

24.901/931, 2023

Introduction to Phonology

Lecture 5

Class work

- Read: chapters 6-7 in Hayes 2009
(Canvas Module: *Features, Contrast, Processes*)
- Problem set 1 solution posted
- Problem set 2 posted, due between 2-26 – 2-28.
- Use features argued for in class/text, not IPA categories. Ask, if unsure.
- Consult Guide to Writing Rules (2023) under Tools and Resources

Current topics

- **FEATURES:** articulatory-auditory properties hypothesized to play a role in the mental representation of speech sounds.
- **PROCESSES:** systematic modifications of speech sounds that the grammar must record; we argue that they operate on features.
- **PRINCIPLES** that underlie large numbers of recurrent processes
- **NEW WAYS** (post 1968) of looking at features.

Reminders: the active/passive distinction

Binary features for place

Corresponding to passive articulators (incomplete, more later)

[$\pm$ alveolar]: constriction made at alveolar ridge vs. somewhere else

[$\pm$ dental]: at the teeth vs. not there

[$\pm$ anterior]: at or in front of alveolar ridge vs. elsewhere

Features corresponding to active articulators

[$\pm$ labial]: constriction made by moving lower lip

[$\pm$ coronal]: ...by tongue tip or blade

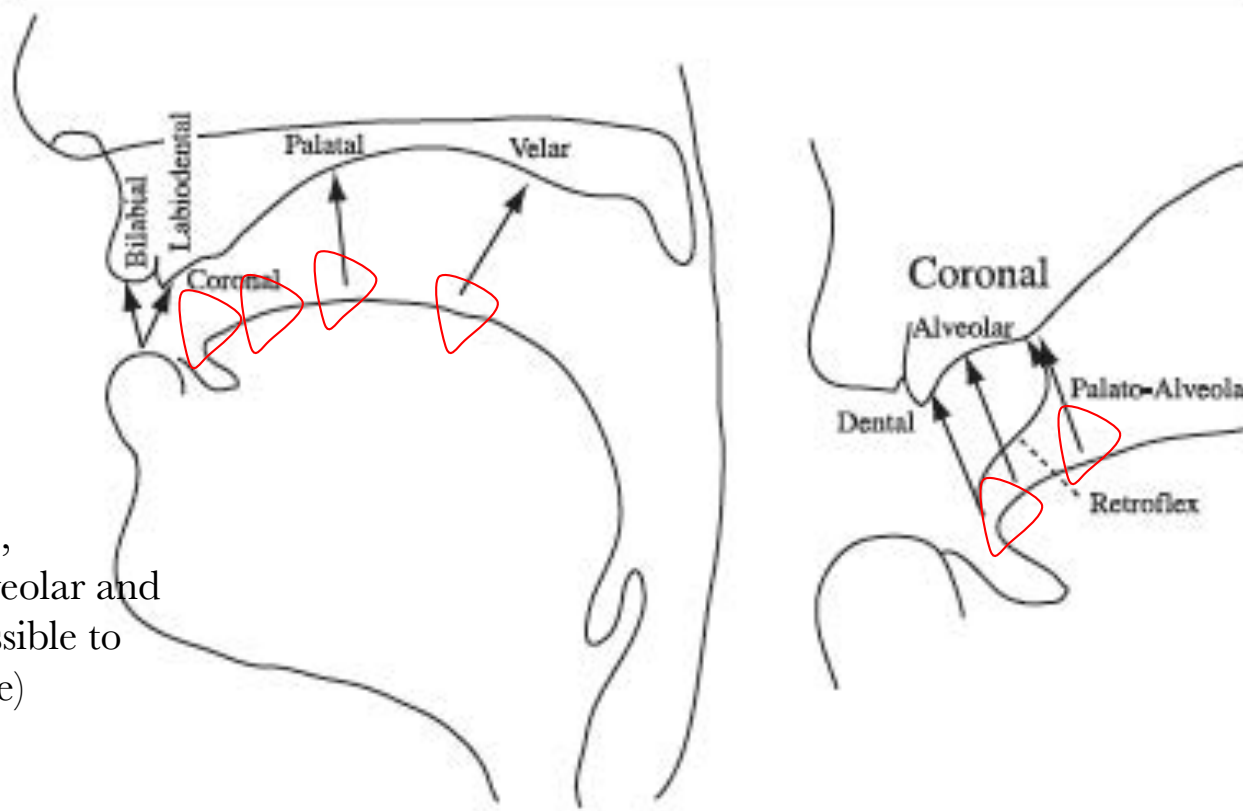
[$\pm$ apical]: ...by tongue tip (*apex*) vs. tongue blade

or [$\pm$ laminal]: ...by tongue blade, not tip

[$\pm$ dorsal]: ...by tongue body

[$\pm$ root]: ...by tongue root (as in uvulars)

Figure 1.7 A sagittal section of the vocal tract, showing the places of articulation that occur in English. The coronal region is shown in more detail at the right.



