

Psych 150/ Ling 155: Psychology of Language

Lecture 2 Representation: Sounds

Announcements

Be working on HW1 and the review questions — remember that you're encouraged to work together on the homework!

Sounds



Sounds

"...the sound system of any language is an intricate, delicately patterned thing. Not only does it have its own unique collection of sounds, but it has different 'rules' for how these sounds can be combined into words." — Sedivy 2014, p.106

Languages vary on the sounds they have.

Sound combination is rule-governed.



Phonotactics

"Languages have patterns that correspond to what are considered 'good' words as opposed to words that look like the equivalent of a patched-together Frankenstein creature." — Sedivy 2014, p.112



Phonotactics

Good or bad for English?

ptangb	☹️	spimton	😊	skrs	☹️
roffo	😊	sastashak	😊	ndela	☹️
lululeming	😊	srbridl	☹️	plempt	😊

Phonotactics

Good or bad for English...why?

"...you might think that it's impossible to pronounce sequences of consonants like *pt*, *nd*, and *dl*, but **actually you do it all the time** in words like *riptide*, *bandage*, *bed linen*—it's just that in English, these consonants straddle word boundaries or even just syllable boundaries." — Sedivy 2014, p.112



Phonotactics

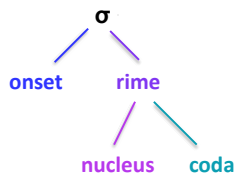
Good or bad for English...why?

"You reject alien words like *ptangb* or *ndela*...not because it takes acrobatic feats of your mouth to pronounce them, but because you have ingrained word templates in your mind that you've implicitly learned, and these words don't match those mental templates. These templates differ from one language to another and are known as **phonotactic constraints**." — Sedivy 2014, pp.112-113

Phonotactic constraints across languages

Phonotactic constraints applied to the syllable (σ)

Syllables are made up of several pieces:



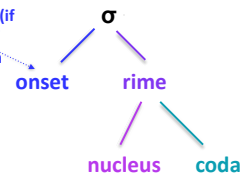
Phonotactic constraints across languages

Phonotactic constraints applied to the syllable (σ)

Syllables are made up of several pieces:

The beginning sounds (if any) that get sliced off and moved in Pig Latin

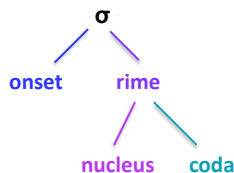
pig → ig-pay
latin → atin-lay
strong → ong-stray
old → old-ay



Phonotactic constraints across languages

Phonotactic constraints applied to the syllable (σ)

Syllables are made up of several pieces:



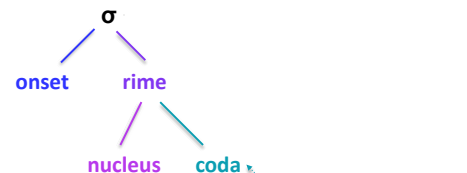
The vowel sound after the onset

dance, fun, kiss, strength

Phonotactic constraints across languages

Phonotactic constraints applied to the syllable (σ)

Syllables are made up of several pieces:



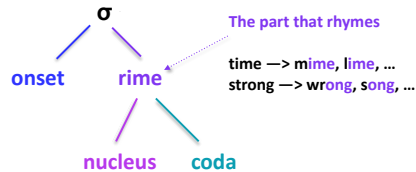
Any consonant sounds at the end (if any)

do, ton, gist, first

Phonotactic constraints across languages

Phonotactic constraints applied to the syllable (σ)

Syllables are made up of several pieces:



Phonotactic constraints across languages

Phonotactic constraints applied to the syllable (σ)

Cross-linguistic syllables (from Box 4.1, p.114 of Sedivy 2014)

C = consonant sound, V = vowel sound

English allows very complex syllables like CCCVCCC (*splints*) as well as less complex syllables like V (*a*), CV (*ma*), VC (*op*), CVC (*map*), CVCC (*mops*). Other languages have tighter restrictions:

Hebrew: only CV, CVC, CVCC

Hawaiian: only V, CV

Indonesian: only V, VC, CV, CVC

Phonotactic constraints across languages

Phonotactic constraints applied to the syllable (σ)

Cross-linguistic syllables (from Box 4.1, p.114 of Sedivy 2014)

In addition to general rules about how many consonants are allowed in the onset and coda, languages also have more specific restrictions about sound sequences that are allowed.

