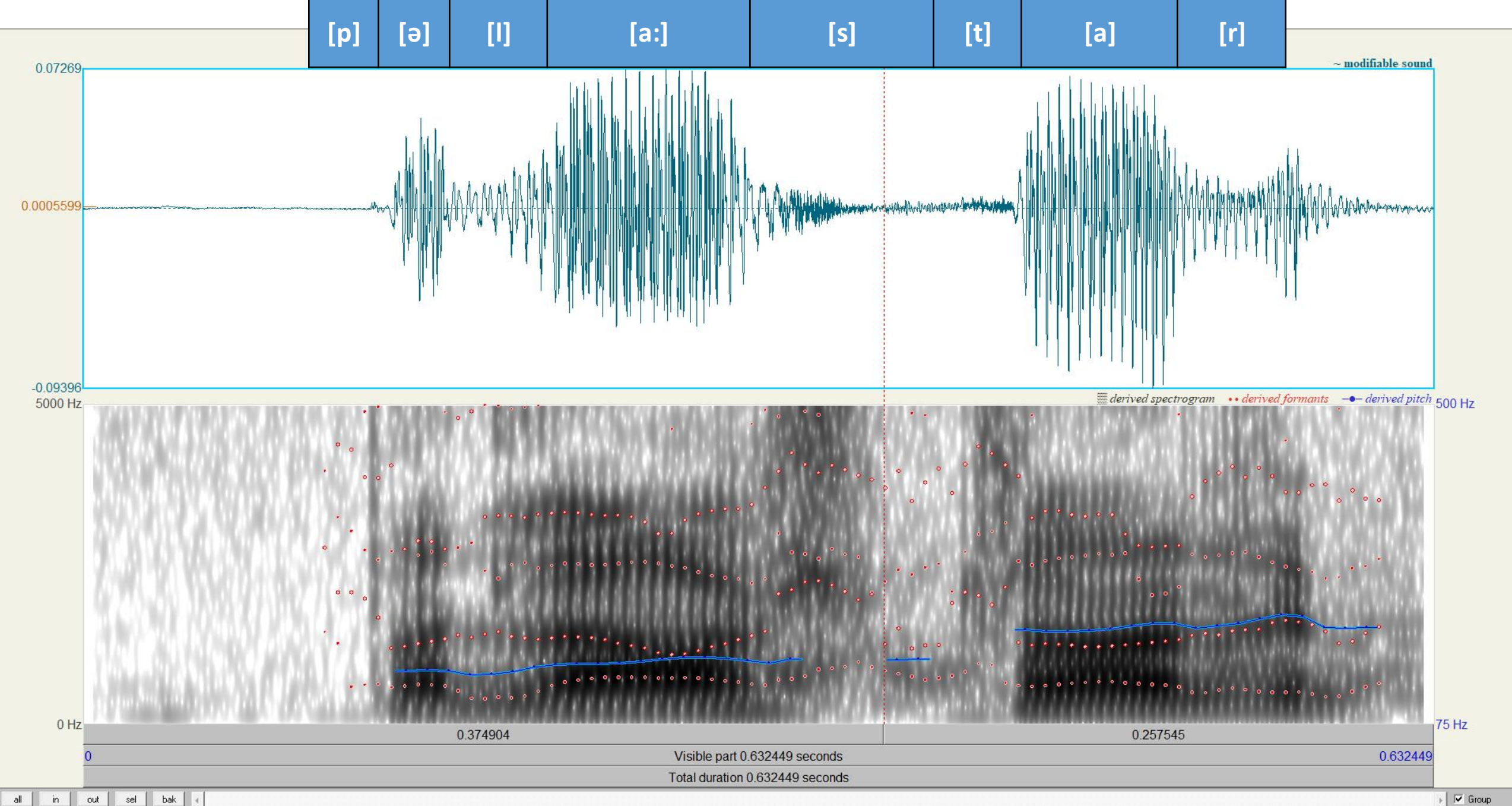
British English Vowels vs American English Vowels



