

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'
<hr/>		
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?’	tʃarin-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'

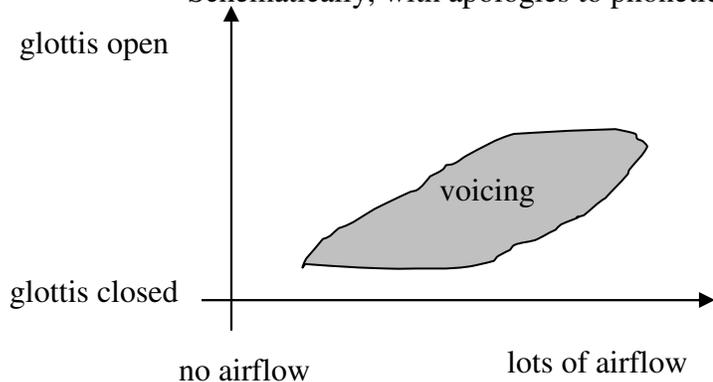
<i>Prefixes:</i>	/e:N+pati/	e:mati	'ribs'
	/oN+pote/	omote	'good-for-nothing'
	/oN+tana/	onana	'calf'

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)

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

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

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:

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

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.

References

- Archangeli, Diana, Laura Moll & Kazutoshi Ohno. 1998. Why not *NC.. In M. Catherine Gruber, Derrick Higgins, Kenneth S Olson, & Tamra Wysocki (eds.), *CLS 34, Part 1: The Main Session*, 1–26. Chicago: Chicago Linguistic Society.
- Bach, Emmon & Robert T Harms. 1972. How do languages get crazy rules? In Robert P Stockwell & Ronald K.S. Macaulay (eds.), *Linguistic change and generative theory*, 1-21. Indiana University Press.
- Blevins, Juliette. 2003. *Evolutionary phonology. The emergence of sound patterns..* Cambridge: Cambridge University Press.
- Broselow, Ellen. 1983. Nonobvious transfer: on predicting epenthesis errors.. In Susan Gass & Larry Selinker (eds.), *Language Transfer in Language Learning.*, 269-280. Rowley, MA: Newbury House.
- Fleischhacker, Heidi. 2006. Similarity in phonology: evidence from reduplication and loan adaptation.. UCLA ph.d. dissertation.
- Flemming, Edward. 1996. Evidence for Constraints on Contrast: The Dispersion Theory of Contrast. *UCLA Working Papers in Phonology* 1. 86-106.
- Friberg, Timothy & Barbara Friberg. 1991. Notes on Konjo phonology.. In J. N Sneddon (ed.), *Studies in Sulawesi Linguistics, Part 2*. Jakarta: NUSA Linguistic Studies.
- Frisch, Stefan A. 1996. Similarity and Frequency in Phonology.. Northwestern University.
- Frisch, Stefan A, Janet B Pierrehumbert & Michael B Broe. 2004. Similarity Avoidance and the OCP. *Natural Language & Linguistic Theory* 22(1). 179–228.
- Halle, Morris. 1978. Knowledge unlearned and untaught: what speakers know about the sounds of their language.. In Morris Halle, Joan Bresnan, & George A Miller (eds.), *Linguistic theory and psychological reality*, 294-303. Cambridge, MA and London: MIT Press.
- Hayes, Bruce & Donca Steriade. 2004. Introduction: the phonetic basis of phonological markedness.. In Robert Kirchner, Donca Steriade, & Bruce Hayes (eds.), *Phonetically based phonology*. Cambridge University Press.
- Hayes, Bruce & Tanya Stivers. 1996. *The phonetics of post-nasal voicing*.
- Hayes, Bruce & Colin Wilson. 2006. A Maximum Entropy Model of Phonotactics and Phonotactic Learning.
- Ito, Junko & Armin Mester. 1995. Japanese phonology.. In John Goldsmith (ed.), *Handbook of Phonological Theory*, 817–838. Cambridge, Mass.: Blackwell.
- Kawahara, Shigeto. 2007. Half rhymes in Japanese rap lyrics and knowledge of similarity. *Journal of East Asian Linguistics* 16(2). 113-144. doi:10.1007/s10831-007-9009-1 (14 February, 2012).
- Kawahara, Shigeto. 2010. *Papers on Japanese imperfect puns*.
- Kennedy, Bob. 2005. Reflexes of initial gemination in Western Micronesian languages.. UCLA, Los Angeles, CA.
- Kuronen, Mikko. 2000. Vokaluttalets akustik i sverigesvenska, finlandssvenska och finska.. University of Jyväskylä ph.d. dissertation.
- Lapoliwa, Hans. 1981. *A generative approach to the phonology of Bahasa Indonesia..* Canberra: Australia National University.
- Löfstedt, Ingvar. 2010. Phonetic Effects in Swedish Phonology: Allomorphy and Paradigms.. UCLA ph.d. dissertation.