For example, English allows “rp” at the end of a word (*burp*) but not at the beginning (**rpub*), and allows “pr” at the beginning of a word (*prim*) but not at the end (**mipr*)

Phonotactic constraints across languages

Phonotactic constraints applied to the syllable (σ)

Cross-linguistic syllables (from Box 4.1, p.114 of Sedivy 2014)

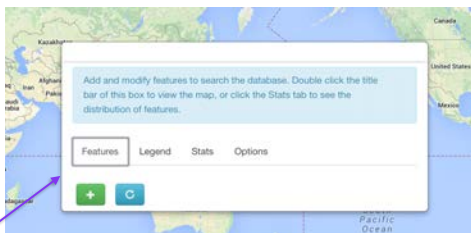
Languages vary on the sequences they allow in their syllable onsets:

English: */kn/ /skw/ */sb/ */vr/
(okay in German) (okay in Italian) (okay in French)

Cross-linguistic variation in syllables

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

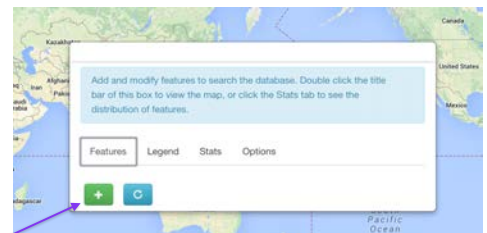
WORLD PHONOTACTICS DATABASE
Home
Introduction to phonotactics
How to use this site
Features
Sample
Contributing
Citing
Downloads
Contact
Launch database



Click on this to get this

Cross-linguistic variation in syllables

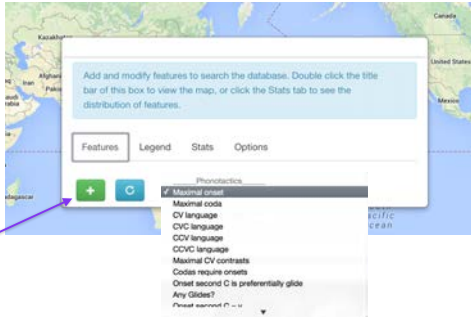
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Then look through the features

Cross-linguistic variation in syllables

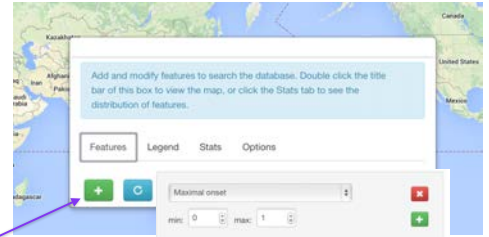
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Then look through the features till you find phonotactics

Cross-linguistic variation in syllables

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



Select something of interest

Cross-linguistic variation in syllables

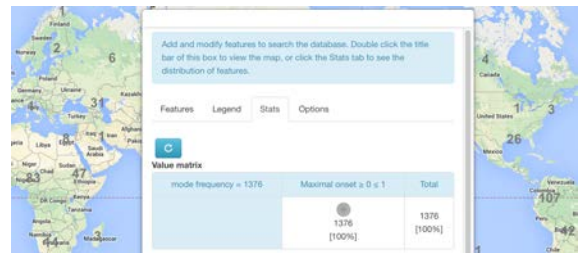
<http://phonotactics.anu.edu.au/index.php>



And see how the languages of the world look

Cross-linguistic variation in syllables

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



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

Phonotactic constraints across languages

Phonotactic constraints applied to the syllable (σ)

Cross-linguistic syllables (from Box 4.1, p.114 of Sedivy 2014)

Phonotactic constraints can be used to identify words in fluent speech. (In real language productions, there are rarely pauses to identify where words start and end.)

Helpful heuristic:

Maximum Onset Principle: Make the syllable onset as big as possible.

Phonotactic constraints across languages

Phonotactic constraints applied to the syllable (σ)

Cross-linguistic syllables (from Box 4.1, p.114 of Sedivy 2014)

Maximum Onset Principle: Make the syllable onset as big as possible.

Ex: How do we divide this up using the phonotactics of English?

bakniskwer

Phonotactic constraints across languages

Phonotactic constraints applied to the **syllable** (σ)

Cross-linguistic syllables (from Box 4.1, p.114 of Sedivy 2014)

Maximum Onset Principle: Make the syllable onset as big as possible.

Ex: How do we divide this up using the phonotactics of English?

ba | kniskwer

Can we put a word boundary here? No! Because the next syllable would begin with the sound sequence /kn/, which isn't allowed in English onsets.

Phonotactic constraints across languages

Phonotactic constraints applied to the **syllable** (σ)

Cross-linguistic syllables (from Box 4.1, p.114 of Sedivy 2014)

Maximum Onset Principle: Make the syllable onset as big as possible.

Ex: How do we divide this up using the phonotactics of English?

bak | niskwer

What about here? Yes. /n/ is a valid English onset, and is "bigger" than having no onset at all.

Phonotactic constraints across languages

Phonotactic constraints applied to the **syllable** (σ)

Cross-linguistic syllables (from Box 4.1, p.114 of Sedivy 2014)

Maximum Onset Principle: Make the syllable onset as big as possible.

Ex: How do we divide this up using the phonotactics of English?

bak | ni | skwer

Next: Can we put a boundary here? Yes. /skw/ is a valid English onset sequence, so "skw" is the biggest onset we could have (rather than "kw", "w", or nothing at all.)

Phonotactic constraints across languages

Practice: Suppose we're using the phonotactics of a German-like language, which has the following rules for syllable onsets:

/kn/ */skw/ */sb/ */vr/
*/kw/

(You may assume any single consonant is a valid onset.)

