NELS 34, November 8, 2003

Language contact phonology:
Richness of the stimulus, poverty of the base

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1. The Problem: 'Hidden' Rankings in Language Contact

(1) Exposure to a new language often provides access to new structure types. Systematic adaptation patterns require 'hidden rankings' (Davidson 2000) not obviously motivated by the data of either language.

(2) OT model of phonological acquisition:
- initial state involves set of constraints which are either unranked, or represent M>>F bias (to derive most restrictive grammar)
- learner establishes ranking based on (accurately perceived) input
- final state for unrankable constraints: floating (Ross 1996, Anttila 1998) or arbitrary ranking (Tesar and Smolensky 2000).

(3) Possible ranking patterns in SLA or loan adaptation:
a. F >> M: motivated by marked forms
b. M >>F: putative default pattern
c. M >>M, F>>F: mysterious if not motivated by data

(4) Possible sources of 'hidden' rankings:
a. default, initial rankings (therefore universal)
b. 'cascade' effect (byproduct of crucial rankings)
c. emergent effect of input frequency (Broselow to appear)
d. effect of articulatory program (Ussishkin & Wedel to appear)
e. result of perception (Silverman 1992, Yip 1993, Kenstowicz 2001, 2003, Kang to appear, Peperkamp 2003)

(5) Claim: All (non-default) ranking is data-driven; attested patterns are a result either of emergent ranking determined by frequency effects, or of interactions between the perception and production grammars.

(6) Outline:
1. Introduction
2. Survey of Ranking Puzzles (M>>M, F>>F)
3. Japanese Palatalization (Mspec >>Mgeneral)
4. Jamaican Creole registers (M>>M)
5. Stress in loan adaptation into Huave, Fijian, Selayarese (F>>F)

2. Some Ranking Puzzles in Language Contact Phonology

(7) Type 1: Differential difficulty (M>>M)
- Mandarin, Tswana (etc.) learners produce voiceless but not voiced obstruent codas even though NL has neither and TL has both (Wissing and Zonneveld 1996, Grijzenhout and van Rooij 2000, Eckman 1981, Flege and Davidian 1984, Flege, McCutcheon, and Smith 1987, Yavas 1994, Broselow, Chen, and Wang 1998, Xu 2003).
- In Japanese borrowings [ti] is more likely than [si] (*ʃitibaNku* 'Citibank'), though NL has neither [t/ʧ] nor [s/ʃ] contrast before [i], and source has both (Ito and Mester 1995)
- Jamaican Creole speakers are more likely to produce onset [st] than [ð] (*dat stik* 'that stick'), though basilect has neither (Meade 2001, Ito and Mester 1999).
- English speakers have greater difficulty producing certain non-English onsets than others (Davidson et. al.2000, Davidson 2003).

(8) Type 2: Differential faithfulness (F>>F)
- Huave borrowings preserve source stress, but not necessarily source segments (Davidson & Noyer 1996).
- Selayarese borrowings preserve source segments, but not necessarily source stress (Broselow 1999).
- Fijian borrowings preserve source stress, but not necessarily source length (Kenstowicz 2003).

(9) Type 3: Differential repair strategies (F>>F)
- Speakers of various languages without complex onsets generally pronounce source Obs-Res as OVR ([kalas] 'class'), but as VCC if cluster consists of [s]-C (([estati] 'statue', Broselow 1992, Fleishhacker 1999).
- Selayarese speakers generally repair coda [s] in borrowings by insertion of a copy vowel ([kalasa] 'class'), but by insertion of a high vowel if the source is monosyllabic ([gasi] 'gas') (Broselow 1999).

(10) Type 4: Ranking mismatches (F1>>F2, F2>>F1)
- In Malayalee English, intervocalic voiced stops are realized as voiceless geminates although in Malayalam, length distinctions are preserved in preference to voicing distinctions (Mohanan and Mohanan 2003). (=reinterpretation of contrast)

3. Emergent Rankings: Japanese Palatalization

(11) Japanese lexical strata (Itô and Mester 1995)

a. [ʃitʃibaNku]: [t] and [s] palatalize/ _i (Japanese pattern)

b. [sitibaNku]: neither palatalizes/_i (English pattern)

c. [ʃitibaNku]: [s] but not [t] palatalizes/_i (neither Japanese nor English)

d. unattested: *[sitʃibaNku] ([t] but not [s] palatalizes/_i)

Ito and Mester (1995): F constraints may be differently ranked in different strata, but M constraints maintain the same relative ranking in all strata. Adaptation pattern (11c) reveals 'hidden' M>>M ranking.