Active articulators =
red triangles

By *coronal region* (far right),
Ladefoged means the alveolar and
hard palate regions accessible to
the *corona* (= tongue blade)

Place: active and passive articulator features

[illegible]

Any pairing {active, passive} is found provided it's feasible

Passive \ Active		Upper lip (= Labial)	Teeth (Dental)	Hard palate		Velum	Uvula
				At ridge (Alveolar)	Behind ridge (Postalveolar)		
Lower lip (= Labial)		p, ϕ	f				
Coronal	Apical	ɬ	θ	t	ʈ		
	Laminal			ɬ̺	ʈ̺		
Dorsal					c	k	
T. Root (Radical)							q

Phonological uses of the distinction between active and passive articulators.

And a process different from assimilation.

Prefixes in Tashlhiyt Berber (Agadir, Morocco)

reflexive				agentive			
ṃ-xazar	scowl	ṇ-fara	disentangle	am-las	shear	an-ṛ ^ʕ mi	tire
ṃ-saggal	look	ṇ-ḥaʃʃam	be shy	am-kṛz	plow	an-bur	celibate
ṃ-ʃ ^ʕ awar	ask	ṇ-xalaf	place	am-agur	remain	an-ḍ ^ʕ fur	follow
mṃ-ʒla	lose	ṇ-kaddab	liar	am-zug	hide	an-ẓ ^ʕ um	fast
		ṇ-faṣ ^ʕ al	arrange			an-ḍ ^ʕ alab	beg
		ṇ-ḅ ^ʕ dan	separate			an-ṛzif	invite

Berber phoneme inventory; Cs classified as in IPA

bilabial	labiodental	alveolar		postalveolar		velar	uvular		pharyngeal		glottal
b m f w u		t	tʃ			k	kʷ	q	qʷ		
		d	dʃ			g	gʷ				
		n	nʃ								
		s	sʃ	ʃ	ʃʃ			x	xʷ	ħ	
		z	zʃ	ʒ	ʒʃ			ɣ	ɣʷ	ʕ	h
		l	lʃ	r	rʃ	j					
						i			a		

Active articulator classification of the same Cs?

What rule distributes n and m in Berber?

reflexive				agentive			
ṃ-xazar	scowl	ṇ-fara	disentangle	am-las	shear	an-ṛ ^ɛ mi	tire
ṃ-saggal	look	ṇ--ħaɣɣam	be shy	am-krz	plow	an-bur	celibate
ṃ-ɣ̣ ^ɛ awar	ask	ṇ--xalaf	place	am-agur	remain	an-ḍ ^ɛ fur	follow
mṃ-ɣ̣ ^ɛ la	lose	ṇ--kaddab	liar	am-zug	hide	an-ẓ ^ɛ um	fast
		ṇ--faṣ ^ɛ al	arrange			an-ḍ ^ɛ alab	beg
		ṇ--ḅ ^ɛ dan	separate			an-ṛ ^ɛ zif	invite

A first approximation

- $m \rightarrow n / _ X [+consonantal, +labial]$
X = variable over strings, any number of segments.
[+cons] excludes [u], [w], which are [-cons].
- $[+cons, +labial] \rightarrow [+coronal] / _ X [+cons, +labial]$
- In prose:
Two Cs may not co-occur in the same word,
if they have the same active articulator, Labial.
If they do so in the input, the first changes to Coronal.
- A form of *dissimilation*. Two similar sounds in the input become less similar.