- Moreton, Elliott. 2008. Analytic Bias and Phonological Typology. *Phonology* 25(01). 83-127. doi:10.1017/S0952675708001413.
- Orr, Carolyn. 1962. Ecuador Quichua phonology.. In Benjamin Elson & Benjamin Elson (eds.), *Studies in Ecuadorian Indian languages I*, 60–77. Norman: Summer Institute of Linguistics of the University of Oklahoma.
- Pater, Joe. 1996. *NC.. In Jill Beckman (ed.), *Proceedings of the North East Linguistics Society 26*, vol. 26, 227–239. Amherst, Mass.: GLSA Publications.
- Pater, Joe. 1999. Austronesian nasal substitution and other NC effects.. In René Kager, Harry van der Hulst, & Wim Zonneveld (eds.), *The Prosody-Morphology Interface*, 310–343. Cambridge: Cambridge University Press.
- Pater, Joe. 2001. Austronesian nasal substitution revisited: What’s wrong with *NC (and what’s not).. In Linda Lombardi (ed.), *Segmental Phonology in Optimality Theory: Constraints and Representations*, 159–182. Cambridge: Cambridge University Press.
- Steriade, Donca. 1999. Alternatives to syllable-based accounts of consonantal phonotactics.. In Osamu Fujimura, Brian Joseph, & B. Palek (eds.), *Proceedings of the 1998 Linguistics and Phonetics Conference*, 205–242. Prague: Karolinum Press.
- Steriade, Donca. 2001a. Directional asymmetries in place assimilation: a perceptual account.. In Elizabeth Hume & Keith Johnson (eds.), *The Role of Speech Perception in Phonology*. San Diego: Academic Press.
- Steriade, Donca. 2001b. *The phonology of perceptibility effects: the P-map and its consequences for constraint organization..* UCLA.
- Steriade, Donca. 2003. Knowledge of perceptual similarity and its uses: evidence from half-rhymes.. In M.J. Solé, D Recasens, & J Romero (eds.), *Proceedings of the 15th International Congress of Phonetic Sciences*, 363-366. Barcelona: Futurgraphic.
- Teoh, Boon Seong. 1988. Aspects of Malay phonology revisited: a non-linear approach.. University of Illinois at Urbana-Champaign.
- Walker, Rachel. 2005. Weak Triggers in Vowel Harmony. *Natural Language & Linguistic Theory* 23(4). 917–989.
- Walker, Rachel, Narineh Nacopian & Mariko Taki. 2002. Nasal consonant speech errors: implications for “similarity” and nasal harmony at a distance. *Collected papers: First Pan-American/Iberian Meeting on Acoustics*. Mexican Institute of Acoustics.
- White, James. 2012. Evidence for a learning bias against “saltatory” phonological alternations in artificial language learning.. Paper presented at the Linguistic Society of America Annual Meeting, Portland, OR.
- Wilson, Colin. 2000. Targeted Constraints: An Approach to Contextual Neutralization in Optimality Theory.. Johns Hopkins University.
- Wilson, Colin. 2001. Consonant Cluster Neutralisation and Targeted Constraints. *Phonology* 18(1). 147–197.
- Wilson, Colin. 2006. Learning Phonology with Substantive Bias: An Experimental and Computational Study of Velar Palatalization. *Cognitive Science* 30(5). 945-982.
- Zhang, Jie & Yuwen Lai. 2006. Testing the role of phonetic naturalness in Mandarin tone sandhi. *Kansas Working Papers in Phonetics*(28). 65-126.
- Zhang, Jie, Yuwen Lai & Craig Sailor. 2006. Wug-testing the “tone circle” in Taiwanese.. In Donald Baumer, David Montero, & Michael Scanlon (eds.), *Proceedings of the 25th West Coast Conference on Linguistics*. Somerville, MA: Cascadilla Proceedings Project.
- Zuraw, Kie. 2007. The role of phonetic knowledge in phonological patterning: Corpus and survey evidence from Tagalog. *Language* 83. 277-316.
- Zuraw, Kie & Yu-An Lu. 2009. Diverse repairs for multiple labial consonants. *Natural Language and Linguistic Theory* 72. 197-224.