Spectrograms of British English Vowels



Spectrograms of American English Vowels



Word 'plaster' spoken by native Hindi speaker with epenthetic schwa

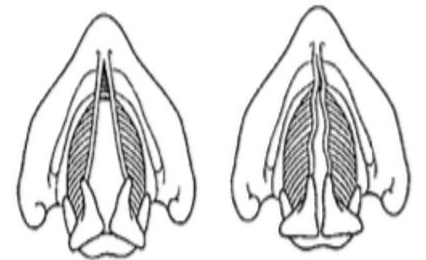
Suprasegmentals

Suprasegmentals

- In addition to the articulatory properties of speech sounds, languages also use prosodic properties, which are called *suprasegmental*.
 - Pitch
 - Length
 - Loudness
 - Stress

Pitch

- Pitch is performed by controlling the tension of the vocal folds and the amount of air that passes through the glottis.
- The combination of
 - Tensed vocal folds and greater air pressure results in **higher pitch**
 - Less tense vocal folds and lower air pressure result in **lower pitch**
- It is measured in 'Frequency' (vibration of vocal folds/second)
- The pitch of a female voice is generally higher than a male voice.
 - The average range for an adult woman's voice is 165–255 Hz,
 - The average range for an adult man's voice is 85–155 Hz.



Pitch

- Two types of controlled pitch movement are found in languages.
 - Tone
 - Intonation

Tone

- In some languages, differences in pitch bring differences in word meaning. Such languages are called **Tone** languages.
 - Some familiar tone languages are Chinese, Japanese, Thai, and Vietnamese, as well as many languages in the North-East of India.
- Pitch in tone languages functions very differently from pitch in a non-tone language like English, French, Hindi.

Tone

- Tones are differentiated into levels because different levels of tone signal different meanings, such tones are called **register tones**.
- Two or three register tones are the norm in most of the world's tone languages.
 - Tsuut'ina (or Sarcee), an Athabaskan language spoken in Alberta, Canada.

H	M	L
[miɬ] 'moth'	[miɬ] 'snare'	[miɬ] 'sleep'

Tsuut'ina level tones ([ɬ] is a voiceless lateral fricative)

- Recent studies suggest that the fourth tone is also common. Some recent studies claim that there is a 5th and 6th tone as well.

Tone

- A single tone may be associated with more than one syllabic element.

Table 2.18 High-tone and low-tone words in Mende

pélé	'banana'
háwámá	'waistline'
kpàkàlì	'tripod chair'

H
pélé

H
hawama

L
kpakali

Tone

- Different tone may be associated with different syllables.

Timeless	<table><tr><td>L</td><td>L</td></tr><tr><td> </td><td> </td></tr><tr><td>ima</td><td></td></tr></table>	L	L			ima		'I show'
L	L							
ima								
Continuous	<table><tr><td>H</td><td>L</td></tr><tr><td> </td><td> </td></tr><tr><td>ima</td><td></td></tr></table>	H	L			ima		'I am showing'
H	L							
ima								
Past	<table><tr><td>L</td><td>H</td></tr><tr><td> </td><td> </td></tr><tr><td>ima</td><td></td></tr></table>	L	H			ima		'I showed'
L	H							
ima								

Figure 2.13 Tense and tone in Bini

Tone

In some languages, tones can change pitch within a single syllabic element, such tones are called **contour tones**.

