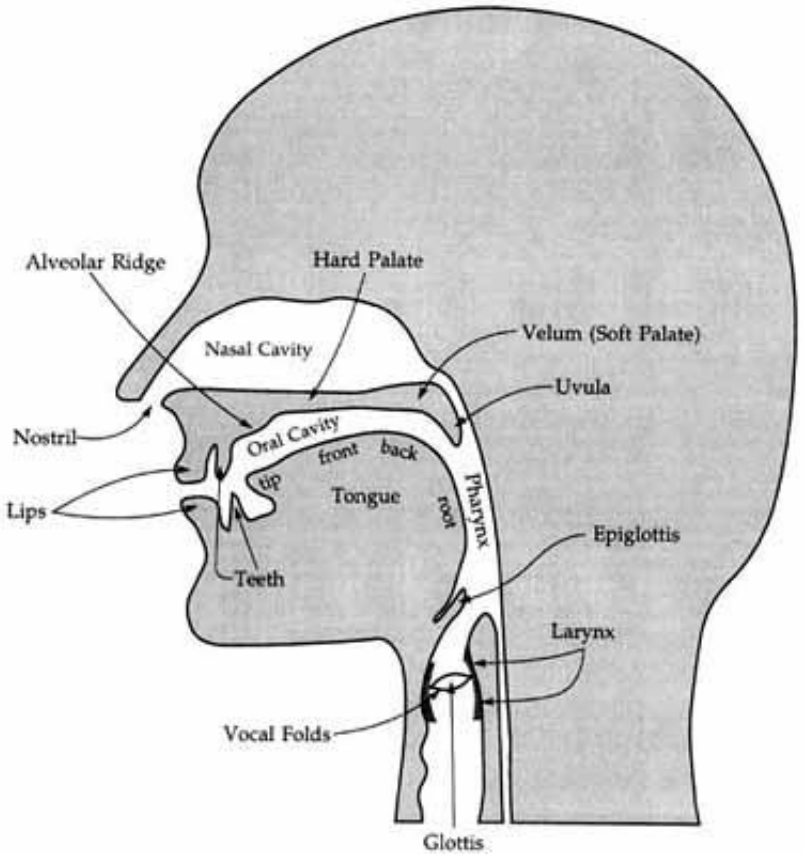
Week 2: Phonetics I



Rebecca Starr
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EL1101E
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Reminders

- Zoom office hours are happening each week on Fridays at 2 PM.
- Tutorials will be starting on Week 4.
- Assignment 1 will be released next week, but not due until Week 5.

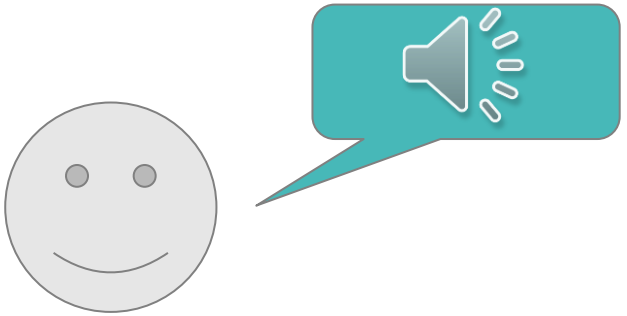
Last week

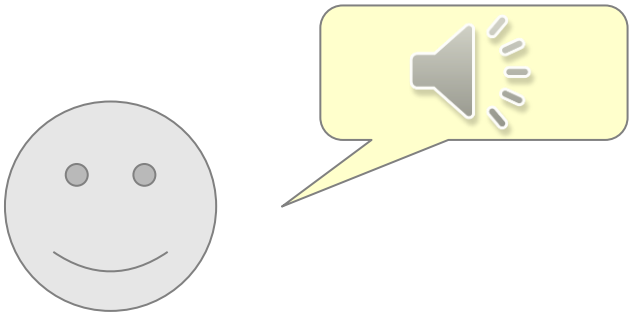
- We learned what linguistics is and where it originated.
- We thought about what ‘knowledge of language’ entails.
- Today, we are starting off our journey through linguistic structure with the smallest units of language, speech sounds!

Today

- Introduction to speech
- Approaches to studying phonetics
- Articulatory Phonetics: how is speech produced?
- Consonants
- Introducing IPA

Let’s listen to some speech...





- Things to think about:
  - Any guesses about what languages these are?
  - Can you tell where the boundaries between words are?
  - Can you tell where the boundaries between sentences are?

Listening to unfamiliar languages

- Language A was Hmong, B was Scots Gaelic.
- Even for languages we do not know, we can perceive some cues for sentence boundaries.
- But we cannot identify the boundaries of words. Within a sentence, speech comes out in a pretty continuous stream.
  - Speech is often referred to as the **speech stream**.

Listening to unfamiliar languages

- Common thoughts when hearing an unfamiliar language:
  - “Why are they speaking so quickly? How can anyone understand this??”
  - “How do people make these sounds? Why is this language so hard to pronounce??”