How would we divide up the following sound sequence, using the Maximum Onset Principle?

bakniskweriavrosbamanuesbivriknat

Phonotactic constraints across languages

Practice: Suppose we're using the phonotactics of a German-like language, which has the following rules for syllable onsets:

/kn/ */skw/ */sb/ */vr/
*/kw/

(You may assume any single consonant is a valid onset.)

How would we divide up the following sound sequence, using the Maximum Onset Principle?

ba | knisk | we | ri | av | ros | ba | ma | nu | es | biv | ri | knat

Sounds

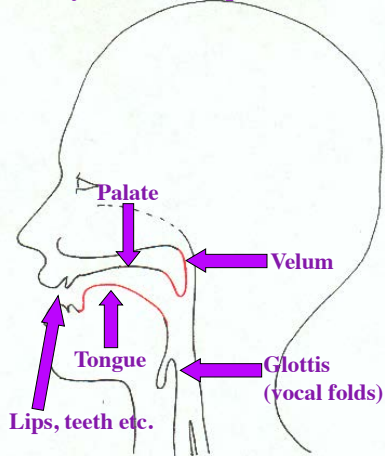
Phonemes: Contrastive sounds you notice in your language because they make **minimal pairs**, where changing a single sound changes the word.

(Examples from p.122, Table 4.1 of Sedivy 2014)

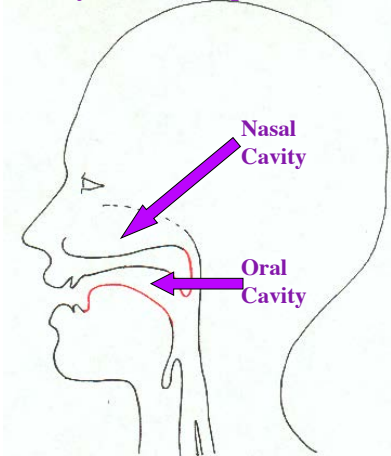
pad/bad safe/save lag/lad

read/lead call/tall yell/well

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

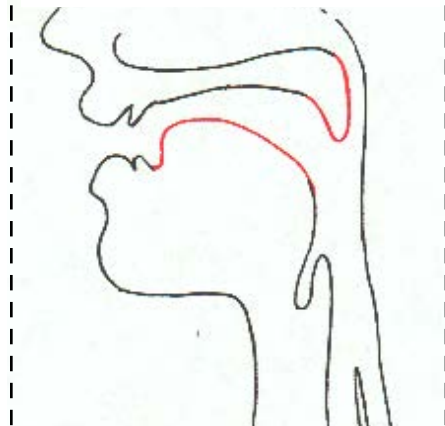
Describing speech sounds

Where is the air-flow blocked? (place of articulation)
labial, alveolar, palatal, velar etc.

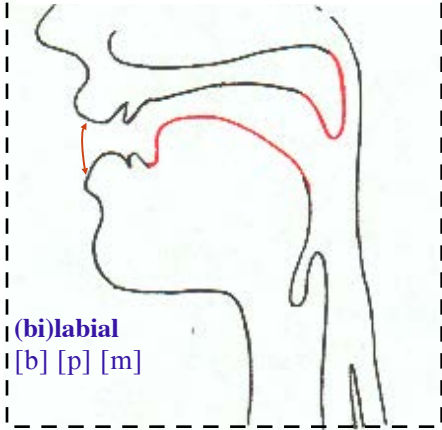
Where/how is the air flowing? (manner of articulation)
nasal/oral, stop, fricative, liquid, tap/flap etc.

What are the vocal folds doing? (voicing)
voiced vs. *voiceless*

Where is the air flow blocked?

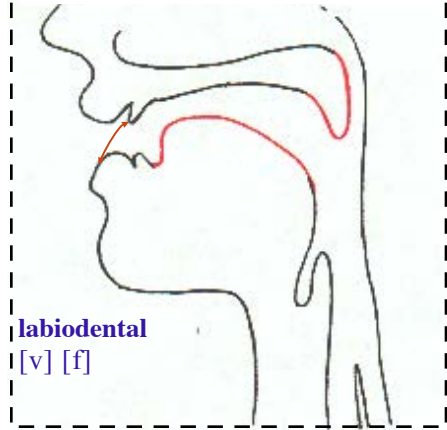


Where is the air flow blocked?



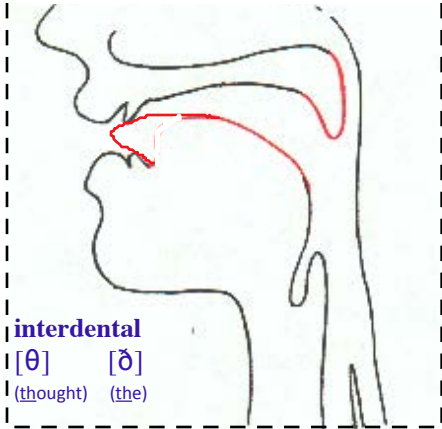
(bi)labial
[b] [p] [m]

Where is the air flow blocked?