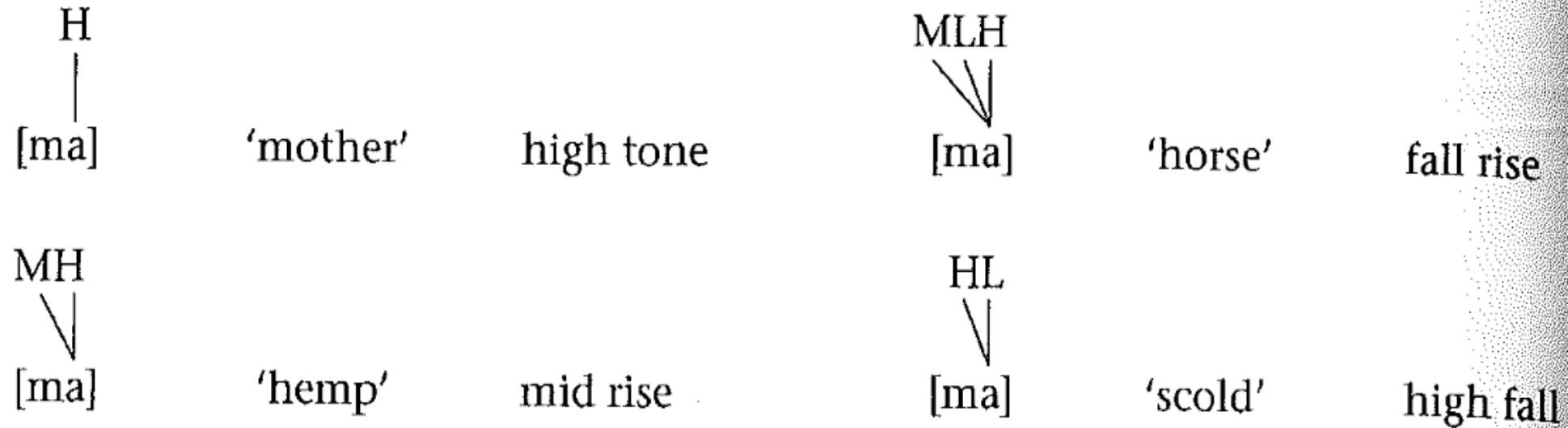


Figure 2.12 Register and contour tones in Mandarin

Tone

THE INTERNATIONAL PHONETIC ALPHABET (revised to 2020)













CONSONANTS (PULMONIC)

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	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b		t d			ʈ ɖ	c ɟ	k ɡ	q ɢ		ʔ
Nasal	m	ɱ	n			ɳ	ɲ	ŋ	ɴ		
Trill	ʙ		r						ʀ		
Tap or Flap		ⱱ	ɾ			ɽ					
Fricative	ɸ β	f v	θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ
Lateral fricative			ɬ ɮ								
Approximant		ʋ	ɹ			ɻ	j	ɰ			
Lateral approximant			l			ɭ	ʎ	ʟ			

Symbols to the right in a cell are voiced, to the left are voiceless. Shaded areas denote articulations judged impossible.

CONSONANTS (NON-PULMONIC)

Clicks	Voiced implosives	Ejectives
 Bilabial	 Bilabial	 Examples:
 Dental	 Dental/alveolar	 Bilabial
 (Post)alveolar	 Palatal	 Dental/alveolar
 Palatoalveolar	 Velar	 Velar
 Alveolar lateral	 Uvular	 Alveolar fricative

OTHER SYMBOLS

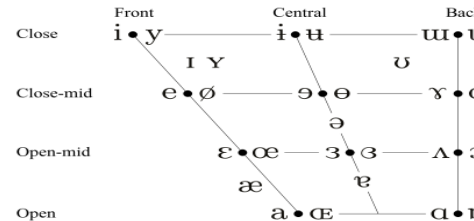
Λ	Voiceless labial-velar fricative	ʑ ʒ	Alveolo-palatal fricatives
W	Voiced labial-velar approximant	ɿ	Voiced alveolar lateral flap
ɥ	Voiced labial-palatal approximant	ɸ	Simultaneous ɸ and ɣ
ħ	Voiceless epiglottal fricative		Affricates and double articulations
ʕ	Voiced epiglottal fricative		can be represented by two symbols
ʕ̰	Epiglottal plosive		joined by a tie bar if necessary.

