

Class 11: Phonetic substance in phonology?

To do

- Samoan assignment (on last week's material) is due Friday
- Next reading is Hall 2006 (due Tuesday)
- Project: turn in report this week
- We need to talk about a mini-conference date!

Overview: Last time we looked at structure above the segment; next week, below the segment. In between, this week we consider the role of phonetic substance in phonology.

1 What is markedness, anyway?

When we say that, e.g., complex onsets are marked, what does that mean?

The idea predates generative linguistics, and seems to have varying interpretations:

1. a structure is marked if it's rare cross-linguistically, or if its presence in a language implies the presence of an (unmarked) alternative
 - e.g., if a language allows complex onsets, it also allows simple onsets
2. and/or a structure is marked if children acquire it later
 - e.g., children acquire simple onsets first, then complex
3. and/or language learners and users actually disprefer the structure
 - not something we can observe directly

Controversies

- Do 1 & 2 go together? If so, does 2 cause 1?
- Is 3 responsible for 1 and/or 2? How can we test 3?

2 Non-mental ways to explain typological rarity

- The article that you read for today (Moreton 2008) explains channel bias vs. analytic bias very well and cites the major works, so why don't we just discuss that for a few minutes.

3 Example of a markedness constraint driven by articulatory difficulty: *NC̥

Pater 1996; Pater 1999; Pater 2001; cf. Archangeli, Moll, & Ohno 1998;

The most famous example of a markedness constraint that different languages resolve differently (see Pater for original sources of data).

- Japanese (at least for Yamato vocabulary; from Pater)

<i>present</i>	<i>past</i>	<i>gloss</i>
kāts-u	kat-ta	'win'
kar-u	kat-ta	'cut'
wak-u	wai-ta	'boil'
ne-ru	ne-ta	'sleep'
mi-ru	mi-ta	'look'
ʃin-u	ʃin-da	'die'
jom-u	jon-da	'read'

In Yamato (native) vocabulary, no words like *ento or *kompu (Ito & Mester 1995)

- “Puyo Pongo” Quichua (Orr 1962 via Pater)

$\widehat{ʃiŋki}$	‘soot’	$\widehat{tʃuntina}$	‘to stir the fire’
$\widehat{tʃuŋga}$	‘ten’	indi	‘sun’
pampal ^l ina	‘skirt’	ɲukant ^l ʃi	‘we’
hambi	‘poison’	pundʒa	‘day’
wasi-ta	‘house’	kan-da	‘you’
a ^l tʃa-ta	‘meat’	atan-da	‘the frog’
puru-ta	‘gourd’	wakin-da	‘others’
ali-t ^l ʃu	‘is it good?’	kan-d ^l ʒu	‘you?’
lumu-t ^l ʃu	‘manioc?’	tijan-d ^l ʒu	‘is there?’
mana-t ^l ʃu	‘isn’t it?’	t ^l ʃarin-d ^l ʒu	‘does he have?’
- Magindanaw (Austronesian, 1,000,000 speakers in the Philippines; I lost the source info!¹)

/pəŋ + báŋun/	pəm-báŋun	‘is waking up’
/pəŋ + dila/	pən-dila	‘is licking’
/pəŋ + gəbá/	pəŋ-gəbá	‘is destroying’
/pəŋ + pása/	pəb-pása	‘is selling’
/pəŋ + sígup/	pəd-sígup	‘is smoking’
/pəŋ + tánda/	pəd-tánda	‘is marking’
/pəŋ + kúpja/	pəg-kúpja	‘is wearing a kupia’
- Compare to Mandar (Austronesian, 200,000 speakers in the Indonesia; Mills 1975 via Pater)

/maN + dundu/	man-dundu	‘to drink’
/maN + tunu/	mat-tunu	‘to burn’
- Konjo—(related to Mandar—125,000 speakers in Indonesia; Timothy Friberg & Barbara Friberg 1991 via Pater). I don’t have the original; these data are schematic only:

/maN + dundu/	man-dundu	‘to drink’
/maN + tunu/	man-nunu	‘to burn’
- Standard Indonesian/Malay (Lapoliwa 1981 via Pater)

/məN+pilih/	məmilih	‘to choose’
/məN+tulis/	mənulis	‘to write’
/məN+kasih/	məŋasih	‘to give’
/məN+bəli/	məmbəli	‘to buy’
/məN+dapat/	məndapat	‘to get, to receive’
/məN+ganti/	məŋganti	‘to change’

note also in Indonesian/Malay

əmpat	‘four’
untuk	‘for’
muŋkin	‘possible’

¹ I think it was a linguistics workbook for Pilipino-language teachers in training; there were phonology, morphology, and syntax exercises from various Philippine languages, with data contributed by program participants.

- Kelantan dialect of Malay—I haven't been able to track down the real data, but it should look schematically like this (Teoh 1988 via Pater):

/məN+pilih/	məpilih	'to choose'
/məN+tulis/	mətulis	'to write'
/məN+kasih/	məkasih	'to give'
/məN+bəli/	məmbəli	'to buy'
/məN+dapat/	məndapat	'to get, to receive'
/məN+ganti/	mənganti	'to change'

- English

ɪmp ^h ʌsəbəl	'impossible'
ɪnt ^h ɛmpərət	'intemperate'
ɪŋk ^h ælkjələbəl	'incalculable'
ɪmbɜːb	'imberb'
ɪndɪsənt	'indecent'
ɪŋglɔːriəs	'inglorious'

- Kwanyama (a.k.a. OshiKwanyama; Niger-Congo language with 421,000 speakers in Angola, and an unknown number in Namibia—data from Pater)

<i>Loans:</i>	sitamba	'stamp'
	pelenda	'print'
	oinga	'ink'

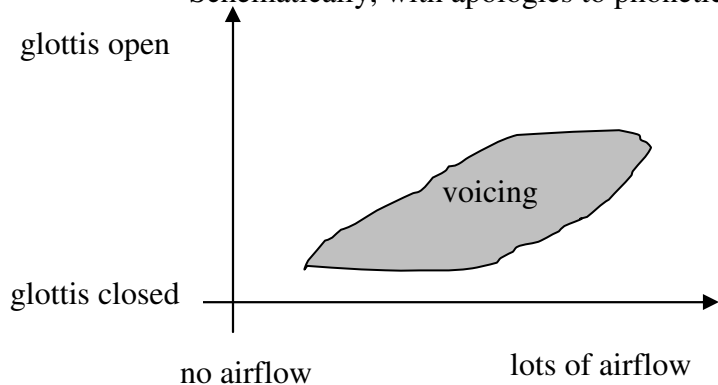
<i>Prefixes:</i>	/e:N+pati/	e:mati	'ribs'
	/oN+pote/	omote	'good-for-nothing'
	/oN+tana/	onana	'calf'

4 Phonetic basis for *NÇ

Hayes & Stivers 1996 (aerodynamic model simulations and experiments with English speakers):
velar pumping and nasal leak

- To have voicing, you need higher air pressure below the glottis than above (so that air flows), and the vocal folds in the right position.
- What range counts as “the right position” depends on the pressure difference.

Schematically, with apologies to phoneticians:



- To stop voicing, you must move out of the zone.
- In a transition from [m] to [p], velum raises.
- The percept of nasality ends before velum actually makes closure → air is leaking out the nose, maintaining air pressure difference across the glottis → voicing is encouraged
- After velum does make closure, it tends to keep rising → “velar pumping”: further encourages airflow across glottis by expanding oral cavity