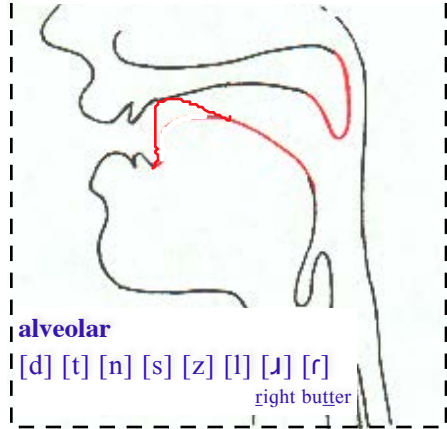
labiodental
[v] [f]

Where is the air flow blocked?



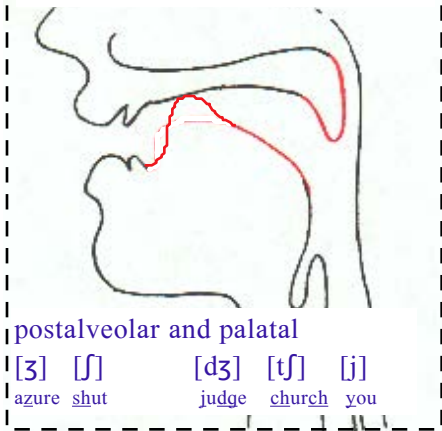
interdental
[θ] [ð]
(thought) (the)

Where is the air flow blocked?



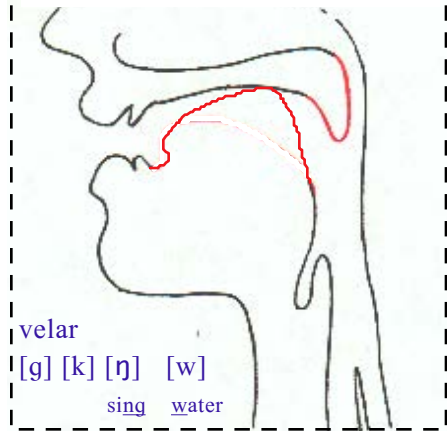
alveolar
[d] [t] [n] [s] [z] [l] [ʃ] [r]
right butter

Where is the air flow blocked?

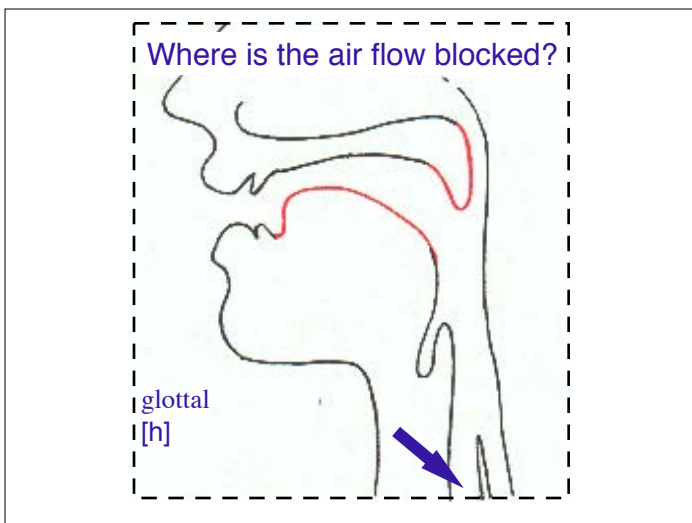
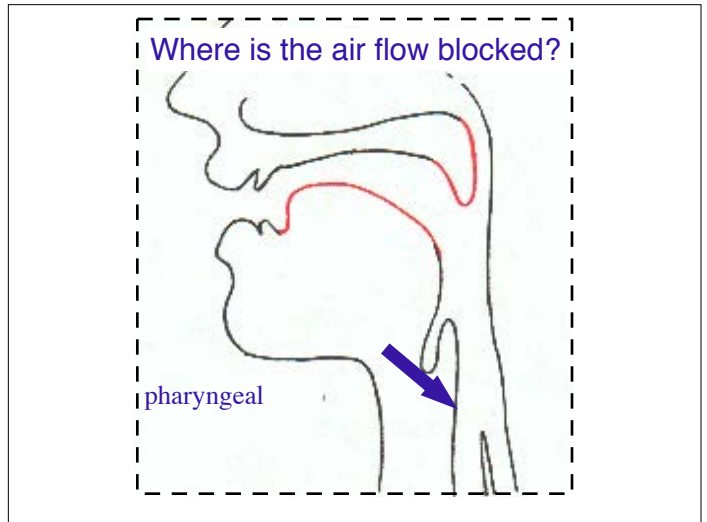
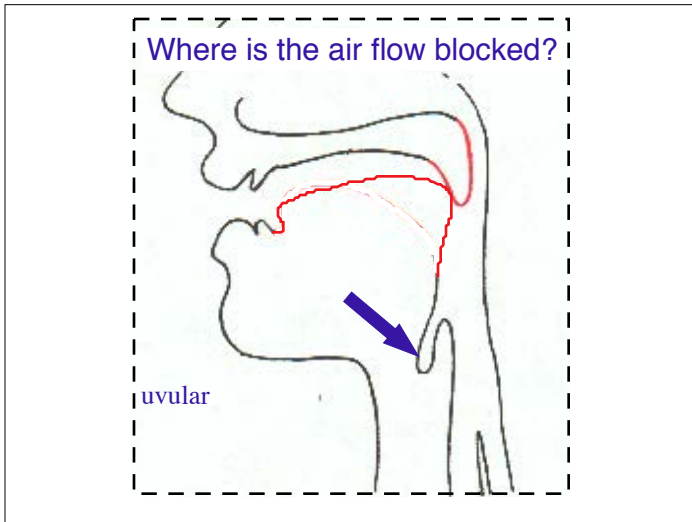