DIACRITICS

o	Voiceless	$\underset{\circ}{t}$ $\underset{\circ}{d}$..	Breathy voiced	$\underset{b}{t}$ $\underset{b}{d}$	┌	Dental	$\underset{d}{t}$ $\underset{d}{d}$
˘	Voiced	$\underset{v}{t}$ $\underset{v}{d}$	˜	Creaky voiced	$\underset{c}{t}$ $\underset{c}{d}$	└	Apical	$\underset{t}{t}$ $\underset{d}{d}$
h	Aspirated	t^h d^h	ˆ	Linguolabial	$\underset{t}{t}$ $\underset{d}{d}$	┌	Laminal	$\underset{t}{t}$ $\underset{d}{d}$
ɔ	More rounded	$\underset{ɔ}{t}$ $\underset{ɔ}{d}$	ˆw	Labialized	t^w d^w	└	Nasalized	$\underset{e}{e}$
ɛ	Less rounded	$\underset{ɛ}{t}$ $\underset{ɛ}{d}$	j	Palatalized	t^j d^j	n	Nasal release	$\underset{d}{d}$
+	Advanced	$\underset{+}{t}$ $\underset{+}{d}$	ʏ	Velarized	$t^ʏ$ $d^ʏ$	l	Lateral release	$\underset{d}{d}$
ˠ	Retracted	$\underset{ˠ}{t}$ $\underset{ˠ}{d}$	ʕ	Pharyngealized	$t^ʕ$ $d^ʕ$	ᵀ	No audible release	$\underset{d}{d}$
˞	Centralized	$\underset{˞}{t}$ $\underset{˞}{d}$	˜	Velarized or pharyngealized	$\underset{t}{t}$			
ɤ	Mid-centralized	$\underset{ɤ}{t}$ $\underset{ɤ}{d}$	ɹ	Raised	$\underset{ɹ}{t}$ ($\underset{ɹ}{t}$ = voiced alveolar fricative)			
ɻ	Syllabic	$\underset{ɻ}{t}$ $\underset{ɻ}{d}$	ɻ	Lowered	$\underset{ɻ}{t}$ ($\underset{ɻ}{t}$ = voiced bilabial approximant)			
ˠ	Non-syllabic	$\underset{ˠ}{t}$ $\underset{ˠ}{d}$	ɹ	Advanced Tongue Root	$\underset{ɹ}{t}$			
ˠ	Rhoticity	$\underset{ˠ}{t}$ $\underset{ˠ}{d}$	ɹ	Retracted Tongue Root	$\underset{ɹ}{t}$			

Some diacritics may be placed above a symbol with a descender, e.g. $\overset{\circ}{\eta}$

VOWELS



Where symbols appear in pairs, the one to the right represents a rounded vowel.

SUPRASEGMENTALS

	Primary stress	ˈ	fəʊnəˈtɪʃən
	Secondary stress	ˌ	
ː	Long	eː	
ˑ	Half-long	eˑ	
◌	Extra-short	◌e	
	Minor (foot) group		
	Major (intonation) group		
	Syllable break		ˌi.ækt
◌	Linking (absence of a break)		

TONES AND WORD ACCENTS

LEVEL		CONTOUR	
ē or 	Extra high	ē or 	Rising
é or 	High	è or 	Falling
ē or 	Mid	ē or 	High rising
è or 	Low	ē or 	Low rising
è or 	Extra low	ē or 	Rising-falling
↓	Downstep		Global rise
↑	Upstep		Global fall



Tone



Intonation

- Pitch movement that is not related to differences in word meaning is called **intonation**. It functions at a sentence level.
- The falling pitch we hear at the end of a statement in English signals that the utterance is complete.
- The rising intonation, on the other hand, signals incompleteness (in that it indicates that a conversation exchange is not finished)