(12) Palatalization Typology

a. Japanese: ***CorFric-i , *CorObs-i*** >> Faith (I&M's CVLink)
(= default M>>F ranking plus M>>M)

b. English: neither coronal stops nor fricatives palatalize before [i]
Faith >> *CorFric-i, *CorObs-i

c. Korean: coronal fricatives, but not stops, palatalize before [i]
*CorFric-i >> Faith >>*CorObs-i

d. Assumption: no language palatalizes coronal stops but not [s]

(13) Problem: why should Japanese speakers assume M >>M ranking when both are unviolated in native vocabulary (*CorFric-i >> *CorObs-i)?

(14) The Gradual Learning Algorithm (Boersma & Hayes 2001) predicts that the rate of constraint demotion mirrors the frequency of violating structures in the input:

	*CorFric-i	*CorObs-i
ti		*
si	*	*

∀x((x violates *CorFric-i) ⇒ (x violates *CorObs-i))
Therefore, more general constraints are demoted more quickly.

(15) Conclusion: MSpec>>MGen rankings can be explained as emergent ranking based on frequency of input structure types, with no need to posit hidden rankings.

See Levelt & van de Vijver 1998, Boersma & Levelt 1999 for similar argument for L1 acquisition; see Broselow, to appear and Xu 2003 for similar arguments for final devoicing in second language acquisition. Also, see Broselow, to appear for discussion of alternative analyses, e.g.., final devoicing as default ranking of positional faithfulness constraints, articulatory program, perception.

4. Markedness in Perception Grammar vs. Production Grammar: Jamaican Creole

(16) Jamaican Creole register continuum: 'that stick'
(Ito and Mester 1995, Meade 2001)

basilect:	[dat tIk]	*[ð], *[sC] >> Faith (substrate)
mesolect:	[dat stIk]	*[ð] >> Faith >> *[sC]
acrolect:	[ðat stIk]	Faith >> *[ð], *[sC]
no register:	**[ðat tIk]*	**[sC] >> Faith >> *[ð]*

(17) Can ranking *[ð]>>*[sC] be a frequency effect?
British National Corpus: 100M words

- occurrence of initial [ð] ≅ 12.8M
- occurrence of initial sC ≅ 1.4M
- 15 words containing [ð] in top 109; *the* = #1 (6,187,267)
- highest sC (*school*) ranked 181 at 52, 227 occurrences.

[ð] (token) frequency > [sC]; therefore GLA predicts wrong ranking.
However, [d-ð] contrast has low functional load in English.

(18) Proposal: Differential difficulty in this case results from interaction of perception and production grammars:

- [#sC-#C] contrast is correctly perceived, but is not permitted by production grammar
- [d-ð] contrast is initially not perceived as significant

(19) Jamaican Speakers' Development (Assuming that different registers represent fossilizations of different stages in acquisition process)

a. Basilect: [dat tIk]
Perception grammar: sC-C contrast, [ð] variant of [d]
Production grammar: *[ð],*sC(onset) >> F
*Input [ð] does not contribute to demotion of *[ð].*
*Input [sC] does contribute to demotion of *[sC]*

b. Mesolect: [dat stIk]
Perception grammar: reranked to allow [d-ð] contrast
Production grammar: *[ð]>>F>>*sC
*Input [ð] now contributes to demotion of *[ð].*

c. Acrolect: [ðat stIk]
Production grammar: as in (b)
Perception grammar: F >> *[ð], *sC
**[ð] has been demoted in response to input [ð]*

(20) Dual Model of Acquisition (cf. Boersma 1998, Pater 1998, Silverman 1992, etc.):

a. Production Grammar:
- maps underlying representations onto surface representations
- consists of M constraints, which discourage contrast in SRs, and F constraints, which support contrast in SRs
- initial ranking is M>>F (giving most restrictive grammar consistent with the data)
- reranking occurs in response to evidence for contrast in input data: greater frequency of marked structure ⇒ lower rank of M
- final ranking allows speaker to produce all contrasts necessary for native language

b. Perception/Parsing/Decoding Grammar:
- maps the acoustic signal onto underlying phonological representations (input to production grammar)
- consists of M constraints, which discourage contrast in URs, and F constraints, which support contrast in URs
- initial ranking is M>>F, which gives smallest number of contrasts consistent with the data
- reranking occurs in response to evidence for contrast in input data: greater functional load ⇒ lower rank of M (*contrast)
- final ranking limits possible UR contrasts to those supported by NL data (i.e., base is not fully rich)

NB: this does not imply that speakers cannot hear acoustic cues that do not function to signal contrast in their NL, only that their perception grammar determines that those cues are not linguistically significant.

