Biconditional Prominence Correlation*

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April 30, 2009

1 Introduction

1.1 Strong-Position Neutralization

- Imagine a language where a contrast for vowel length is maintained in unstressed syllables, but is neutralized to long vowels in stressed syllables
- The alien language in (1) is consistent with this: stressed short vowels do not occur[1]

(1)

ˈbaː.baː	'hub-cap'
ˈbaː.ba	'true love'
*ˈba.baː	
*ˈba.ba	

- Interestingly, (1) is not representative of any real language
- I will refer to such patterns as *Strong-Position Neutralization* (SPN).

(2) *Strong-Position Neutralization*
Any pattern in which a contrast is neutralized in metrically strong positions, but is maintained in corresponding weak positions

- Existing theories proposing augmentation constraints, which demand some salient property in strong positions, predict SPN
- That prediction seems not to be borne out. Augmentation is never neutralizing

*Thanks to Junko Ito, Armin Mester, Jaye Padgett, and audiences at the 2007 Mid-America Linguistics Conference at the University of Kansas, the 2008 meeting of the LSA in Chicago, the 2008 meeting of GLOW in Newcastle-upon-Tyne, and a March 2009 job talk at the University of Leipzig.

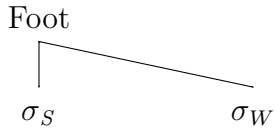
[1]The glosses are by permission of Jaye Padgett, who often assigns these two glosses to fake minimal pairs in class lectures.

- Given the constraints in (3),

  (3) a. DEP-$\mu/\acute{\sigma}$: Don't add moras in stressed syllables (Beckman 1999).
  b. MAX-μ: Don't delete moras (McCarthy and Prince 1995).
  c. *STRESSED/V: A short vowel should not be stressed (Crosswhite 2001).
  d. *UNSTRESSED/VV: A long vowel should be stressed (Crosswhite 2001).

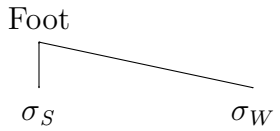
  factorial typology (Prince and Smolensky 1993/2004) yields:

  (4) a. Full Contrast (FC):
  DEP-$\mu/\acute{\sigma}$ $\gg$ *STR/V; MAX-μ $\gg$ *UNSTR/VV

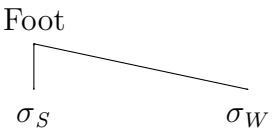
  X vs. x X vs. x

  b. Weak-Position Neutralization (WPN):
  DEP-$\mu/\acute{\sigma}$ $\gg$ *STR/V; *UNSTR/VV $\gg$ MAX-μ

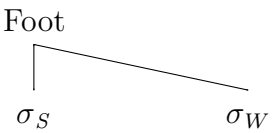
  X vs. x x only

  c. Full Neutralization (FN):
  *STR/V $\gg$ DEP-$\mu/\acute{\sigma}$; *UNSTR/VV $\gg$ MAX-μ

  X only x only

  d. **Strong-Position Neutralization (SPN)**:
  *STR/V $\gg$ DEP-$\mu/\acute{\sigma}$; MAX-μ $\gg$ *UNSTR/VV

  X only X vs. x

(5) a. FC: Classical Arabic (Brame 1970)

	$\acute{\sigma}$	$\breve{\sigma}$
Long V	ˈm**aː**lik 'owner'	mam**aː**ˈliːk 'slaves/Mamelukes'
Short V	ˈm**a**lik 'king'	t**a**ˈmalluk 'taking possession'

b. WPN: Cairene Arabic (Broselow 1976)

	$\acute{\sigma}$	$\breve{\sigma}$
Long V	ˈm**aː**lik 'owner'	–
Short V	ˈm**a**lik 'king'	mam**a**ˈliːk 'slaves/Mamelukes'

c. FN: Icelandic (Anderson 1969; Árnason 1980)

	$\acute{\sigma}$	$\breve{\sigma}$
Long V	ˈmj**uː**kur 'soft'	–
Short V	–	ˈpønt**u**ˌnar 'order (gen.)'

(6) Unpredicted gap: SPN

/babaː/	*Str/V	Dep-$\mu/\acute{\sigma}$	Max-μ	*Unstr/VV
☞ SPN .ˈbaː.baː.		*		*
FN .ˈbaː.ba.		*	*!	
FC .ˈba.baː.	*!			*
WPN .ˈba.ba.	*!		*!	