7 Some things to ponder about the P-map

- Exactly what is being compared when a faithfulness constraint gets its default ranking?
 - Output vs. input? That's kind of funny because the input isn't a pronounced form, so its perceptual properties are hypothetical.
 - Output vs. faithful output (candidate *a* in the above)?
 - Output vs. related output? E.g., [rat] vs. [rad-im]. Those are both real, pronounced forms, but it's tricky because the target segments are in different contexts. Do we measure $\Delta(d/V_V,t/V_ \#)$?
- How well connected is the P-map? Can $\Delta(X,Y)$ be measured for absolutely any X,Y? Or only for close-enough pairs?
- Does $\Delta(X,Y)$ really act like a number, so that we can always compare $\Delta(X,Y)$ and $\Delta(Z,W)$? Or is the "greater than" relation sparser than that, so that some distances can't be compared?
- How specific are the Xs and Ys? MAX-C, MAX-OBSTRUENT, MAX-VCELESSOBSTR, MAX-p...

8 In general, the P-map is good for the "too-many-solutions" problem

- Some markedness constraints have a variety of "solutions"
 - *NC, as we saw
 - OCP-labial in various Western Austronesian languages (Zuraw & Lu 2009)
 - *{I,U} in Romance metaphony (Walker 2005)
 - *INITIALGEMINATE (Kennedy 2005)

⇒ This is what we expect in OT

- But some don't—that's the too-many-solutions problem:
 - *CC deletes C_1 , not C_2 in VC_1C_2V Wilson 2000; Wilson 2001
 - * $\begin{bmatrix} -\text{son} \\ +\text{voice} \end{bmatrix} \#$ causes final devoicing, but not deletion, epenthesis, etc.

⇒ predicted, if P-map imposes difficult-to-overturn ranking: MAX-C, DEP-V >> IDENT(voice)/_#

9 Discussion: why sometimes just one solution, sometimes many?

I think the diachronic/Blevinsian perspective is helpful here.

- If motivation for * $\begin{bmatrix} -\text{son} \\ +\text{voice} \end{bmatrix} \#$ is phonetic force causing final obstruents to devoice, there's a natural direction of language change (learner mistakes lack of phonetic realization of voicing for a lack of voicing in phonological output).

So what if motivations are different in nature? Let's discuss what we'd expect...

- **OCP-labial:** suppose having similar consonants nearby causes difficulties for motor planning (see Frisch 1996; Frisch, Pierrehumbert, & Broe 2004, Walker, Nacopian, & Taki 2002).

Attested changes:

- change place of stem: /p-um-.../ → [k-um...]; violates IDENT(place)/stem
- change place of infix: /p-m-.../ → [k-n...]; violates IDENT(place)/affix
- change consonantality of infix: /C-m-...p.../ → [C-w...p...]; violates IDENT(cons)
- fuse stem and infix consonants: /p-um-.../ → [m...]; violates UNIFORMITY
- move infix out of constraint's domain of application: /p-um-.../ → [mu-p...]; LINEARITY
- delete the infix: /p-m-.../ → [p...]; violates MAX, REALIZEMORPH
- paradigm gap: /p-m-.../ → *unpronounceable*; violates MPARSE ("pronounce the input")

- ***{I,U}**: perhaps motivation is insufficient perceptual distance from [e,o], [i,u] (see Flemming 1996)

Different ways to handle ***{I,U}** in Romance metaphony when raising /ε,ɔ/ (Walker 2005)

- /ε,ɔ/ raise to [i,u]; violates IDENT(tense)
- /ε,ɔ/ fail to raise; violates HARMONY(high), HARMONY(tense)
- /ε,ɔ/ raise to [e,o]; violates HARMONY(high)
- /ε,ɔ/ raise to [ie,uo] or [ie,ue]; violates INTEGRITY (no splitting)

- ***INITIALGEMINATE**: This one's harder...