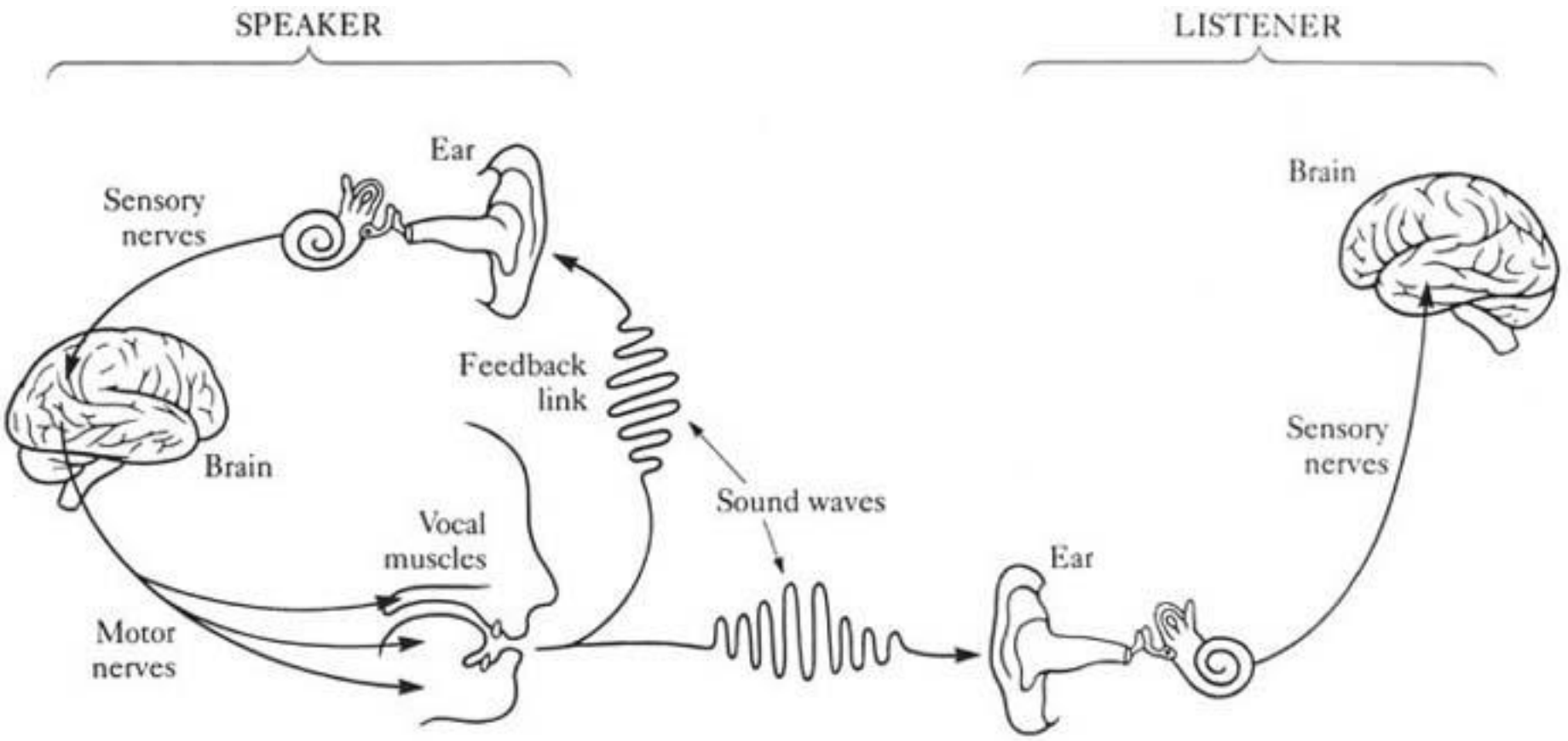
The language experts

- Humans are, in many ways, experts in our native languages.
- When we speak, we automatically coordinate our muscles to form the appropriate sound sequence.
- When we hear a language we know, our brain automatically breaks it up and analyzes it.
- These processes are invisible to us and seem easy.
  - But in fact, they are so complex that we have yet to train a computer to reliably do any of them.

The speech chain

- What steps are involved in the speaking and listening process?
- Although the speaker and hearer are two different individuals, we can conceive of the production and perception of speech as a single **speech chain**.