- Any theory in which augmentation constraints (like *Str/V) and reduction constraints (like *Unstr/VV) are independent makes this prediction (Kenstowicz 1994; Crosswhite 2001; de Lacy 2002; Smith 2005).
- Further, as long as faithfulness constraints like Dep-$\mu/\acute{\sigma}$ and Max-μ are freely rerankable w.r.t. each other, the prediction will remain.
- Principal goal: a theory that predicts SPN to be absent or exceedingly rare.

1.2 Informal solution

- SPN does not arise for the following general reasons:

1. No constraint demands augmentation only
2. Contrasts are at least as likely to be preserved in strong positions as in weak

- These reasons translate into the principal formal components of my theory.

1.3 Formal solution

1.3.1 Prominence Correlation component

- First, augmentation and reduction are not governed by independent constraints. If one is demanded, so is the other.
- As such, I conflate *Str/V and *Unstr/VV, as in (7).

(7) Prom(σ, ft) $\leftrightarrow$ Long: If and only if a syllable is prominent within a foot, it is longer than all other syllables in that foot.

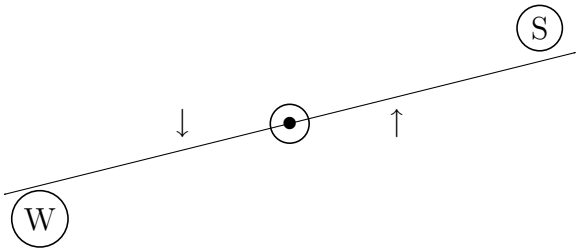
(8) Prom(σ, wd) $\leftrightarrow$ Long: If and only if a syllable is prominent within a word, it is longer than all other syllables in that word.

- These are Prominence Correlation (PC) constraints, which adhere to what I call the Prominence Correlation Metaconstraint

(9) Prominence Correlation Metaconstraint
Any constraint associating a metrically prominent position with a phonetic property takes the following general form: "If and only if a prosodic constituent X is prominent within a larger constituent Y, then X is salient in terms of suprasegmental property Z, relative to its co-constituents of the same prosodic level."

- I.e., no constraint that demands reduction alone, nor augmentation alone.

(10) Force acting on strong and weak acts equally on both



- Related to the notion that stress is relational, or syntagmatic: a strong element is only defined w.r.t. a weak element in some local domain (Liberman and Prince 1977).
- The PCM effectively requires the comparison of a strong and a weak element in a local domain, w.r.t. some phonetic property.

1.3.2 Faithfulness component

- Second component: all cue-based faithfulness constraints for a given feature outrank all general faithfulness constraints for the same feature
- No 'positional' faithfulness; i.e., nothing specific to an abstractly strong position.
- Reason: positional faithfulness constraints predict that even when there are no correlates of prominence, there should still be contrast asymmetries
- CATCH predicts that this will never happen. Correlates bolster contrasts; abstract positional strength does not.

(11) *Contrast-Asymmetry-Through-Correlates Hypothesis* (CATCH):
Asymmetries between strong and weak metrical positions with respect to a given contrast will not arise unless the strong position bears prominence correlates that bolster cues to that contrast.

(12) Which note is easiest to identify as middle C?

$\downarrow_x$	on-beat (strong)	10 dB	262 Hz	20 ms.
$\downarrow_y$	off-beat (weak)	60 dB	262 Hz	20 ms.

- Instead of PF, there are faithfulness constraints specific to particular contrast cues: greater duration, intensity, noise, etc... (see Steriade (1997, 2002))

(13) DEP-μ/INT: In relatively intense syllables, don't add moras.

- With cue-based faithfulness in a fixed ranking over general: DEP-μ/INT $\gg\gg$ MAX-μ

1.3.3 Desired prediction is made

- With both components in place – biconditional PC, and the fixed ranking of cue-based over general faithfulness – SPN is not predicted under factorial typology.
- The symbol [$_+$] indicates that intensity has been assigned to a syllable as a correlate of word-level prominence (via P(σ, W) $\leftrightarrow$ INT).