(21) Development of [d-ð] contrast
Polka et.al (2001): major acoustic difference in English [ð-d] contrast is F2:

means (range)	[d]	[ð]
F2 at onset (Hz)	1746 (1699-1790)	1536 (1455-1699)
F2 change (Hz)	604 (550-681)	456 (336-631)
noise duration (ms)	16.2 (7.7-20.4)	18.6 (8.5-39.6)
noise amplitude (dB)	53.7 (50.1-56.7)	56.2 (51.4-60)

(22) Constraints for mapping acoustic signal to UR
a. "M" constraint: F2(1450-1800) ⇒ {D} (=d,ð}
(i.e., there is no significant contrast between low intensity apical obstruents in terms of [+/-continuant])
b. "F" constraint: F2 <1700 ⇒ /ð/

(23) Jamaican/French Perceptual Mapping

F2 1746 (acoustic signal)	F2(1450-1800) =D	F2(<1700) =ð
☞ /D/		
/ð/		* !
F2 1536 (acoustic signal)		
☞ /D/		*
/ð/	* !	

(24) English ranking F2<1700⇒/ð/ >> F2(1450-1800)⇒{D} maps [d] and [ð] to two different categories

(25) [d-ð] contrast is difficult to perceive: Moroson and Jamieson (1989) found that adult Canadian Francophones after training successfully distinguished [θ-ð] contrast, but still could not distinguish [d-ð].

(26) [d-ð] contrast is mastered late: Polka et al (2001) discovered that both Anglophone and Francophone infants (6-8 months and 10-12 months) showed relatively poor [d-ð] discrimination relative to other contrasts. "For English listeners, comparable performance levels were maintained across both infant ages, whereas there was clear evidence of an increase in performance between 10-12 months and adulthood" (p.2197).

5. Differential Faithfulness: Stress in Loan Adaptation

(27) Proposal of this section: whether source stress is maintained in loan adaptation is a function not of a hidden ranking of a production grammar constraint MatchStress, but rather of the role stress plays in signalling word boundaries and/or lexical contrasts in the NL.

5.1. Huave (Davidson and Noyer 1996)

Faith to Source Stress >> Faith to Source Segments
TrochaicFeet, Align-R, MatchStress >> Max(C,V)

(28) Huave native vocabulary:

- stress falls on final closed syllable, otherwise on penult
  aráŋ 'hace', taraŋás 'hice', taraŋasán 'hicimos'
  (Kreger and Stairs 1981)
- all major lexical category words end in consonant
- no vowel length contrast, no secondary stress

(29) Loans into Huave from Spanish: Most Nativized:

Spanish	Huave	
garabáto	garabát	'hook'
kardúmen	kardúm	'flock'
márso	márs	'March'

MatchStress: Preserve stress of source word.
TrochaicFeet: Feet are bimoraic trochees (['CVCV] or ['CVC])
Align-R: Right prosodic word Edge = right edge of a foot
Final-C: Each prosodic word ends in a consonant. (= D&N Free-V)
Max(C,V): Don't delete a consonant/vowel.

/garabáto/	Match Stress	Trochaic Feet, Align-R	Final-C	**Max**
a. gara[báto]			*!	
☞b. gara[bát]				*

(30) Huave from Spanish: Less Nativized:

Spanish	Huave	
gwanábana	gwanába	'sweet-sop'
mandádo	mandáda	'command'

/gwanábana/	Match Stress	Trochaic Feet, Align-R	**Max**	Final-C
a. gwa[nába]na		*!		
b. gwana[bána]	*!			
☞c. gwa[nába]			*	*
d. gwa[náb]			*!*	

Doublets: domíngo domíng/domíngu 'Sunday' (etc.)

(31) Huave from Spanish: Least Nativized:

Spanish	Huave	
myérkoles	myérkoles	'Wednesday'
médiko	médiko	'doctor'

/médiko/	**Max**	Match Stress	Trochaic Feet, Align-R	Final-C
☞ a. [médi]ko			*	*
b. [médik]	*!			