The speech chain



Approaches to phonetics

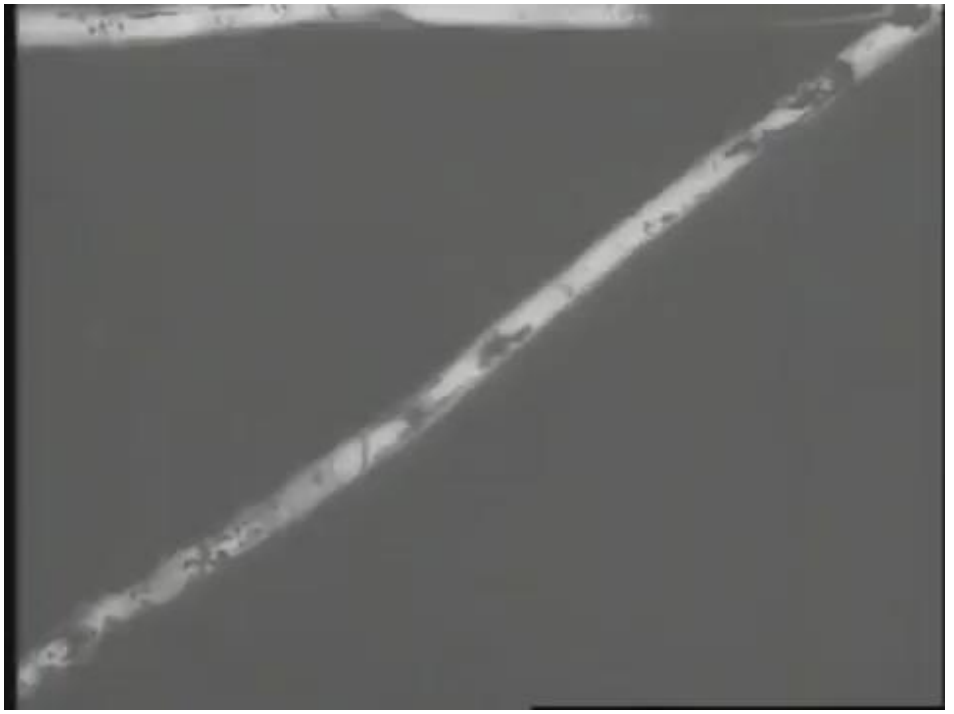
- **Phonetics**: the study of speech sounds.
- As we saw in the chain, there are cognitive, physiological, and acoustic aspects of the production and perception of speech.
  - This means a lot to study, requiring many different types of research tools.

Approaches to phonetics

- Three main areas of phonetics:
  - **Articulatory phonetics**: the study of how speech sounds are produced.
  - **Acoustic phonetics**: the study of the acoustic properties of the speech signal.
  - **Auditory phonetics**: the study of listeners' perception of speech sounds.
- Focus on articulatory phonetics in this module.

Articulatory Phonetics

- How do we produce speech?
- Let's watch a slightly creepy X-ray video. Notice how many different parts are moving to produce these sounds:

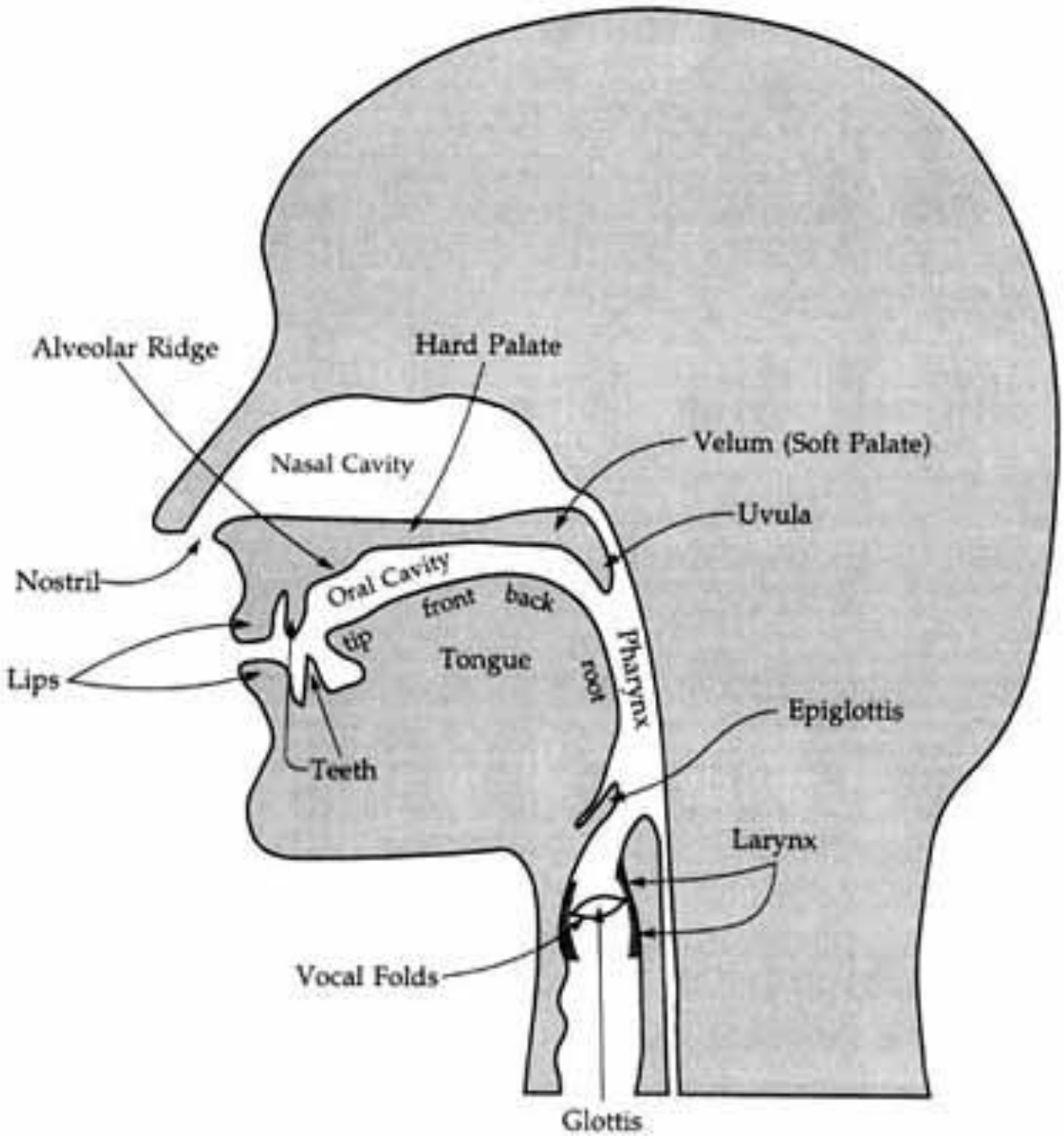


https://www.youtube.com/watch?v=DcNMCB-Gsn8

Process of speech production

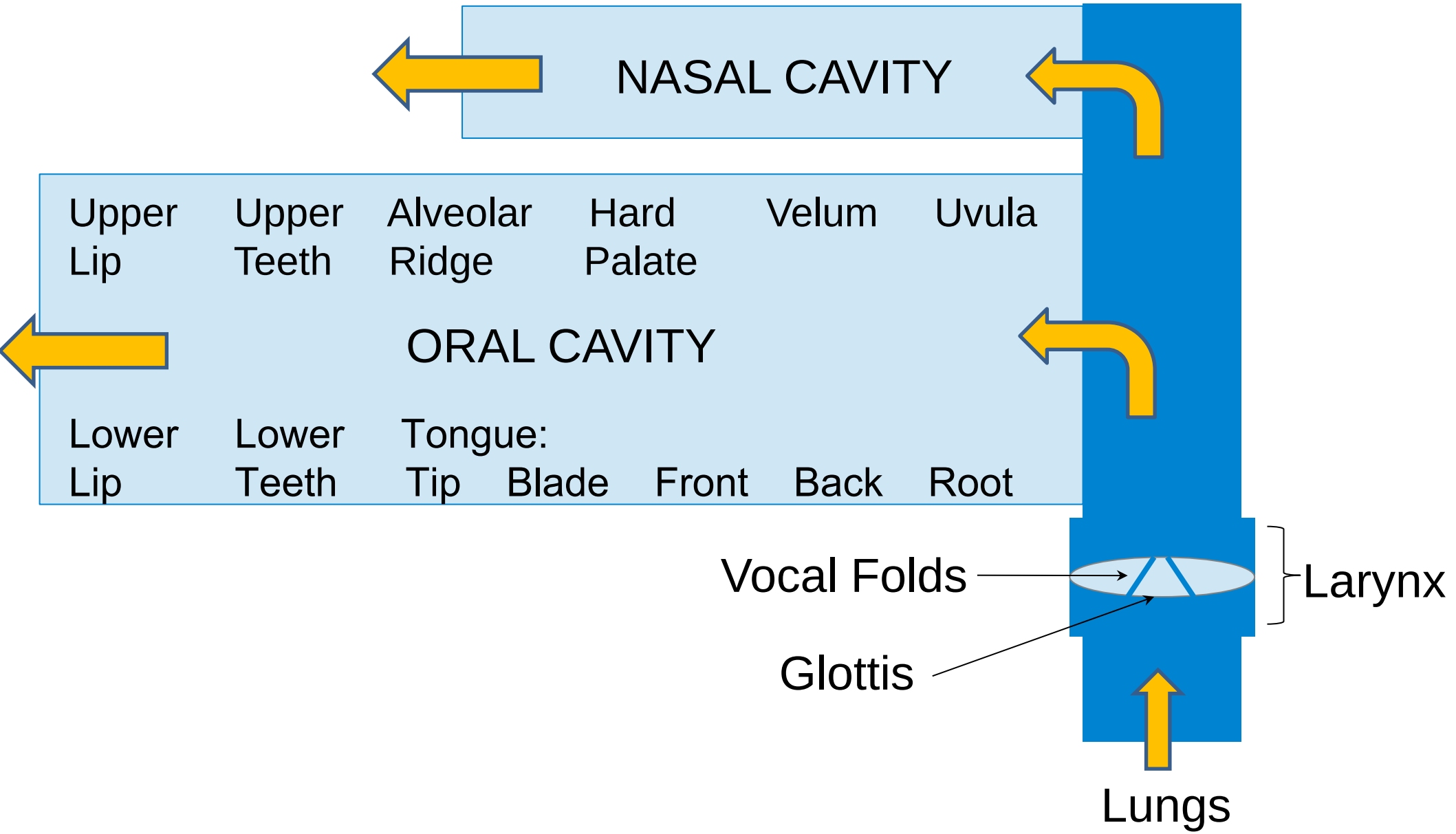
- The voice is powered by air coming up from the lungs.
- The human voice, including speech, is created by the way that air is molded by different parts of the **vocal tract** as it travels up to escape through our mouth and nose.