postalveolar and palatal
[ʒ] [ʃ] [dʒ] [tʃ] [j]
azure shut judge church you

Where is the air flow blocked?



velar
[g] [k] [ŋ] [w]
sing water



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
[l] [r]

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...?”
[tʃ]
becomes “Whachould...?”

“What did you...?”
[dʒ]
becomes “What did zha...?”
[dʒ]
becomes “Whaja...?”

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 either **voiced** or **voiceless**.

English pairs:

b p v f d t
z s ð θ ʃ ʒ tʃ dʒ

IPA (mostly) full chart

THE INTERNATIONAL PHONETIC ALPHABET (revised to 1993)
CONSONANTS (PULMONIC)

	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				ʀ					ʀ		
Tap or Flap				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.

English consonants

THE INTERNATIONAL PHONETIC ALPHABET (revised to 1993)

CONSONANTS (PULMONIC)

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Stop	p b			t d				k ɡ			
Nasal	m			n				ŋ			
Trill											
Tap or Flap				ɾ							
Fricative		f v	θ ð	s z	ʃ ʒ		tʃ dʒ				h
Lateral fricative											
Glide							j	w			
Liquid				ɹ	l						

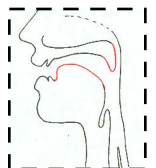
Where symbols appear in pairs, the one to the right represents a voiced consonant. Shaded areas denote articulations judged impossible.

Vowels

What can you do to alter the shape of your vocal tract?

You can....

- (1) Raise or lower your tongue (high, mid, low)
- (2) Advance or retract your tongue (front, central, back)
- (3) Round or spread your lips (round, spread)
- (4) Tense or not tense your mouth (tense, lax)



A quick note about tense/lax

"...by advancing the tongue root....the tongue becomes tense and humped rather than lax and flat, and the hump narrows the air chamber in the mouth above it, changes the resonances."
- Pinker, *The Language Instinct*

(4) Tense or not tense your mouth
(tense, lax)

So what vowels are there in English?

i "sheep, sleep"
I "ship, slip"

So what vowels are there in English?

i
I
e "laid, spade, trade"
ɛ "led, sped, tread"

So what vowels are there in English?

i
I
e
ɛ
æ "bat, lad"

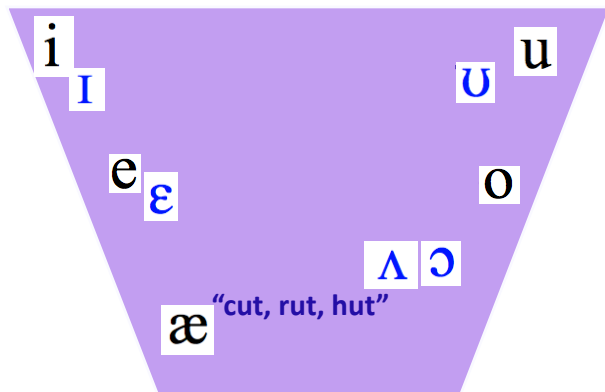
So what vowels are there in English?

i
I "Luke, who'd, suit"
"look, hood, soot" **U** **u**
e
ɛ
æ

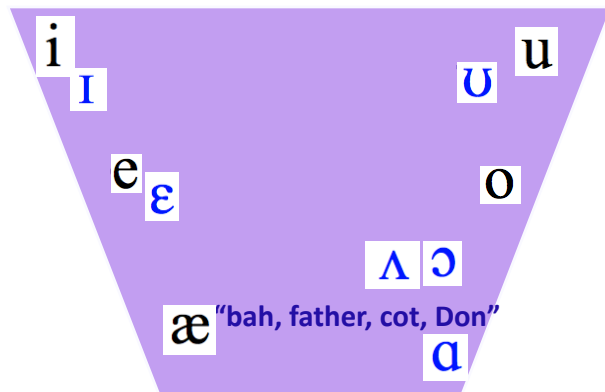
So what vowels are there in English?