English	Hindi
Fred parked the car. (falling intonation, statement)	Tum jaa rahe ho. (with falling intonation, statement)
Did Fred park the car? (rising intonation, question)	Tum jaa rahe ho? (with rising intonation, question)

Length

- In many languages, there are both vowels and consonants whose articulation takes longer than other vowels and consonants. This phenomenon is known as **length** and is widespread in the world's languages.
- Length is indicated by colon [:]

Hindi

[din] 'day'

[di:n] 'poor'

[puri:] 'city'

[pu:ri:] 'full'

Italian

[kasa] 'house'

[kas:a] 'box'

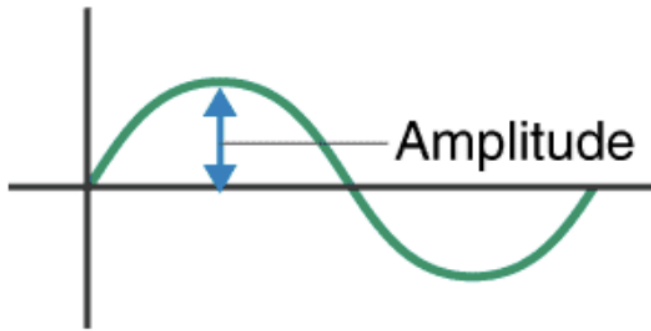
[fatɔ] 'fate'

[fat:ɔ] 'fact'

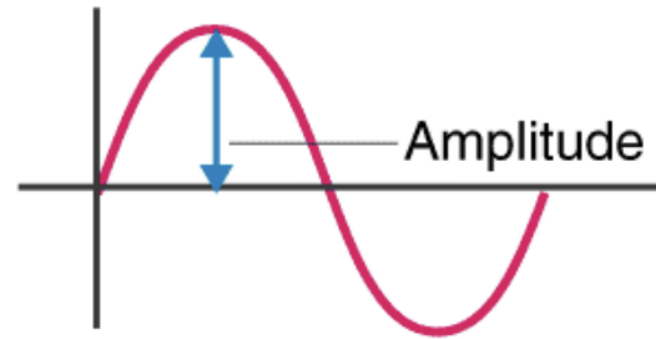
Loudness

- **Loudness** refers to how loud a sound is or how much (sound) energy it has.

- Measured in 'amplitude'



quieter



louder

Stress

- Some vowels are perceived as *more prominent* than others.
- In the English word *banana*, the second vowel is more prominent than the other two.
 - banana [bəˈnɑː nə]
- A segment that is perceived as more prominent is said to be **stressed**.
- **Stress** is a cover term for the combined effects of pitch, loudness, and length—the result of which is perceived prominence.