Kennedy 2005:

- In various Micronesian languages, initial geminate Cs were created by reduplication.
- Word-initial position is a tough place to maintain a C-length distinction, especially for stops, because you need to perceive when the consonant begins ([pa] vs. [ppa], as opposed to [apa] vs. [appa])

Pohnpeian	*ppek	>	mpek	IDENT(nasal)
Marshallese—Ratak	*kkan	>	kekan	DEP-V/C__C
Marshallese—Ralik	*kkan	>	yekkan	DEP-V/#__C
Pingelapese	*ttil	>	iitil	IDENT(syllabic)
Woleaian	*kkaše	>	kkaše	
	*kaše	>	xaše	IDENT(continuant)

10 P-map case study: Löfstedt 2010's analysis of Swedish paradigm gaps

(see other chapters in Löfstedt 2010 for additional tests and applications of the P-map)

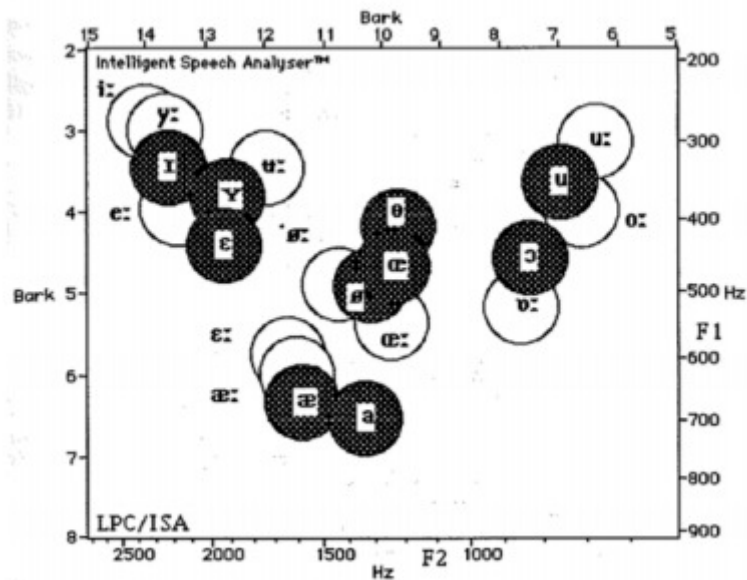
Swedish short and long vowels come in pairs—we can see this in nicknames (and elsewhere):

(192)	<u>FULL NAME</u>	<u>NICKNAME</u>
	<u>(LONG V)</u>	<u>(SHORT V)</u>
Δ (ɑ , a)	kl[ɑ:]s [ɑ:]gøst	kl[a]s:ə [a]gə
Δ (ɯ , ø)	kn[ɯ:]t h[ɯ:]bert	kn[ø]t:ə h[ø]b:ə
Δ (ε , ɛ)	p[ε:]r	p[ɛ]r:a
Δ (y , ɣ)	st[y:]rbjørn	st[ɣ]b:ə
Δ (e , ɛ)	st[e:]fan	st[ɛ]f:ə
Δ (o , ɔ)	r[o:]land p[o:]l	r[ɔ]l:ə p[ɔ]l:ə
Δ (u , ʊ)	[u:]lof b[u:]	[ʊ]l:ə b[ʊ]s:ə
Δ (i , ɪ)	m[i:]kael s[i:]gfrid	m[ɪ]k:ə s[ɪ]g:ə
Δ (ø , ɘ)	j[ø:]ran	j[ɘ]r:ə

(pp. 88-89)

Some of these pairs are more distant in formants from others:

(221)



(p. 110, from Kuronen 2000's p. 119)

Normally, the neuter of a /t/-final adjective is formed by lengthening the /t/, which shortens the preceding vowel:

vi:t	'white'	vi:t:	'white-neut'
sø:t	'sweet'	sø:t:	'sweet-neut'

But [la:t] 'lazy' and [fla:t] 'flat' simply lack neuter singular forms!

Löfstedt's analysis: $\Delta(\alpha:a)$ is just too big. Better to not say the word (violating MPARSE) than to violate faithfulness that badly.

11 Investigating channel bias vs. analytic bias

Looking at the basic data in a language, often both channel-bias and analytic-bias explanations are available. To test an analytic-bias hypothesis, we often need to go beyond basic data.