The Vocal Tract



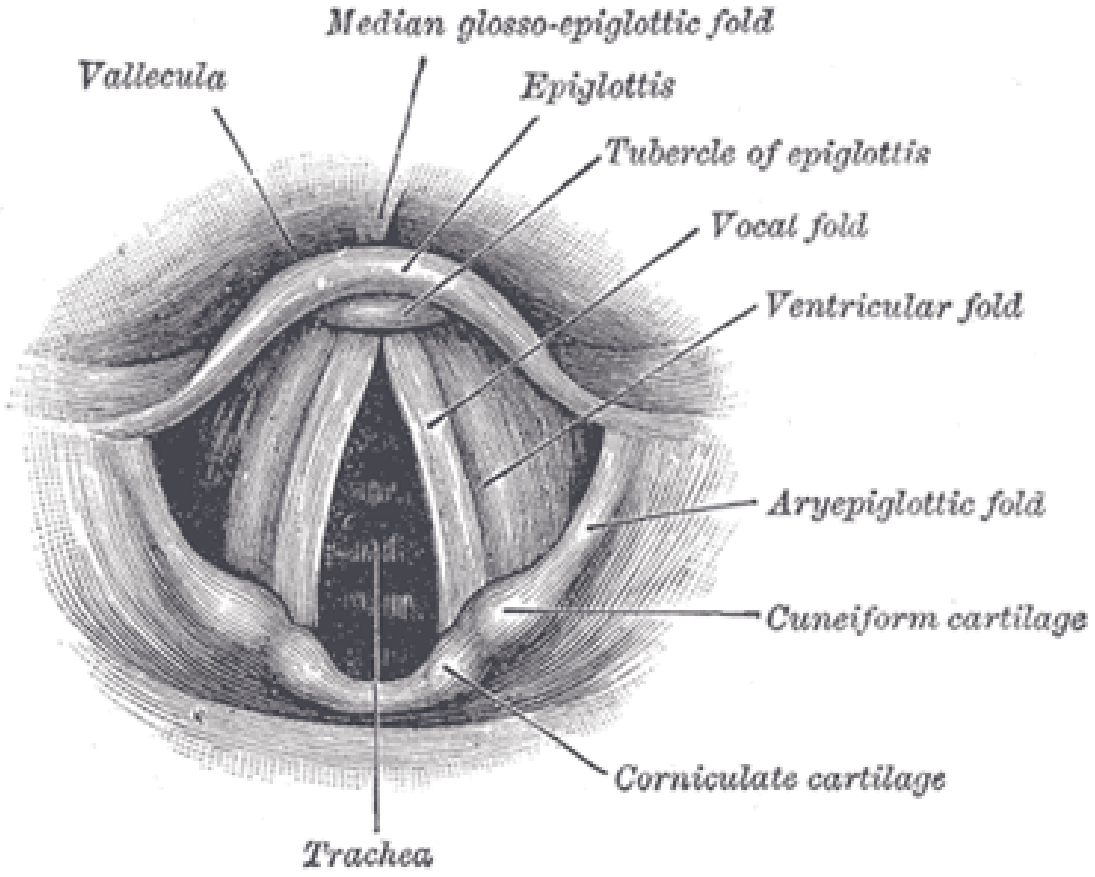
(http://jcarreras.homestead.com/rrphonetics1.html)

The vocal tract



Larynx

- Commonly called voice box / Adam's apple.
- Vocal folds can be manipulated into various configurations.
- In certain configurations, air passing through causes the folds to vibrate, producing sound.



Clip of the vocal folds in action...

- http://www.youtube.com/watch?v=mJedwz_r2Pc#t=18

Voicing

- What is the difference between a “z” sound and an “s” sound?
- Put your hand over your larynx and see if you can feel any difference between “zzzz” and “ssss.”

Voicing

- The vocal folds provide one of the key distinctions in speech sounds:
  - **Voiced**: vocal folds vibrating
  - **Voiceless**: vocal folds not vibrating
- Which of the following words start with a voiced consonant?

(a) pair
(b) shine
(c) judge
(d) bear

Voicing

Which of the following words start with a voiced consonant?

(a) pair:	voiceless
(b) shine:	voiceless
(c) judge:	voiced
(d) bear:	voiced

Voicing

- What about vowels, are they voiced or voiceless?