Stress: Two types

- **Primary stress:**

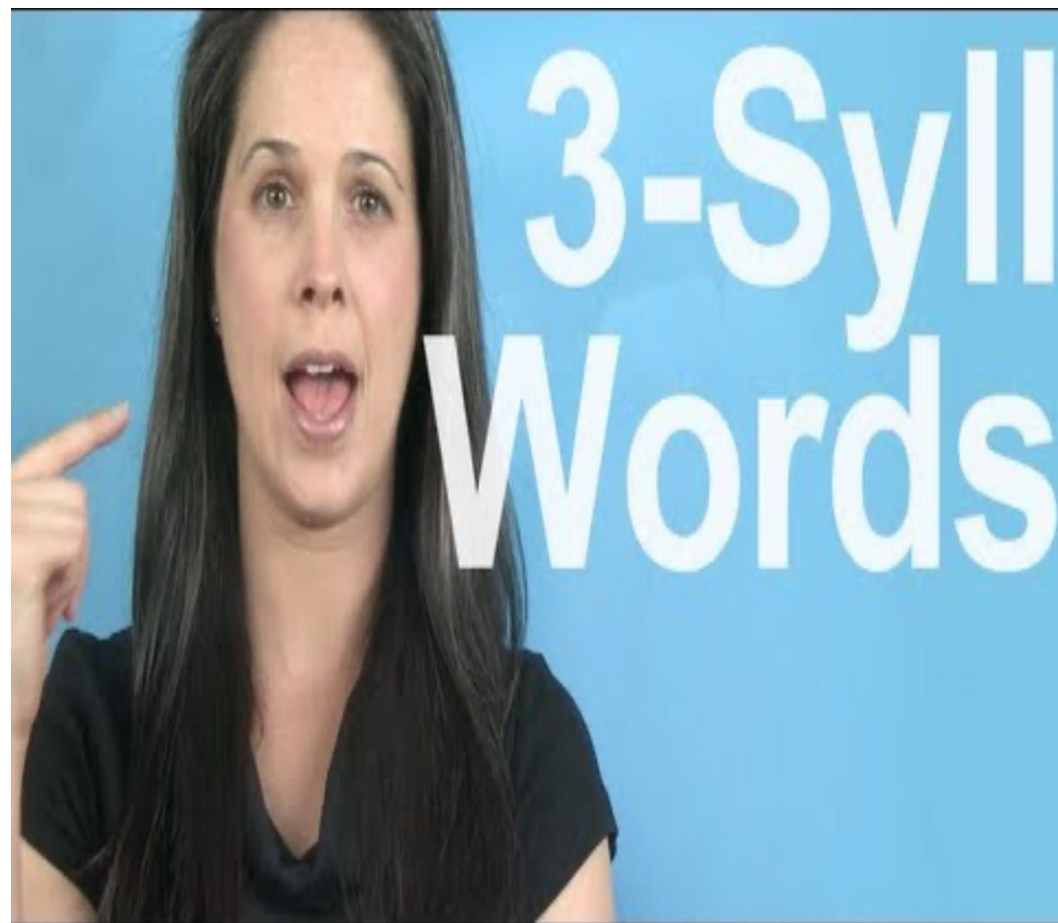
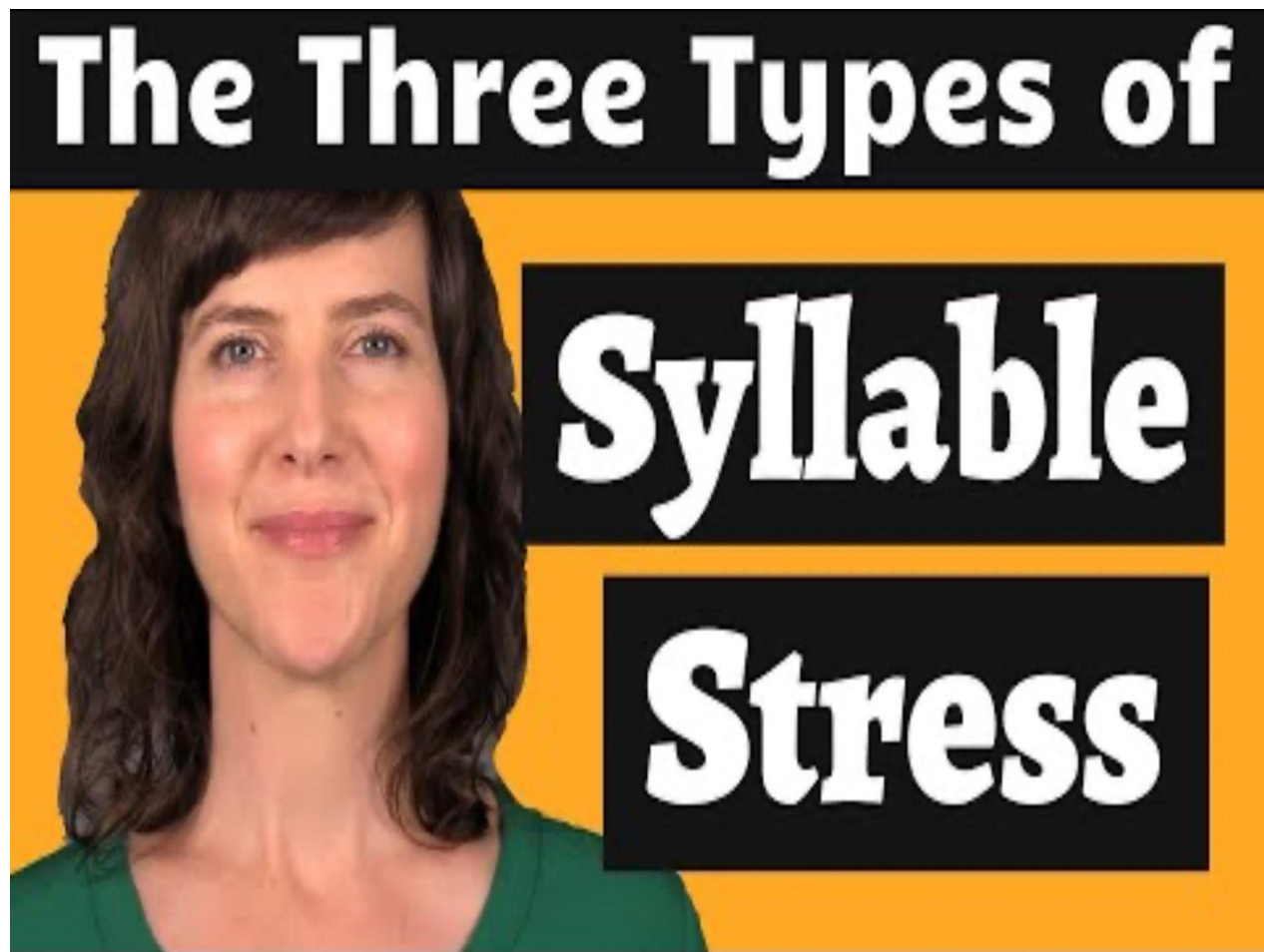
- The most prominent one, marked by the *acute* accent as on [´]