i
I **U** **u**
"coat, wrote, hoed" **o**
"caught, wrought, hawed" **ɔ**
æ

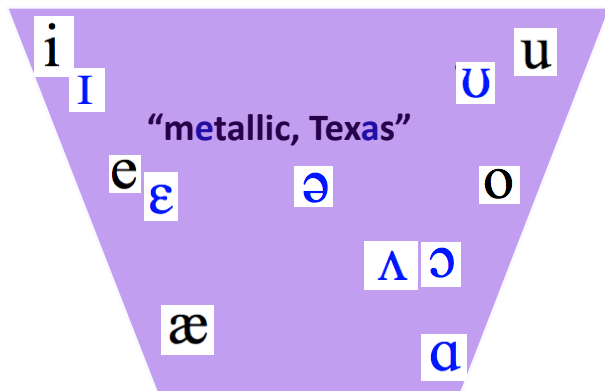
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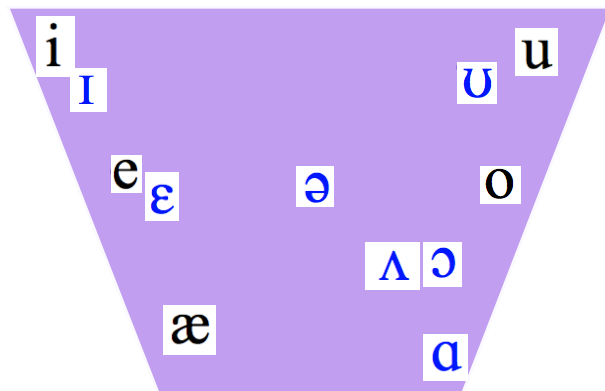
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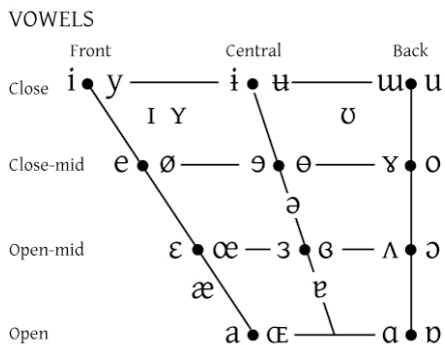
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So what vowels are there in English?

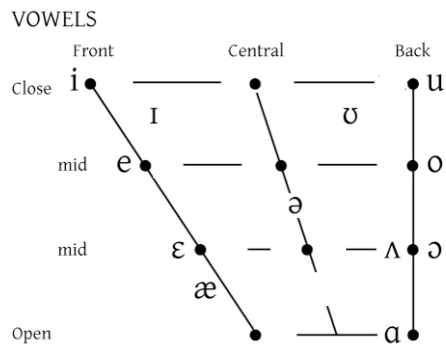


The (mostly) full vowel chart



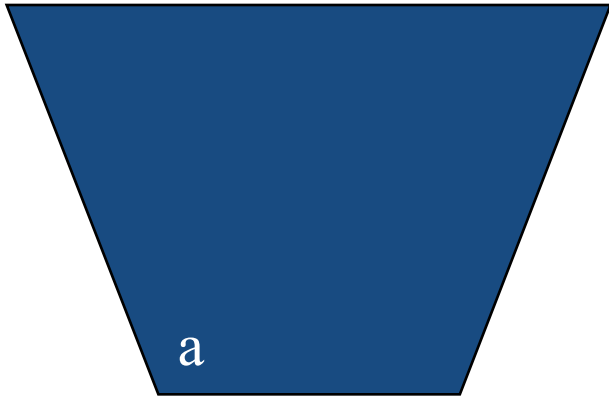
Where symbols appear in pairs, the one to the right represents a rounded vowel

English vowels

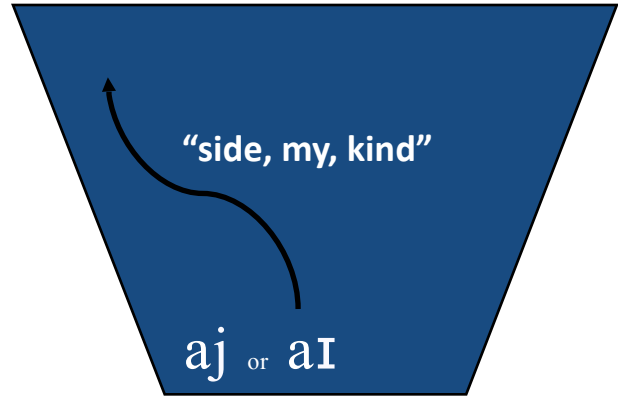


Where symbols appear in pairs, the one to the right represents a rounded vowel

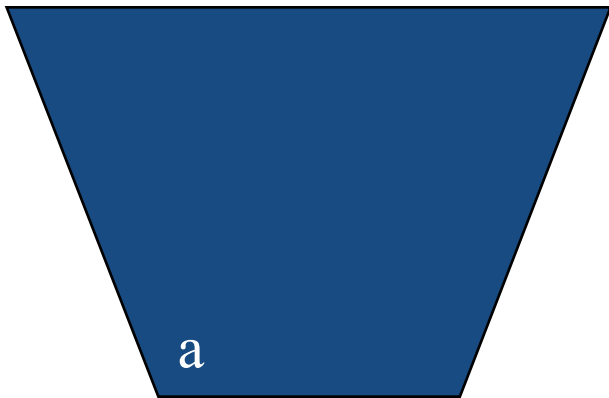
Diphthongs: Two vowel-ish sounds together