The active articulator feature [+labial]

- Yields the simpler rule

$[+cons, +labial] \rightarrow [+coronal] / _ X [+cons, +labial]$

- Instead of the disjunctive:

$[+cons, +bilabial] \rightarrow [+coronal] / _ X \{ [+cons, +bilabial], [+labiodental] \}$

Sudanese possessed nouns

kitaab ‘book’

bit ‘daughter’

samak ‘fish’

kitaaf Fathī

bit Fathī

samak Fathī

kitaap Samir

bis Samir

samak Samir

kitaap ʃariif

biʃ ʃariif

samak ʃariif

kitaap Xaalid

bit Xaalid

samax Xaalid

kitaap ḥasan

bit ḥasan

samak ḥasan

Sudanese possessed nouns; possessors are names

kitaab ‘book’ bit ‘daughter’ samak ‘fish’

kitaaf Fathī

bit Fathī

samak Fathī

kitaap Samir

bis Samir

samak Samir

kitaap ʃariif

biʃ ʃariif

samak ʃariif

kitaap Xaalid

bit Xaalid

samax Xaalid

kitaap ḥasan

bit ḥasan

samak ḥasan

IPA description of CCs undergoing rule

b f $\rightarrow$ f f

t s $\rightarrow$ s s

tʃ $\rightarrow$ ʃʃ

k x $\rightarrow$ x x

bilabial+labiodental

alveolar+alveolar

velar+velar

alveolar+post-alveolar

Using the active/passive articulator distinction?

- A C becomes a complete copy of immediately following Cⁱ, if they have the same [α articulator] value in the UR.
- C_[α articulator] → Cⁱ / — Cⁱ_[α articulator] (preliminary)
- [α articulator] abbreviates [same active articulator].
- [α]: variable over {Labial, Coronal, Dorsal, Root}.

Arabic ‘sun and moon’ letters

ʔal-qamr

‘the moon’

ʔaʃ-ʃams

‘the sun’

ʔal-faras

‘the mare’

ʔad-daar

‘the house’

ʔal-kitaab

‘the book’

ʔaz-zajt

‘the oil’

ʔal-harb

‘the war’

ʔan-nahr

‘the river’

ʔal-ʔab

‘the father’

ʔaθ-θawb

‘the garment’

IPA description of the 1st root C

ʔal-qamr	uvular stop	ʔaɧ-ɧams	postalveolar fric.
ʔal-faras	labiodental fricative	ʔad-daar	alveolar stop
ʔal-kitaab	velar stop	ʔaz-zajt	alveolar fricative
ʔal-harb	glottal fricative	ʔan-nahr	alveolar nasal
ʔal-ʔab	glottal stop	ʔaθ-θawb	(inter)dental fricative

Some components of the rule: first, the rule's *target*

$l \rightarrow \text{something} / \text{ ___ } \text{ somewhere}$

The feature [+lateral] picks out [l] and only [l] in Arabic, so we can re-write:

$[+lateral] \rightarrow \text{something} / \text{ ___ } \text{ somewhere}$

- What is the active articulator of l?

$[+coronal, +lateral] \rightarrow C_i / \text{ — } C_{[+coronal]i}$

The rule has further restrictions, not covered here.

More instances of dissimilation, as in Berber
A principle behind dissimilation
Its consequences for analysis of assimilation

Adjectives in *-al*, *-ar*. Which variant goes where?

pol-ar

cellul-ar

alveol-ar

angul-ar

nucle-ar

simil-ar

lun-ar

line-ar

circul-ar

cca 800

canonic-al

abdomin-al

origin-al

acoustic-al

suffix-al

front-al

cerebr-al

later-al

flor-al

cca 6000

- UR of suffix?
- Rule proposals?

Adjectives in *-al*, *-ar*

pol-ar

cellul-ar

alveol-ar

angul-ar

nucle-ar

simil-ar

lun-ar

line-ar

circul-ar

cca 800

after [...l...]

after [...r...l...]

canonic-al

abdomin-al

origin-al

acoustic-al

suffix-al

front-al

cerebr-al

later-al

flor-al

cca 6000

Exceptions

(1) palatal
alkaloidal

(2) local
fluvial
legal
colloquial
logical

⊢ after [...l...]

after [...l...r...]