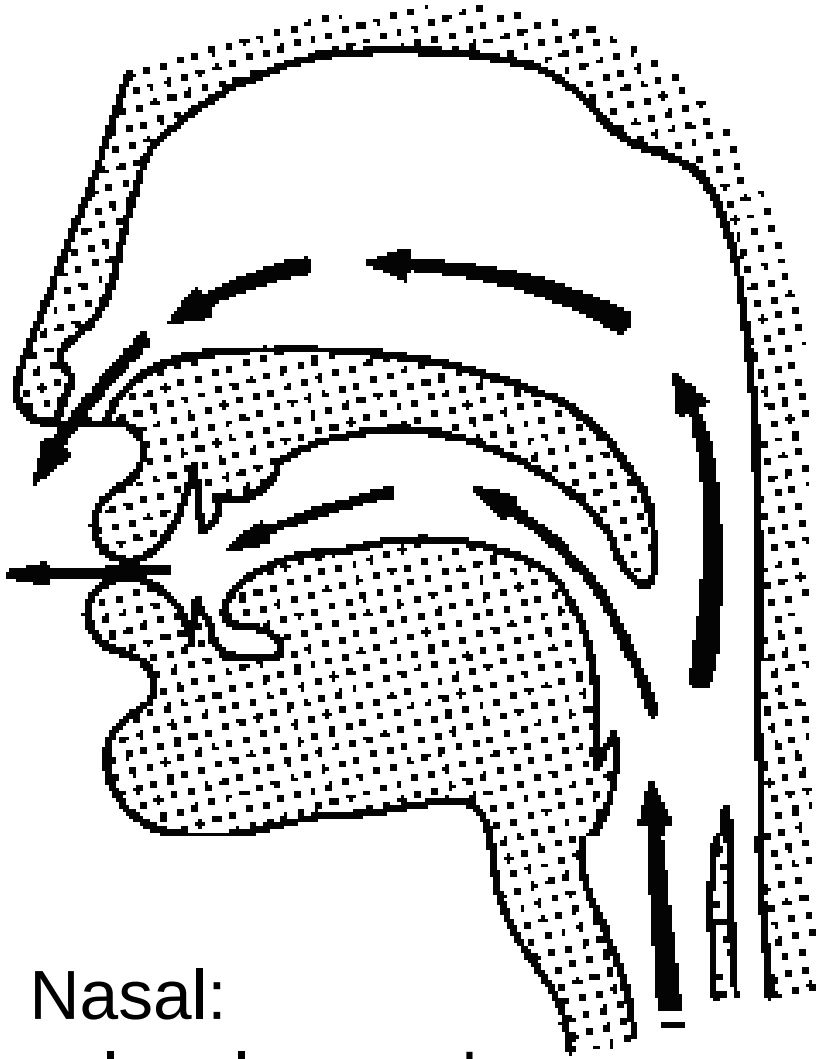
Voicing

- What about vowels, are they voiced or voiceless?
  - In English (and most languages), all vowels are voiced.

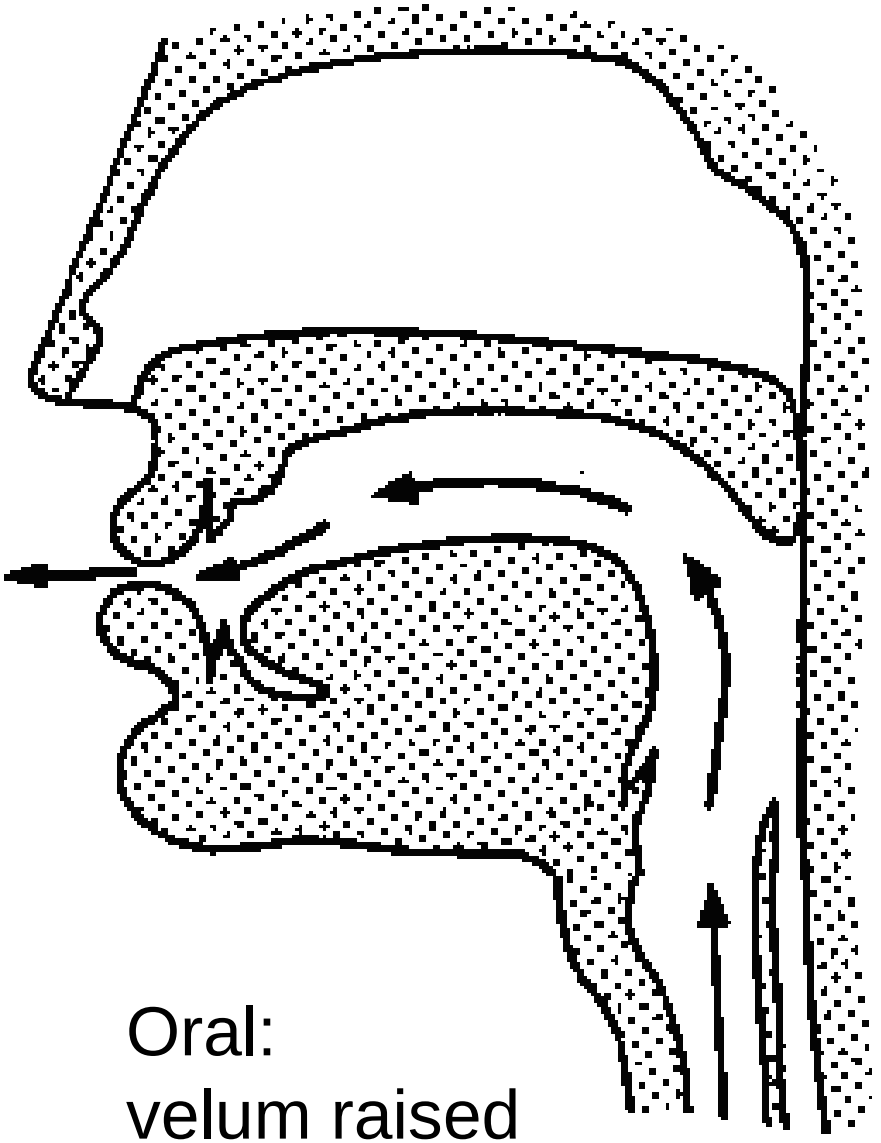
Nasal and Oral

- Hold your nose and say “ahhhh”
- Now hold your nose and say “mmmm”

Nasal and Oral



Nasal:
velum lowered



Oral:
velum raised

Consonants vs. Vowels

- Consonants: airflow through the oral cavity is **obstructed** in some way.
- Vowels: airflow through the oral cavity is **not obstructed**.
- Today, we'll focus on (English) consonants.

Three key features capture consonants

1) Voicing (voiced vs. voiceless)

2) Place of articulation

- Where is the air flow obstructed?