- **Secondary stress:**

- The second most prominent one, marked by the *grave* accent as on [˘]

	Book	IPA
Telegraphic	[t ^h ɛləɡɹæfɪk]	[,t ^h ɛlə'ɡɹæfɪk]
Telegraphy	[t ^h əlégɹəfɪ]	[t ^h ə'lɛɡɹə,fɪ]
Telegraph	[t ^h éləɡɹæf]	['t ^h ɛlə,ɡɹæf]

Stress: American English



Practical Applications of Phonetics

Practical Application

The study of speech sounds has several practical applications across different fields.

- Language Learning and Teaching

- Helps learners produce accurate sounds in a foreign language by understanding articulation and sound patterns.
- IPA helps in learning precise pronunciation.

- Speech Therapy/Articulation Disorders/Clinical Research

- Hearing Impairment: Designing better cochlear implants and hearing aids.
- Speech Disorders: Understanding conditions like stuttering or dysarthria for treatment development.
- Identifying and correcting speech sound errors in children or adults.

Practical Application

○ Technology

- Speech Recognition Systems: Phonetics is essential in designing applications like virtual assistants (e.g., Siri, Alexa) and voice-activated systems.
- Text-to-Speech Synthesis: Creating natural-sounding artificial voices in applications like audiobooks or navigation systems.
- Language Processing: Enhancing automatic translation tools like Google Translate.

○ Linguistic Research

- Dialect Studies: Analyzing regional and social variations in speech patterns.
- Historical Linguistics: Understanding the evolution of sounds in languages over time.

Next class

- Phonology

- Readings: O'Grady, Williams, et al. 2010. Phonology, in *Contemporary Linguistics*. 6th edition. Boston. New York: Bedford/St. Martin's.
- Grady_Phonology_Ch 3
- Sections 1 & 2