- Features of rln

	coronal	sonorant	nasal	lateral
r	+	+	-	-
l	+	+	-	+
n	+	+	+	-

- UR is /al/
- Rule: $[+lateral] \rightarrow [-lateral] / [+lateral] X_ , X = \text{a variable over strings}$
 Condition: X does not contain [r] ($[-lateral, +son, +cor, -nas]$)

Latinate liquid dissimilation

[+lateral] → [-lateral] / [+lateral] X_,
where X does not contain [ɹ] ([-lateral, +son, +cor, -nas])

UR	nav-al (navy)	pol-al (pole)	flor-al (flor-id)	circul-al (circle)
Dissimil.	n/a	pol-ar	n/a (r intervenes)	circul-ar
SR	naval	polar	floral	circular

Latin liquid dissimilation, a different view

UR	nav-al (navy)	pol-al (pole)	flor-al (flor-id)	circul-al (circle)
Dissimil.	n/a	pol-ar	n/a (r intervenes)	circul-ar
SR	naval	polar	floral	circular

Two identical liquids ([+son, +cons, +cor, -nas]) are avoided: *l...l, *r...r
The closer they are, the worse the sequence.

Dissimilate to avoid *the worst sequence*:

**circul-al* worse than *circul-ar*

lVl closer, worse than rVCVCVr

flor-al better than **flor-ar*

rVr closer, worse than lVCVl

Hard to write a rule with all this info – but wait until mid-March.

Labial dissimilation

- Huave (isolate, Oaxaca; Kim 2008; Anghelescu 2019)

- Vowels:

High	i i ^h	Back u u ^h
	e e ^h	o o ^h
Low		a a ^h

- Consonants:

	Labial	Coronal	Velar	Labiovelar	Glottal
Stops	p mb	t nd	k ŋg	kw ŋgw	
Affricates		ts nts			
Fricatives	[f]	s			h
Nasals	m	n			
Liquids		l r r			
Glides	w	j			

- Prohibition: [w] can't follow [o, u]

a. i. la=pa^hk-a-w

PF=face.up-V-ITR

's/he is now lying face up'

ii. la=we^hk-ia-w

PF=be.born-V-ITR

's/he has now been born'

b. i. la=mo^hk-o-∅

PF=face.down-V-ITR

's/he is now lying face down'

ii. la=tfut-u-∅

PF=sit-V-ITR

's/he is now sitting'

= a clitic boundary.

A clitic = short word

incorporated in an adjacent

word. Cf. English possessive -s

Huave rule

- $[+labial, -cons] \rightarrow \emptyset / [+labial, -cons] ___$
- Note [mo] in [la=mohko]: $[+labial, +cons] [+labial, -cons]$
- Only extreme similarity prohibited here

Takeaway

- *Dissimilation*:
 - ➡ UR contains a sequence of similar segments
 - ➡ In SR, one of them is dropped or made less similar (*dissimilated*)
- Sequences of similar sounds are avoided
- The closer they are, the worse, the more likely the remedy
- The more similar they are, the worse (cf. Berber, Huave require both active articulator match and $[\pm\text{cons}]$ match)

Static patterns of dissimilation

- Static = no alternation, but a gap in distribution:
similar sound tend not to co-occur in the same domain.
- The closer together (e.g. CC, C(V)C; VV, V(C)V) the worse, if similar.
- All languages (Graf 2014 MIT diss.)
- The more shared features, the less likely it is they co-occur.
- Some features ([+labial], [+strident], [+ejective], [+lateral]) matter more for similarity than others ([±voiced], [±sonorant], [±continuant]).
- In Semitic roots (Arabic, Hebrew, Amharic, Tigre, Tigrinya) Cs with same active-articulator rarely co-occur.

Co-occurrence of Cs with same active articulator in Arabic roots (Frisch et al. 2005, NLLT)

T, D, S, Z =
pharyngealized

Adjacent C's: (C(V)C) in one root.

		Adjacent						
		Labial	Cor obs		Velar	Guttural		Cor son
		b f m	t d T D	θ ð s z S Z	k g q	χ ʁ	ħ ʕ h ʔ	l r n
Labial	b f m	0.00	1.37	1.31	1.15	1.35	1.17	1.18
Cor obs	t d T D		0.14	0.53	0.80	1.43	1.25	1.23
	θ ð s z S Z			0.04	1.16	1.41	1.26	1.21
Velar	k g q				0.02	0.07	1.04	1.48
Guttural	χ ʁ					0.00	0.07	1.39
	ħ ʕ h ʔ						0.06	1.26
Cor son	l r n							0.06

