Class 6: Downward interfaces I

> **To do**
> ☐ Manam assignment due Friday (Feb. 2)

Overview: Previously we looked at structure above the segment; next week, structure 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: *NÇ̬

(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)

present	*past*	*gloss*
ka͡ts-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)

ʃiŋki	'soot'	t͡ʃuntina	'to stir the fire'
t͡ʃuŋga	'ten'	indi	'sun'
pampalʲina	'skirt'	ɲukant͡ʃi	'we'
hambi	'poison'	pund͡ʒa	'day'
wasi-ta	'house'	kan-da	'you'
aj͡tʃa-ta	'meat'	atan-da	'the frog'
puru-ta	'gourd'	wakin-da	'others'
ali-t͡ʃu	'is it good?'	kan-d͡ʒu	'you?'
lumu-t͡ʃu	'manioc?'	tijan-d͡ʒu	'is there?'
mana-t͡ʃu	'isn't it?'	t͡ʃarin-d͡ʒu	'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'

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[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.

- 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; Friberg & 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/	məɲasih	'to give'
/məN+bəli/	məmbəli	'to buy'
/məN+dapat/	məndapat	'to get, to receive'
/məN+ganti/	məŋganti	'to change'

  note also in Indonesian/Malay

ə**mp**at	'four'
u**nt**uk	'for'
mu**ŋk**in	'possible'

- 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/	məŋganti	'to change'

- English

ɪmpʰɑsəbəl	'impossible'
ɪntʰɛmpəɹət	'intemperate'
ɪŋkʰælkjələbəl	'incalculable'
ɪmbɝb	'imberb'
ɪndisənt	'indecent'
ɪŋglɔɹiəs	'inglorious'

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

Loans:	sitamba	'stamp'
	pelenda	'print'
	oinga	'ink'

Prefixes:	/eːN+pati/	eːmati	'ribs'
	/oN+pote/	omote	'good-for-nothing'
	/oN+tana/	onana	'calf'

4   Phonetic basis for *NC̥

- 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 (so they can vibrate).

  ▪ What range counts as "the right position" depends on the pressure difference. Schematically, with apologies to phoneticians:
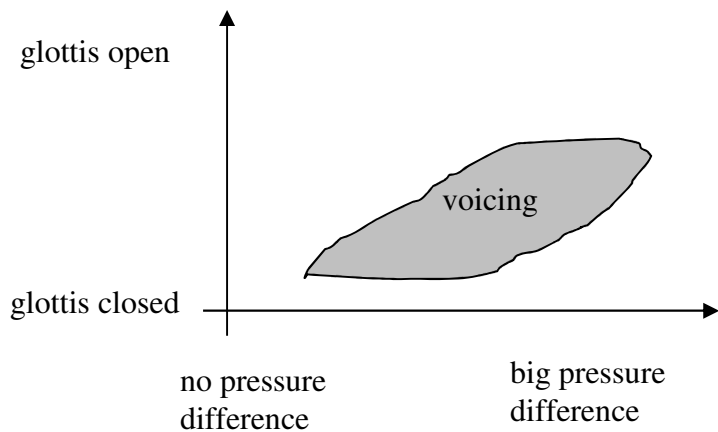
> ▪ To **stop** voicing, you must move out of the zone.
> ▪ In a transition from [m] to [p], velum raises.
> ▪ The percept of nasality ends before velum actually makes closure → air is **leaking out the nose**, maintaining air pressure difference across the glottis → voicing is encouraged
> ▪ After velum does make closure, it tends to keep rising → "**velar pumping**": further encourages airflow across glottis by expanding oral cavity

Analytic bias theory: humans are predisposed towards grammar that includes *NC̥

Channel bias theory (following Blevins 2003 Evolutionary Phonology*)*: Output of parents' phonology is [ampa], but sounds a bit like [amba], so children may mistakenly learn *NC̥.

✇ Let's try to sketch out how this or a different channel-bias theory will work for the various repairs we saw above.

5   Ex. of faithfulness constraint driven by perception: IDENT(place)/__V (Steriade 2001)

- Why do so many languages have /an+pa/ → [ampa] but not /an+pa/ → [anta], /ap+na/ → [apma]?
  - Cf. our brief discussion of cues to consonant place (Steriade 1999).

- Steriadean approach: in /an+pa/, /p/'s place is well cued (release burst, outgoing formant transition), while /n/'s isn't.
  - Be faithful to the better-cued contrast.