(32) Puzzle: What is the source of F>>F rankings?
a. MatchStress>>Max(C,V)

- Hayes (1999): O-O constraints rank high by default.
  BUT why O-O(stress) >> O-O(segment)?

b. MatchStress>>Max(C)>>*ComplexOnset>>Dep(V)
plato polat 'silver' (*pat)

(33) Alternative Analysis:

- Perception grammar not only maps acoustic cues onto phoneme categories, but also guides segmentation of strings into words
- MatchStress>>Max(C,V) is an effect of mapping from acoustic input to UR.
- In Huave, V'C = end of word (for lexical categories); anything following is either part of the next word, or is just noise (e.g. final stop release in English).

(34) Comparison

a. Why is stress preserved at price of segment loss?

- Speaker-oriented account: MatchStress >> MaxSegment
- Listener-oriented account: high-ranking perception constraint ['VC(V)] ⇒ right edge of word

b. Why are there no cases of non-trochaic stress plus apocope? (*médik<o>)?

- Speaker-oriented account: TrochFeet>>Max >>Final-C
- Listener-oriented account: Apocope is a function of misparsing, not of the production grammar. Once the parsing principle ['VC(V)] ⇒ right edge of word is demoted (acknowledging possibility of antepenultimate stress), we no longer expect apocope.

c. Why is consonant deletion possible only in post-tonic position though Huave has no complex onsets? (plato → polat 'silver', plasa → plas, *p<l>ato, *p<l>as)

- Speaker-oriented account: MatchStress>>Max(C)>>*ComplexOnset>>Dep(V)
- Listener-oriented account: Huave speakers' perception grammar directs that material following the stress foot is not linguistically significant. Material preceding stress, however, is potentially contrastive.

5.2. Selayarese (Basri 1999, Broselow 1999)

Max(C,V) >> MatchStress
TrochFeet, Align-R, Max(C,V) >> MatchStress

(35) Selayarese native stress

- main stress on penultimate syllable (TrochFeet, Align-R)
  sam[púlo] 'ten'
  [bálaŋ] 'creek'
  kali[hára] 'ant'
- antepenultimate stress for forms with final epenthetic vowel:
  [sáha] la /sahal/ 'profit'
  (sa[hála] /sahala/ 'sea cucumber')
  (epenthesis only after stem-final /r,l,s/)
- clitics outside stress domain
  [géle] -ma - kaŋ 'we are no longer...'

(36) Selayarese loan stress: invariably follows native language system:

Bahasa Indonesia	Selayarese	
gəmúk	gómmoʔ	'fat'
sədəkáh	sidákka	'alms'
kəlás	kálasa	'class'
bərás	bérasa	'rice'
bələbás	balábasa	'ruler'

(37) Selayarese stress is

- not a reliable indicator of word edges (epenthesis, clitics may place syllables after stress foot)
- not a signal of lexical contrast, except in very restricted set of cases, e.g. *sáhala* (epenthetic) vs. *sahála* (non-epenthetic) form. For stress to be necessary in signalling contrast, non-epenthetic form must (i) be vowel-final; (ii) have identical final and penultimate vowels; (iii) have [r], [l], or [s] as final syllable onset, as these are the only consonants that trigger epenthesis.

Therefore Selayarese speakers attend to segments more carefully than to stress.

5.3. Fijian (Kenstowicz 2003)

Faith to Source Stress >> Faith to Vowel Length
TrochaicFeet, Align-R, MatchStress >> DepMora
(MatchStress = K's MaxStress)

(38) Fijian Native Vocabulary (Kenstowicz 2003, Hayes 1995)

- main stress right (Align-R)
- alternating stress from right, long vowels always stressed (TrochaicFeet)
- ma[káwa] 'old'
  [màca][wá:] 'worthless'
  [mà:][cáwa] 'week'
  [kàmba][tá-ka] 'climb with it' (Hayes 1995, p. 144)
- vowel may be shortened (but never lengthened) to allow formation of bimoraic trochee at right edge:
  [síβi] 'exceed' [sì:][βí-ta] 'exceed, trans.' (Hayes 1995, p.145)
  /si:βi/
  (*[si:][βí:], though this is an acceptable word structure, cf. [nrè:][nré:] 'difficult', Hayes 1995, p. 142)
- stress is predictable, given length

(39) Loans into Fijian from English

a. English Penult Stress:
pa[jáma] 'pajama'
ta[váko] 'tobacco'
[ò:][méka] 'omega'
[tò:][píto] 'torpedo'

b. English Final Stress (lengthening to support trochaic foot at right edge):
ba[zá:] 'bazaar'
qi[tá:] 'guitar'

c. English Antepenultimate Stress:
[kò:][lóni] 'colony'
[tà:][féta] 'taffeta'
[kàli][kó:] 'calico'
[pòli][ó:] 'polio'

(40) Loan Stress Generalizations:

a. English main stress vowel always receives stress (if not in a prominent position, by being lengthened).
b. English long vowel before main stress is always analyzed as long ([ò:][méka], [tò:][píto]).
c. English final long vowel is sometimes analyzed as long ([kàli][kó:] vs. [tò:][píto]).