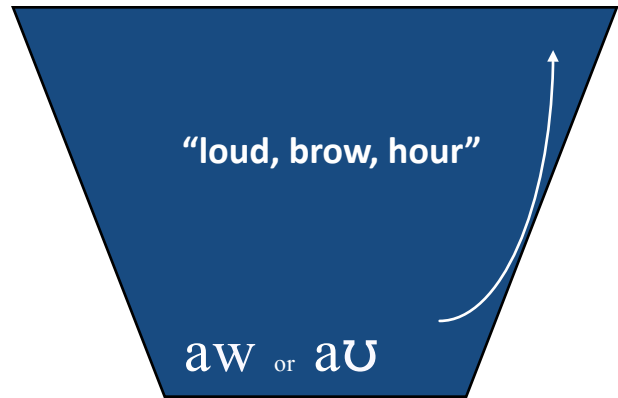
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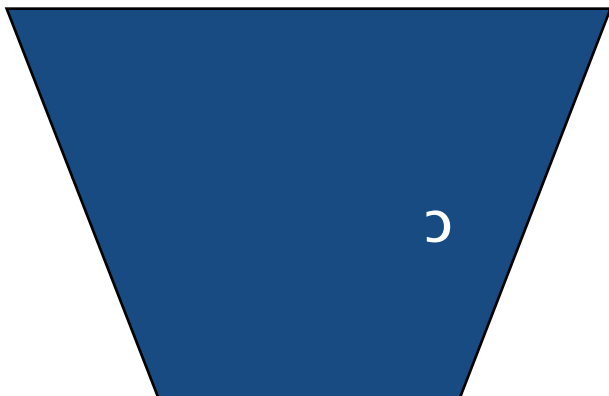
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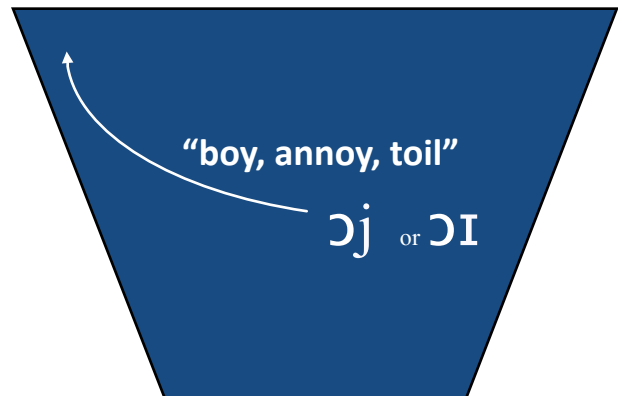
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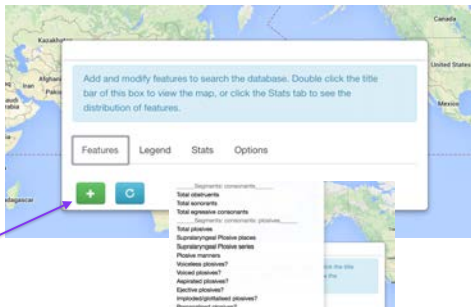


Diphthongs: Two vowel-ish sounds together



Cross-linguistic variation in sounds (called segments)

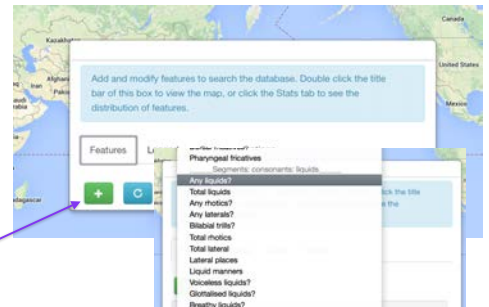
<http://phonotactics.anu.edu.au/index.php>



Then look through the features till you find segments

Cross-linguistic variation in sounds (called segments)

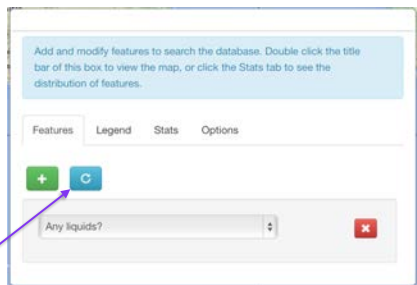
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Select something of interest

Cross-linguistic variation in sounds (called segments)

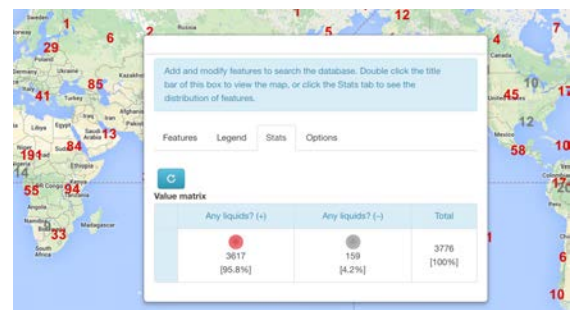
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And see how the languages of the world look

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.