- figures = ratios of *observed vs. expected co-occurrence in C1(V)C2* by shared active articulator
- *expected*: calculated based on lexical frequencies of C1 and C2 in their positions in the word.
- *lexical frequency*: number of occurrences of C in dictionary, in given position.
- $n > 1$: means that sequence (e.g. *bVt, tVb*) is more frequent than expected (= not avoided)
- $n < 1$: means that sequence (e.g. *bVm/mVb*) is less frequent than expected (= avoided)

		Adjacent						
		Labial	Cor obs		Velar	Guttural		Cor son
		b f m	t d T D	θ ð s z S Z	k g q	χ ʁ	ħ ʕ h ʔ	l r n
Labial	b f m	0.00	1.37	1.31	1.15	1.35	1.17	1.18
Cor obs	t d T D		0.14	0.53	0.80	1.43	1.25	1.23
	θ ð s z S Z			0.04	1.16	1.41	1.26	1.21
Velar	k g q				0.02	0.07	1.04	1.48
Guttural	χ ʁ					0.00	0.07	1.39
	ħ ʕ h ʔ						0.06	1.26
Cor son	l r n							0.06

T, D, S, Z =
pharyngealized

Co-occurrence of Cs w. same active articulator in Arabic in same root (Frisch et al. 2005)

T, D, S, Z =
pharyngealized

e.g. bVkVm, or mVtVb, or kVtVχ.

		Labial	Cor stop		Velar	Guttural		Cor son
		b f m	t d T D	θ ð s z S Z	k g q	χ ʁ	ħ ʕ h ʔ	l r n
Labial	b f m	0.30	1.08	1.02	1.26	1.25	1.28	1.11
Cor obs	t d T D		0.38	1.06	1.24	1.05	1.02	0.97
	θ ð s z S Z			0.24	1.16	1.35	1.14	1.23
Velar	k g q				0.07	0.68	1.19	1.03
Guttural	χ ʁ					0.25	0.12	1.10
	ħ ʕ h ʔ						0.34	1.13
Cor son	l r n							0.67

Comparable result in most languages investigated (Graf 2014 MIT diss):
Distance matters in detecting/dealing with similarity

Obligatory Contour Principle (OCP)

- *Contour*: a sequence of different tones; by extension, dissimilar sounds
- *Dissimilar* means: different values for specific features
- *Similar* means: identical value for specific feature(s)
- OCP is a general preference of the form:
sounds with identical values for feature F can't co-occur in one domain
(same word, same morpheme or same CC, i.e. strictly adjacent).
- OCP proposed for tone (Leben 1976, 2019, Hyman 2009): adjacent syllables with same tones are dispreferred.
- Then evidence emerged to extend the constraint to other Fs.
- 'Adjacent' in Arabic C version of OCP means 'adjacent in UR, or 'separated by at most 1 V'.

Difference between similar and identical

- Thus far, similar pairs – e.g. bVm, sVθ, kVq – are conflated with identical ones – e.g. bVb, sVs, qVq.
- In fact, they are treated differently by the grammars of Semitic lgs:
 - Similar pairs are disfavored but not unattested.
 - Identical pairs are essentially unattested (qualifications suppressed)
(more in McCarthy 1979 MIT diss; Frisch, Broe, Pierrehumbert 2005 NLLT + early refs)
- That makes sense: identity is the extreme degree of similarity.
If similarity is avoided, identity will be avoided even more.

Universal?

- OCP-based rules don't seem universal.
- But there are some recurrent, general things about them.
- If a less similar sequence is prohibited the more similar one also is.
(If f...b is prohibited, b...b is).
- If similar sequence is prohibited at some distance, closer counterparts also are.
- No language actively prefers similar non-identical sequences,
to dissimilar ones.
(if f...b is ok, s...b is ok too)
- The same features (round, glottalization, aspiration, active artic.) tend to appear in OCP-based rules of individual languages.
- Therefore, it seems sound to draw conclusions from the idea that the OCP is a universal preference, sometimes suppressed or attenuated.

Processes conditioned by similarity raise a question

3 types of processes triggered by sequences of similar sounds:

(i) The similar sequence eliminated (feature change, deletion):

Latin, Huave, Berber

(ii) The similar sequence is avoided, we don't know *how*:

Arabic

(iii) The similar sounds become identical when adjacent.

Sudanese, Arabic Sun-and-Moon

Is something in need of explanation?

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