All these methods have their pros and cons [citations far from complete!²]:

- Teach people an artificial language, holding back crucial cases, and see how they then treat those crucial cases—do they choose the “natural” option or not? (Wilson 2006, White 2012, work in progress by Yun Kim)
- Find a real language that lacks crucial cases, make up words to instantiate those cases, and see what speakers do (Zuraw 2007)—a.k.a. Lise Menn's idea of “Bach testing” (Halle 1978)
 - Same thing but arising naturally when borrowing words or speaking L2 (Broselow 1983)
- See how fast and accurate speakers are in applying “natural” vs. “unnatural” rules that already exist in their language (Zhang, Lai, & Sailor 2006, Zhang & Lai 2006)
- See what choices people make in composing poetry/lyrics (Steriade 2003, Kawahara 2007) or puns (Fleischhacker 2006, Kawahara 2010).

² I just cited the first ones that came to mind, so naturally there is an overrepresentation of UCLA.

12 How about *unnatural but real phonology*?

Bach & Harms 1972: “crazy rules”

Japanese coronals undergo affrication before certain vowels:

ta	tʃi	tsu
da	dʒi	
sa	ʃi	su
za		zu

$$\begin{bmatrix} \text{-sonorant} \\ \text{+coronal} \\ \text{<+voice>} \end{bmatrix} \rightarrow \begin{bmatrix} \text{+del rel} \\ \text{+strident} \\ \alpha\text{anterior} \\ \text{<\alphacontinuant>} \end{bmatrix} / \text{---} \begin{bmatrix} \text{V} \\ \text{+high} \\ \alpha\text{back} \end{bmatrix}$$

Affrication before [u] seems very unnatural. B&H propose the following series of events.

1. Somebody innovates a rule that’s phonetically reasonable:³

$$\begin{bmatrix} \text{-sonorant} \\ \text{+coronal} \end{bmatrix} \rightarrow \begin{bmatrix} \text{+del rel} \\ \text{+strident} \\ \text{+anterior} \end{bmatrix} / \text{---} \begin{bmatrix} \text{V} \\ \text{+high} \\ \text{-back} \end{bmatrix}$$

○ What does the syllable inventory look like now?

2. The rule gets generalized a little in a way that’s structurally (if not phonetically) reasonable:

$$\begin{bmatrix} \text{-sonorant} \\ \text{+coronal} \end{bmatrix} \rightarrow \begin{bmatrix} \text{+del rel} \\ \text{+strident} \\ \alpha\text{anterior} \end{bmatrix} / \text{---} \begin{bmatrix} \text{V} \\ \text{+high} \\ \alpha\text{back} \end{bmatrix}$$

○ What does the syllable inventory look like now?

3. Now a new, also reasonable rule is innovated...

$$\begin{bmatrix} \text{-sonorant} \\ \text{+strident} \\ \text{+voice} \\ \text{+anterior} \end{bmatrix} \rightarrow \text{[+continuant]}$$

4. ...then generalized:

$$\begin{bmatrix} \text{-sonorant} \\ \text{+strident} \\ \text{+voice} \\ \alpha\text{anterior} \end{bmatrix} \rightarrow \text{[\alphacontinuant]}$$

5. And it all gets collapsed into the one “unholy” rule (p. 15). So each step is reasonable, but the result is “crazy”.

○ Let’s discuss what constraints we’d need for an OT analysis—some of them might be phonetically unmotivated.

³ I hope this is right—I’m changing what I think was a typo from old notes; I don’t have the chapter handy.

The dream of a universal constraint set probably can't be completely fulfilled. We probably need to equip the learner with the ability to learn constraints (see Hayes & Wilson 2006).

Next time: phonologization

To sum up

- Articulatory or perceptual justifications for constraints (or rules) often present themselves.
 - We dwelt especially on Steriade's idea of a P-map: that speakers have implicit knowledge of perceptual distance, and disfavor correspondence between distant points.
- But we also have to consider the possibility that a phonetic explanation operates only diachronically.
- There might be some cases where a diachronic explanation doesn't work.
- There are some methods for testing an analytic bias.

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