(14) SPN is blocked

	/babaː/	1 DEP-μ/INT	2 MAX-μ	3 P(σ, W) $\leftrightarrow$ LONG
SPN	.ˈba$_+$ːbaː.	*		*
2 $\gg$ 3 $\gg$ 1	(blocked)			
FN	.ˈba$_+$ː.ba.	*	*	
3 $\gg$ 1 $\gg$ 2				
WPN	.ˈba$_+$.ba.		*	*
1 $\gg$ 3 $\gg$ 2				
FC	.ˈba$_+$.baː.			**
1 $\gg$ 2 $\gg$ 3				

- The three remaining patterns are all predicted ☺

2 Typology of contrast by position

2.1 Survey of duration contrasts

- Within a modest sample of languages for C and V length, various combinations of FC, FN and WPN are attested; SPN is not

(15) Contrast patterns for C and V length

Language	C length	V length
Classical Arabic (Brame 1970) Epena Pedee (Harms 1994) Fulani (Taylor 1953) Hungarian (Kenesei et al. 1998) Latin (Mester 1994) Malayalam (Asher and Kumari 1997) Tamil (Schiffman 1999) Telugu (Krishnamurti and Gwynn 1985)	FC	FC
Anguthimri (Crowley 1981) Cairene Arabic (Broselow 1976) Vogul (Kálmán 1965) Welsh (Williams 1989) Italian (Nespor and Vogel 1986)	FC	WPN
Tunisian Arabic (Angoujard 1990)	FC	FN
Chickasaw (Munro 2005) K'ekchi' (Berinstein 1979) Mongolian (Walker 1995) Slave (Rice 1989)	–	FC
Icelandic (Árnason 1980)	WPN	FN
Aguacatec (McArthur and McArthur 1956) Cahuilla (Seiler 1977) Cebuano (Wolff 1966) German (Giegerich 1985) Hopi (Jeanne 1978, 1982) Mam (England 1983) St. Lawrence Is. Yupik (Krauss 1975) Zabiče Slovene (see above)	–	WPN
Dehu (Tryon 1967b) Hixkaryana (Derbyshire 1985) Nengone (Tryon 1967a) Kaqchikel (Berinstein 1979) Mohawk (Michelson 1988)	–	FN
Norton Sound Unaliq (Jacobson 1985)	FN	FN

- The seven patterns which are predicted to be absent, all of which involve SPN of some sort, are indeed absent from the sample.

- A few predicted patterns are also absent, and this may or may not be in need of explanation.

(16) Unattested types

	C length	V length
Predicted	WPN	WPN
	WPN	FC
	FN	WPN
	FN	FC
Not predicted	FC	SPN
	SPN	FC
	SPN	SPN
	SPN	WPN
	WPN	SPN
	FN/–	SPN
	SPN	FN/–

- The sample could obviously be expanded, and could include contrasts for properties other than duration.

- Still, it is striking that not one example of SPN turned up in the sample.

2.2 Analyses of attested patterns

2.2.1 Full Contrast

- FC arises under the schema F_{strong}, $F_{weak} \gg$ PC.

- Classical Arabic: contrast for V length, both stressed and unstressed (Brame 1970; McCarthy 1979).

(17) Vowel length contrast

	$\acute{\sigma}$	$\breve{\sigma}$
Long V	ˈmaːhir 'clever (m.s.)'	ˈhumaː 'they (du.)'
Short V	ˈhumaː 'they (du.)'	ˈmaʔhu 'with him'

(18) Full Contrast for vowel length

/humaː/	Dep-μ -V/Int	Max-μ -V	P(σ, w) ↔ Long	*LongV
☞ A .ˈhu̟.maː.			**	*
B .ˈhu̟.ma.		*!	*	
C .ˈhu̟ː.maː.	*!		*	**
D .ˈhu̟ː.ma.	*!	*		*

- Faithfulness to vocalic moras, both intensity-based and general, outranks PC and other markedness constraints

2.2.2 Weak-Position Neutralization

- WPN arises under the schema $F_{strong} \gg PC \gg F_{weak}$.
- In Cairene Arabic, contrast between long and short V remains only in stressed syllables

(19)

Classical	Cairene	Gloss
mamaːˈliːk	mamaˈliːk	'slaves'
maχṭuːˈṭaːt	maχṭuˈṭaːt	'documents'
ħaːˈnuːt	ħaˈnuːt	'shop'

- Underlying long vowels are shortened in $\breve{\sigma}$, neutralizing vowel length contrasts
- Reduction of unstressed vowels: Dep-μ-V/Int $\gg$ P(σ, w) ↔ Long $\gg$ Max-μ-V

(20) Reduction of unstressed vowels

/kaːtíba/	Dep-μ-V/Int	P(σ, w) ↔ Long	Max-μ-V
☞ A .ka.ˈti̟.ba.		*	*
B .kaː.ˈti̟.ba.		**	
C .ka.ˈti̟ː.ba.	*!		*
D .kaː.ˈti̟ː.ba.	*!	*	