3) Manner of articulation

- How is the air flow obstructed?
- Includes nasality (oral vs. nasal)

Place of articulation: articulators

- Obstructions are created using **articulators** (almost all in the oral cavity)
- We can usually identify an **active** articular and a **passive** articulator.
  - For example, the tongue often moves up to contact part of the roof of the mouth.

Place of articulation: time for some Latin

Location	**Place of articulation**
lips	labial
teeth	dental
alveolar ridge	alveolar
hard palate	palatal
soft palate (velum)	velar
glottis	glottal

Bilabial

- Oral:
  - PET
  - BET
  - WET
- Nasal:
  - MET

- Which of these sounds are voiced vs. voiceless?

Labiodental

FINE (voiceless)

VINE (voiced)

- Why are they called labiodental?

Interdental

THIN (voiceless)

THIS (voiced)

Wait, there are two “th” sounds? How are we supposed to write each one?

Interdental

- Let's learn our first two International Phonetic Alphabet (IPA) symbols:

THIN: [θ] (a Greek theta)

THIS: [ð] (called "eth")

- More about the IPA in a bit!

Interdental

- Different people have different ways of making these sounds!
  - Some put their tongue between their teeth (interdental)
  - Others put their tongue behind their teeth (dental)
- For this course, we'll just call them "interdental".

Alveolar

- Oral:
  - TUNE
  - DUNE
  - SOON
  - ZOO
  - LOON
  - RUNE (*note:* the reading for this week classifies this sound as ‘retroflex’ instead of alveolar, but for this course we will consider it alveolar.)
- Nasal
  - NOON

Post-alveolar

SHIP: [ʃ]

GENRE / MEASURE: [ʒ]

CHIP: [tʃ]

GYM: [dʒ]

Palatal

YES: [j]

Velar

Oral:

KIT

GIFT

Nasal:

KING, THINK [ŋ] (“engma”)

- In English, engmas never appear at the beginning of a word or syllable. But they do in other languages like Cantonese.

Uvular?

- We don’t have any uvular sounds in English.
- But they are fun:
  - [R] Can you guess what sound this is?

Glottal

- Produced by narrowing or closing vocal folds.

HAT

UH-OH: [ʔ] (“glottal stop”)

(NOTE: We often produce words that begin with vowels with an initial glottal stop (e.g., “apple”). However, this initial glottal stop is not considered part of the ‘basic’ pronunciation of the word, because it only appears in certain contexts. So, the first consonant in “apple” would be [p], not [ʔ].)

Summary: places of articulation in English

- Bilabial: [b] [p] [m] [w]
- Labiodental: [f] [v]
- Interdental: [θ] [ð]
- Alveolar: [d] [t] [n] [l] [s] [z] [r]
- Post-alveolar: [ʃ] [ʒ] [tʃ] [dʒ]
- Palatal: [j]
- Velar: [g] [k] [ŋ]
- Glottal: [h] [ʔ]

Manner of articulation

- Is place of articulation enough information for us to distinguish between sounds?

[d] [z]

- Both of those sounds are voiced alveolar consonants.
- But they are obviously very different!

Stops

- In a **stop**, the oral cavity is completely blocked.
- There are two types of stop:
  - Oral stop (aka **plosive**):
    - [p], [b], [t], [d], [k], [g], [ʔ]
    - Good test for plosive: can you hold out the sound?
  - Nasal stop:
    - [m], [n], [ŋ]

Fricatives and Affricates

- **Fricative**: partial obstruction, causing turbulence (a “buzzy” noise).
  - [f], [v], [θ], [ð], [s], [z], [ʃ], [ʒ], [h]
- **Affricate**: a stop plus a fricative.
  - [tʃ], [dʒ]

Fricatives and Affricates

Quiz yourself: which of these start with fricatives, and which with affricates?

(1) staple

(2) juice

(3) phase

(4) Cheryl

(5) Tsinghua University

(6) Djokovic

Fricatives and Affricates

Quiz yourself: which of these start with fricatives, and which with affricates?

(1) staple: [s] fric.

(2) juice: [dʒ] affric.

(3) phase: [f] fric.

(4) Cheryl: [ʃ] fric.

(5) Tsinghua: [tɕʰ] affric.

(6) Djokovic: [d͡ʑ] affric.

Approximants: Liquids and Glides

- Liquids:
  - Constriction but no turbulence
  - [l] : lateral liquid
  - [r]: central liquid
- Glides:
  - Also called “semi-vowels.” Very vowely.
  - [j], [w]

Summary of manners of articulation

- Stops:
  - Plosives: [p], [b], [t], [d], [k], [g], [ʔ]
  - Nasals: [m], [n], [ŋ]
- Fricatives: [f], [v], [θ], [ð], [s], [z], [ʃ], [ʒ], [h]
- Affricates: [tʃ], [dʒ]
- Approximants:
  - Liquids: [l], [r]
  - Glides: [j], [w]

How can we distinguish these consonants?

- How many distinguishing features do we need to identify any consonant?
- How about:
  - Voiced bilabial

How can we distinguish these consonants?

- How many distinguishing features do we need to identify any consonant?
- How about:
  - Voiced bilabial: could be [m], [b], or [w]

Distinctive features

- Maximum info we need to identify any consonant:
  - Voicing
  - Place
  - Manner
    - Reminder: includes nasality
    - For liquids, we need lateral / central.
- Certain consonants of English are identifiable with less info (e.g., [j]).