- Let's sketch how a channel-bias explanation would work. (See Hayes & Steriade 2004 for a formulation and rebuttal)

6   Steriade's P-map: an analytic-bias account of perception-driven faithfulness constraints (Steriade 2008)

a. Speakers have a "P-map", implicit knowledge of perceptual distance Δ(X,Y) between any pair of sounds *X*, *Y* (potentially tagged for their contexts):
  - e.g., Δ(p/__V, t/__V) > Δ(n/__C, m/__C)   [Δ for underline difference]

b. Faithfulness constraints can refer to details of their target and their surface context:

  - not just IDENT(place) but IDENT(place)/ __ V, IDENT(place)/ __ C
                                                                         −son   +nas
  - not just DEP-V, but DEP-i, DEP-a, DEP-ə, DEP-V/s__t, DEP-V/t__r, ...

c. Constraints penalizing big changes should outrank constraints penalizing small changes:

  - IDENT(place)/ __ V >> IDENT(place)/ __ C
                    −son   +nas

- Presumably these default rankings can be overturned by the learner in response to contradictory data, but they will be a drag on language change
  - See Wilson 2006, White 2012 for implemented models (priors in MaxEnt)

I → O	*faith. violated*	*perceptual comparison*	*distance (fake values)*
/an+pa/ → [ampa]	IDENT(place)/ __ C +nas	(nas/__C, diff-place-nas/__C)	6
/an+pa/ → [anta]	IDENT(place)/ __ V −son	(obstr/__V, diff-place-obstr/__V)	8
/an+pa/ → [ana]	MAX-C/__V	(C/__V, Ø/__V)	10
/an+pa/ → [apa]	MAX-C/__C	(C/__C, Ø/__C)	8

- No matter where we rank the markedness constraint in relation to the faithfulness hierarchy, winner is *b* or *a*:

	/an+pa/	AGREEPLACE	MAX-C/__V	MAX-C/__C	IDENT(place)/ __ V −son	IDENT(place)/ __ C +nas
a	[anpa]	*!				
b	☞ [ampa]					*
c	[anta]				*!	
d	[ana]		*!			
e	[apa]			*!		

7 Some things to ponder about the P-map

- Exactly what is being compared in Δ(X,Y), to give a faithfulness constraint 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 Δ(d/V__V, t/V__#)?

- How well connected is the P-map?
  - Can Δ(X,Y) be measured for absolutely any X,Y? Or only for close-enough pairs?

- Does Δ(X,Y) really act like a number, so that we can always compare Δ(X,Y) and Δ(Z,W)?
  - Or is the "greater than" relation sparser than that, so that some distances can't be compared?

- How specific are the *X*s and *Y*s?
  - MAX-C, MAX-OBSTRUENT, MAX-VOICELESSOBSTRUENT, MAX-p...
  - Maybe they all coexist

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

- Some markedness constraints have a variety of "solutions"
  - *NC̥, as we saw
  - OCP-labial in various Western Austronesian languages (Zuraw & Lu 2009)
  - *{ɪ,ʊ} 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)
  - $*\begin{bmatrix} -son \\ +voice \end{bmatrix}$ # 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 the motivation for $*\begin{bmatrix} -\text{son} \\ +\text{voice} \end{bmatrix}$ # is a 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** (Zuraw & Lu 2009): suppose having similar consonants nearby causes difficulties for motor planning (see Frisch 1996; Frisch, Pierrehumbert & Broe 2004, Walker, Hacopian & Taki 2002)

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

- ***{ɪ,ʊ}** (Walker 2005): perhaps motivation is insufficient perceptual distance from [e,o], [i,u] (see Flemming 1996)

- Different ways to handle *{ɪ,ʊ} in Romance metaphony when raising /ɛ,ɔ/ ((Walker 2005))
  h. /ɛ,ɔ/ raise to [i,u]; violates IDENT(tense)
  i. /ɛ,ɔ/ fail to raise; violates HARMONY(high), HARMONY(tense)
  j. /ɛ,ɔ/ raise to [e,o]; violates HARMONY(high)
  k. /ɛ,ɔ/ raise to [ie,uo] or [iɛ, uɛ]; violates INTEGRITY (no splitting)