2.2.3 Full Neutralization

- FN arises under the schema PC $\gg$ F_{strong}, F_{weak}.
- Icelandic obeys "The Stressed Syllable Law" (Murray and Vennemann 1983:526), later Stress-to-Weight Principle (Prince 1990; Riad 1992). Stressed syllables always heavy.
- Vowels are lengthened in stressed open syllables

(21) Vowel lengthening in stressed syllables

/skolaboka/ 'school books'	P(σ, F) $\leftrightarrow$ Long	Dep-μ-C /Int	Dep-μ-V /Int
☞ A .(ˈsko̞ː.la).(ˌbo̞ː.ka).			**
B .(ˈsko̞l.la).(ˌbo̞k.ka).		*!*	
C .(ˈsko̞.la).(ˌbo̞.ka).	*!		

- Furthermore, long vowels can *only* occur in stressed syllables (Árnason 1980:14-15). In unstressed syllables, they must shorten

(22)

ˈtaska	*ˈtaskaː	'briefcase'
ˈakvaˌrella	*ˈakvaːˌrella	'aquarelle'
ˈalmaˌnak	*ˈalmaːˌnak	'almanac'

- Hence, P(σ, F) $\leftrightarrow$ Long must outrank Max-μ

(23) Vowel shortening in unstressed syllables

/akvaːrella/	P(σ, F) $\leftrightarrow$ Long	Max-μ
☞ A .(ˈak.va).(ˌrel.la).		*
B .(ˈak.vaː).(ˌrel.la).	*!	

2.3 SPN is unattested

- SPN could arise under the schema $F_{weak} \gg PC \gg F_{strong}$

(24) Strong-Position Neutralization in a toy language

/qaːqa/	Max-μ	P(σ, W) $\leftrightarrow$ Long	Dep-μ/Int
☞ SPN .qaː.ˈqa̰ː.		*	*
FC .qaː.ˈqa̰.		**!	
FN .qa.ˈqa̰ː.	*!		*
WPN .qa.ˈqa̰.	*!	*	

- While Smith (2005) claims to have identified a few instances of this sort of pattern, these are better reanalyzed

2.3.1 Zabiče Slovene

- Distinction between high and mid short vowels is neutralized in stressed syllables, but retained in unstressed syllables (Rigler (1963:185-186); Crosswhite (2001:47-48); Smith (2005:109-112)). /i/ and /ɨ/ become [e] under stress, and /u/ becomes [o].

(25) The Vowels of Zabiče Slovene (Rigler 1963; Crosswhite 2001)

Bimoraic Accented			Monomoraic Accented			Unaccented		
iː	ɨː	uː				i	ɨ	u
ie		uo						
eː		oː	e	ə	o	e	ə	o
ɛː		ɑː		a			a	

- Crosswhite's (2001) analysis requires *Str/X; necessarily distinct from *Unstr/X, since conflating the two families would predict height neutralization both in stressed and unstressed syllables (i.e., /í/ → [é] *and* /ĕ/ → [ĭ]).

(26) SPN in Zabiče Slovene?

	/í/$_1$ /é/$_3$	/ĭ/$_2$ /ĕ/$_4$	*Str/i,u	Ident[hi]	*Str/e,o
☞ A		ĭ$_2$			
	é$_{1,3}$	ĕ$_4$		*	**
B		ĭ$_{2,4}$		*	
	é$_{1,3}$			*!	**
C	í$_1$	ĭ$_2$	*!		
	é$_3$	ĕ$_4$			*

- I believe Crosswhite is wrong to set aside the long vowel inventory.
- Assumes that the motivation for the lowering of high vowels is to improve the syntagmatic salience of stressed syllables. Instead, motivation might be the desire to avoid overcrowding the vowel space.
- Consider again the Zabiče Slovene vowel inventory without the divide between bimoraic and monomoraic accented vowels.

(27) The Vowels of Zabiče Slovene, take 2

Accented					Unaccented		
iː		ɨː		uː	i	ɨ	u
ie	(*i)	(*ɨ)	(*u)	uo			
eː	e	ə	o	oː	e	ə	o
ɛː		a		ɑː		a	

- Even without the short high vowels, the accented vowel space is considerably more crowded than the unaccented vowel space.

- SPACE constraints (Padgett 1997, 2003) punish overcrowding of contrastive elements in perceptual space.

  (28) SPACE(μ) $\geq$ 1/n: Segments contrasting in vowel duration should occupy at least 1/nth of the available perceptual space.