(41) Kenstowicz 2003 Analysis

DepMora: don't add a mora
PP-2: a short unstressed V may not be realized as a long stressed V

/colony/	Troch Stress, Align-R	Match Stress	Dep Mora	PP-2
☞a.[kò:][lóni]			*	
b. [kòlo][ní:]			*	*! (i → í:)
c. ko [lóni]		*!		
/calico:/				
a.[kà:][líko]			*!	
☞b.[kàli][kó:]				

NB: we must assume that Fijians analyze final V of 'calico' as underlyingly long (otherwise (b) would be ruled out by PP-2.

(42) Alternative (Processing-based) Analysis

a. Fijian speakers listen for long vowels, because length is lexically contrastive in Fijian: [màca][wá:] 'worthless' vs. [mà:][cáwa] 'week'.
b. English stress is heard as prominence. In Fijian, a vowel may be metrically prominent by virtue of
   i. occupying a prominent position (head of bisyllabic foot), *or*
   ii. being long

Therefore, according to Fijian perception grammar, a stressed vowel in a non-prominent position must be long.

(43) Fijian Perceptual Mapping Constraints:

a. FinalVLong: If final > (significantly more prominent than) preceding V, then ⇒long (i.e., map V to category V:)

b. VVLong: If adjacent vowels are prominent, then first V ⇒ long

c. EarlyVLong: If antepenult V > all following Vs, then ⇒ long

d. *LongV: Assume V ⇒ short V.

(44) Inputs = English 'calico', 'colony', 'tobacco', 'omega'

	FinalV Long	VVLong	EarlyV Long	*LongV
a. /kaliko/	*! (o>i)		(a ≈o)	
b. /ka:liko/	*! (o>i)			*
☞c. /kaliko:/			(a ≈o)	*
d. /ka:liko:/				*!*
a. /koloni/			*! (o > o,i)	
☞ b./ko:loni/				*
c. /koloni:/	*! (i≈o)		* (o > o,i)	*
d. /ko:loni:/	*! (i≈o)			**
☞ a. /tavako/				
b. /ta:vako/				*!
c. /tavako:/	*! (o ≤a)			*
d. /ta:vako:/	*! (o ≤ a)			**
a. /omeka/		*! (o,e >a)		
☞ b. /o:meka/				*
c. /omeka:/	*! (a < e)			*
d. /o:meka:/	*! (a < e)			**

(45) Comparison

a. Why does English main stress Valways receive some stress?

- Speaker-oriented account: MatchStress >> DepMora
- Listener-oriented account: stressed V in non-prominent position is heard as long

b. Why is English pretonic long Valways heard as long?

- Speaker-oriented account: not predicted
- Listener-oriented account: stress clash signals length

c. Why is English final long Vonly sometimes heard as long?

- Speaker-oriented account: not predicted
- Listener-oriented account: perception of length in final syllable depends on length/prominence relative to preceding vowel

(46) Inherent V Duration in FL Perception:

Peng and Ann 2001: in Singapore English, Nigerian English, and English of Spanish speakers, "If a multisyllabic word develops a primary stress placement distinct from L1, primary stress in L2 falls on the syllable whose vowel lasts the longest." (page 14), e.g. illusTRAtor, frusTRAted, exerCISE, CHInese, autoBiography.

average English V durations (Crystal and House 1988):

ɔɪ > au > ai > o > ɔ > a > ei > æ > er > u > i > ...

298 202 160 155 146 134 133 131 116 114 107...

5.4. Stress Summary

- Huave (demarcative stress): material after stress is ignored
- Selayarese (stress not reliably demarcative, and not lexically contrastive): no processing constraints force maintenance of source stress
- Fijian (V length lexically contrastive, stress depends on length): prominent V in non-prominent position is analyzed as long

6. Summary:

General Claim: All NL rankings are motivated by data. Apparent 'hidden rankings' revealed in language contact are an effect of

a. frequency effects in input data

b. NL perception/parsing grammar, which may identify only certain contrasts as linguistically significant.

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