 ♇ *INITIAL GEMINATE*: 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)	FULL NAME (LONG V)	NICKNAME (SHORT V)
Δ (ɑ , a)	kl[ɑ:]s	kl[a]s:ə
	[ɑ:]gəst	[a]g:ə
Δ (ʉ , ɵ)	kn[ʉ:]t	kn[ɵ]t:ə
	h[ʉ:]bert	h[ɵ]b:ə
Δ (ɛ , ɛ̞)	p[ɛ:]r	p[ɛ̞]r:a
Δ (y , ʏ)	st[y:]rbjørn	st[ʏ]b:ə
Δ (e , ɛ̞)	st[e:]fan	st[ɛ̞]f:ə
Δ (o , ɔ)	r[o:]land	r[ɔ]l:ə
	p[o:]l	p[ɔ]l:ə
Δ (u , ʊ)	[u:]lof	[ʊ]l:ə
	b[u:]	b[ʊ]s:ə
Δ (i , ɪ)	m[i:]kael	m[ɪ]k:ə
	s[i:]gfrid	s[ɪ]g:ə
Δ (ø , ø̞)	j[ø:]ran	j[ø̞]r:ə

(pp. 88-89)

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

(221)
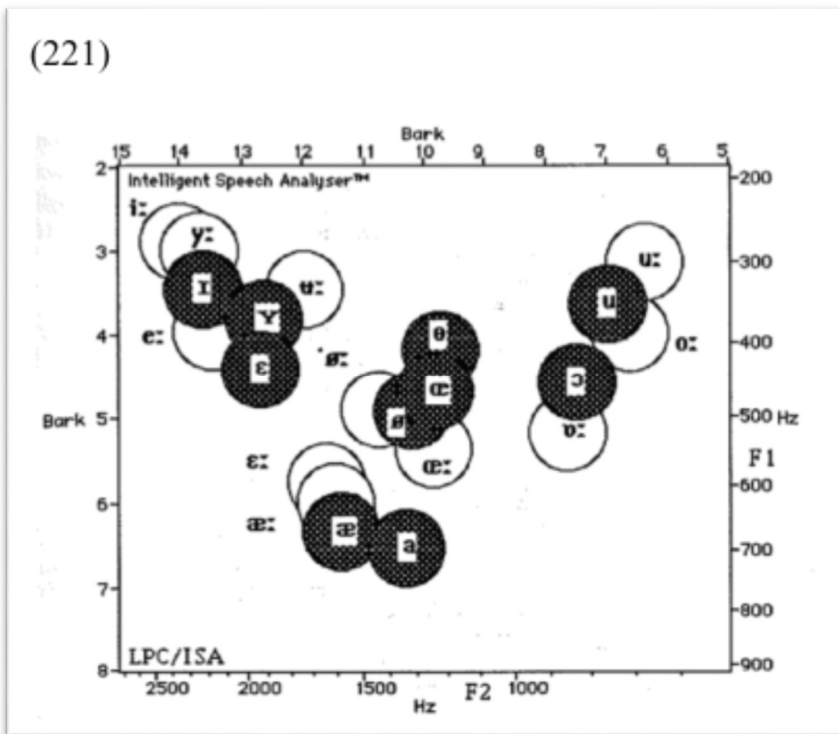
(p. 110, from Kuronen 2000's p. 119)

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

  viːt   'white'   vɪtː   'white-*neut*'

  søːt   'sweet'   søtː   'sweet-*neut*'

  ▪ But [lɑːt] 'lazy' and [flɑːt] 'flat' simply lack neuter singular forms!

- Löfstedt's analysis: Δ(ɑː,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, Kim 2012, for an overview Moreton & Pater 2012)

  - 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)
  - See how well people have learned the natural vs. unnatural patterns that happen to be present in their lexicon (Hayes et al. 2009, Carpenter 2010, Becker, Ketrez & Nevins 2011, Becker, Nevins & Levine 2012, Jarosz & Rysling, Garcia 2017)

12   How about *un*natural but real phonology?

- Bach & Harms 1972: "crazy rules"
- E.g., Japanese coronals undergo affrication before certain vowels:

ta	tʃi	tsu
da	dʒi	
sa	ʃi	su
za		zu

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

- Affrication before [u] seems very unnatural.
  - B&H propose the following series of events. (see over)

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

1. Somebody innovates a rule that's phonetically reasonable:[3]

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

☞ 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:

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

☞ 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:

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

4. And it all gets collapsed into the one "unholy" rule (p. 15). So each step is reasonable, but the result is rather unnatural.

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

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[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).

To sum up
- Phonetics certainly plays a role in shaping phonological typology, but exactly how it does it remains controversial

Next time
- "Phonologization": how does a language get from phonetic motivation to an abstracted phonological pattern?

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