Practice: identify the consonants!

(a) voiceless alveolar oral fricative

(b) voiced velar nasal stop

(c) voiceless bilabial oral stop

Practice: identify the consonants!

(a) voiceless alveolar oral fricative: [s]

(b) voiced velar nasal stop: [ŋ]

(c) voiceless bilabial oral stop: [p]

Why do we need the International Phonetic Alphabet?

- As we have seen, using Roman letters makes it difficult for us to identify each English consonant.
- In general, the alphabet is not great for phonetics. For one thing, different languages use it differently:

English	French	German
chair	**ch**aise	Ba**ch**

Why do we need the International Phonetic Alphabet?

English in particular has very inconsistent spelling:

tough	**[ʌf]**
though	**[oʊ]**
through	**[u]**
thought	**[ɔ:]**
bough	**[aʊ]**

What is the IPA?

- A special set of alphabetic characters representing speech sounds, designed to phonetically transcribe language.
- Designed to represent all speech sounds in every language consistently.
- Consists of letters and diacritics (little symbols that indicate minor variations).

Consonant section of full IPA chart

THE INTERNATIONAL PHONETIC ALPHABET (revised to 2005)

CONSONANTS (PULMONIC) © 2005 IPA

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d		ʈ ɖ	c ɟ	k g	q ɢ		ʔ
Nasal	m	ɱ		n		ɳ	ɲ	ŋ	N		
Trill	B			r					R		
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			

Where symbols appear in pairs, the one to the right represents a voiced consonant. Shaded areas denote articulations judged impossible.

Full IPA chart here:
https://www.internationalphoneticassociation.org/sites/default/files/IPA_Kiel_2015.pdf

English consonants

(all the consonants you need for this module)

	BILABIAL	LABIODENTAL	INTER-DENTAL	ALVEOLAR	POST-ALV.	PALATAL	VELAR	GLOTTAL
PLOSIVE	p b			t d			k g	ʔ
NASAL	m			n			ŋ	
FRICATIVE		f v	θ ð	s z	ʃ ʒ			h
AFFRICATE					tʃ dʒ			
LIQUID (CENTRAL)				r				
(LATERAL)				l				
GLIDE	w					j		

How do we transcribe using IPA?

- We write IPA within square brackets to indicate a phonetic transcription.
- Depending how precise we want to be, we can use a more **narrow** (detailed) or **broad** transcription.

	narrow	broad
“pan”:	[pʰæ̃n]	[pæn]

- For this module, we will focus on broad transcription.
- To type in IPA, I recommend this tool: http://westonruter.github.io/ipa-chart/keyboard/

Is the IPA always the same for English?

- The IPA represents pronunciation. If a word is pronounced differently, it is transcribed differently.
  - Ex: “water” is pronounced very differently in the US vs. UK:

    [wɑrər] [wɔtə]

- Thus, there is no single correct IPA for English.
- This variation comes up more for vowels, so we will return to this question next week.

Are we learning the “real” IPA?

- In this module we are using a few common simplifications often used in the transcription of English.
- Most notably, in official IPA, [r] represents an alveolar trill (as in Malay and Spanish), while [ɹ] represents the English r sound.
- No one wants to get stuck writing an upside-down r for no reason.

Are you lying to us about anything else??

- If you look on the full IPA chart, you may be distressed to discover that [w] is missing from the main consonant chart.
- That's because, technically, [w] has a "labio-velar" place of articulation. You can find [w] in the "other symbols" section of the official IPA chart.
- For the purposes of this class, treat [w] as bilabial.

Can I find IPA transcriptions of words in the dictionary?

- While some dictionaries use the IPA to indicate pronunciation, others use their own systems.
- One useful resource for IPA is Wiktionary.
  - If you google almost any word followed by wiktionary, you'll find a Wiktionary entry that lists the US and UK transcriptions of that word in IPA.
- Another source: the Cambridge Dictionary.

Why am I finding some consonants difficult to distinguish?

- Although Singapore English doesn’t differ much from US or UK English for consonants, there are a couple things you should be aware of.

Why am I finding some consonants difficult to distinguish?

- **Final consonant devoicing**: in Singapore, many speakers pronounce voiced consonants at the ends of words as voiceless.
  - Do ‘peace’ and ‘peas’ sound the same to you?
- **th/dh stopping**: in Singapore, many speakers pronounce [θ] as [t] and [ð] as [d].
  - Do ‘thin’ and ‘tin’ sound the same to you?

Why am I finding some consonants difficult to distinguish?

- Don’t worry – we won’t be testing you on distinguishing sounds that we know are difficult for speakers of Singapore English.
- But it is interesting to learn about the distinctive features of Singapore English!
- We will return to this topic next week when we learn about vowels.

IPA Consonant Practice

Try to guess these words:

(1) [dʒulaɪ]

(2) [θɪŋk]

(3) [ðɛn]

(4) [mɛʒər]

(5) [mɛnʃən]

IPA Consonant Practice

Try to guess these words:

(1) [dʒulaɪ] July

(2) [θɪŋk] think

(3) [ðɛn] then

(4) [mɛʒər] measure

(5) [mɛnʃən] mention

Next week

- Vowels and stress