More sounds

While we're consciously aware of the phonemes of our language, we actually produce more sounds than just our phonemes.

From Sedivy 2014, p.121:

"...you learned that the words *tall* and *tree* begin with the same sound, and that the second and third consonants of the word *potato* are identical. But that's not exactly right. Pay close attention to what's happening with your tongue as you say these sounds the way you normally would in conversational speech...turns out that sounds are affected by the phonetic company they keep."

t sounds: *tall* vs. *stall*, first *t* vs. second *t* in *potato*

More sounds

While we're consciously aware of the phonemes of our language, we actually produce more sounds than just our phonemes.

When sound differences don't fundamentally change the identity of the speech unit (ex: every *t* sound seems to be some version of *t*), we call these **allophones** of the phoneme.

Allophones of the phoneme /t/:

"aspirated t" [t^h] [t] "flap" [t^h] [ɾ]
t sounds: *tall* vs. *stall*, first *t* vs. second *t* in *potato*

How sounds pattern

How do we tell if two sounds are separate phonemes or are allophones of the same phoneme?

See if the sounds are in **complementary distribution**: If the linguistic environments these sounds appear in do not overlap, the sounds are said to be in complementary distribution.

Linguistic environment: The sounds that are around the sound in question (also includes word beginning and endings).

Example: hug = /hʌg/
 The linguistic environment for "h" = #__ʌ (where # = word boundary)
 The linguistic environment for "ʌ" = h__g
 The linguistic environment for "g" = ʌ__#

How sounds pattern

Complementary distribution in English:
 velar stop [k] and palatal stop [c]

Words using [k]: kæn (*can*), kɔwp (*cope*), kʌn (*con*), kuwn (*coon*)

Words using [c]: ceɪp (*cape*), cɪl (*kill*), cil (*keel*), cɪk (*kick*)

How sounds pattern

Complementary distribution in English:
 velar stop [k] and palatal stop [c]

Words using [k]: kæn (*can*), kɔwp (*cope*), kʌn (*con*), kuwn (*coon*)
 Ling env for [k]: #__æ #__o #__ɑ #__u

Words using [c]: ceɪp (*cape*), cɪl (*kill*), cil (*keel*), cɪk (*kick*)
 Ling env for [c]: #__e #__ɪ #__i #__ɪ

How sounds pattern

Complementary distribution in English:
 velar stop [k] and palatal stop [c]

Words using [k]: kæn (*can*), kɔwp (*cope*), kʌn (*con*), kuwn (*coon*)
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Words using [c]: ceɪp (*cape*), cɪl (*kill*), cil (*keel*), cɪk (*kick*)
 Ling env for [c]: #__e #__ɪ #__i #__ɪ

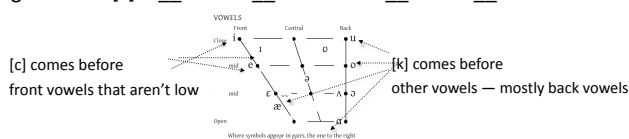
These environments don't overlap! In fact, if we look back at the vowel chart, we can see a simple difference between the two sets of linguistic environments....

How sounds pattern

Complementary distribution in English:
 velar stop [k] and palatal stop [c]

Words using [k]: kæn (*can*), kɔwp (*cope*), kʌn (*con*), kuwn (*coon*)
 Ling env for [k]: #__æ #__o #__ɑ #__u

Words using [c]: ceɪp (*cape*), cɪl (*kill*), cil (*keel*), cɪk (*kick*)
 Ling env for [c]: #__e #__ɪ #__i #__ɪ



How sounds pattern

Complementary distribution in English:
 velar stop [k] and palatal stop [c]

Words using [k]: kæn (*can*), kɔwp (*cope*), kʌn (*con*), kuwn (*coon*)
 Ling env for [k]: #__æ #__o #__ɑ #__u

Words using [c]: ceɪp (*cape*), cɪl (*kill*), cil (*keel*), cɪk (*kick*)
 Ling env for [c]: #__e #__ɪ #__i #__ɪ

[c] comes before front vowels that aren't low

If we look at where these consonants are pronounced, this makes sense — the palatal sound is produced further forward.

[k] comes before other vowels — mostly back vowels

How sounds pattern

Complementary distribution in English:
velar stop [k] and palatal stop [c]

Words using [k]: kæn (*can*), kɒp (*cope*), kɒn (*con*), kuwn (*coon*)

Ling enviro for [k]: #_æ #_o #_ɑ #_u

Words using [c]: ceɪp (*cape*), cɪl (*kill*), ci:l (*keel*), ci:k (*kick*)

Ling enviro for [c]: #_e #_ɪ #_i #_ɪ

This tells us that [c] and [k] are allophones of the same phoneme in English.

Recap

The sound system is one part of our linguistic knowledge for a language.

This system includes the sounds themselves and how they pattern with each other within syllables and across words.

Phonemes are contrastive sounds in a language while allophones are non-contrastive variants of a phoneme that appear in complementary distribution.



You should be able to do up through 9 on the introductory & representation review questions and up through 6 on HW1.