- Force behind Zabiče Slovene neutralization could be SPACE(μ) $\geq$ 1, which would abolish all vowel duration contrasts if given free rein.

- Contrast between high long and high short vowels shifts to one between high long and mid short; remaining contrasts are more distinct. The contrast between [iː] and [i], based only on a vowel duration contrast, is shifted to one between [iː] and [e], at the cost of the [i] vs. [e] contrast[2].

  (29) SPACE drives the neutralization

	$\acute{\sigma}$	/iː/$_1$ /eː/$_3$	/i/$_2$ /e/$_4$	SPACE (μ) $\geq$ 1	MAX [hi]
☞	A	iː$_1$ eː$_3$	e$_{2,4}$	*	*
	B	iː$_1$ eː$_3$	i$_2$ e$_4$	* *!	

- Same neutralization does not obtain for long vowels: DEP[hi] $\gg$ SPACE(μ) $\geq$ 1

- Proximity of [eː] and [e] is tolerated in order to satisfy faithfulness

  (30) DEP[hi] $\gg$ SPACE(μ) $\geq$ 1

	$\acute{\sigma}$	/iː/$_1$ /eː/$_3$	/i/$_2$ /e/$_4$	DEP [hi]	SPACE (μ) $\geq$ 1	MAX [hi]
☞	A	iː$_1$ eː$_3$	e$_{2,4}$		*	*
	B	iː$_1$ eː$_3$	i$_{2,4}$	*!	*	
	C		i$_{2,4}$			*
		eː$_{1,3}$		*!		
	D	iː$_{1,3}$		*!		
			e$_{2,4}$			*

[2]The fact that the [eː] vs. [e] contrast is maintained may be due to the greater duration of lower vowels, and hence the greater available perceptual space.

- If I am right, then the neutralization exhibited by Zabiče Slovene will never be found in a language which is in all other ways equivalent but which lacks the bimoraic accented vowel inventory; that is, Alternate Zabiče, illustrated in (31), is not possible.

(31) Alternate Zabiče: Impossible vowel inventory

Accented			Unaccented		
			i	ɨ	u
e	ə	o	e	ə	o
	a			a	

- Crosswhite's analysis predicts Alternate Zabiče to be possible, since it makes no reference to the bimoraic vowel sub-inventory

2.3.2 Niuafo'ou

- Niuafo'ou exhibits a ban on glides in stressed syllable onsets (Tsukamoto 1988). Repair: resyllabify glide as a vowel (32b).

(32) a. [ju.ˈni.t̬i̥] *unit*
[wa.ˈe.a] *wire*
[wa.ˈi.ne] *wine*

b. [i.ˈa.te] *yard* *[ˈja.te]
[u.ˈa.fu̥] *wharf* *[ˈwa.fu̥]
[u.ˈi.pi̥] *whip* *[ˈwi.pi̥]
[ku.ˈa.ta] *quarter* *[ˈkwa.ta]

- de Lacy (2001); Smith (2005): use constraints ranking stressed syllable onsets by sonority

(33) No glide onsets in stressed syllables (Smith 2005:128)

	/jate/	[*Ons/Gl]/σ́	Onset/σ́	Onset	Faith(μ)
A	.ˈja.te.	*!			
☞ B	.i.ˈa.te.		*	**	*

- While glides might make relatively bad onsets, it hardly seems like an augmentation of prominence to strip the syllable of its onset altogether

- What we might expect: fortition to a segment lower in sonority. Some dialects of Spanish: word-initial /j/ becomes voiced palatal obstruent [ʝ] (Hualde 2004).

- Zero-onset is worst kind of onset, in a stressed syllable or otherwise. [*Onset/Ø]/σ́ (equivalent to Onset/σ́) should be in a fixed ranking above [*Onset/Glide]/σ́

- Reinterpretation of the evidence: change from /ja/ to [ia] is a diphthongization. Single syllable with a rising nucleus (i.e., [.i̯a.]), hence a heavier stressed syllable
- Comparable to Harris's (1982) analysis of the same sorts of rising diphthongs, which behave as though heavy for stress purposes.

(34) Diphthongization, not resyllabification

	/játe/	P(σ, w) $\leftrightarrow$ Long	Ident[syll]	Onset
☞ A	.ˈi̯a.te.		*	*
B	.ˈja.te.	*!		
C	.i.ˈa.te.	*!	*	**

- Glides not punished for being bad onsets, but for not contributing weight to stressed syllables.
- Violates Onset, but gains a better stressed rime: trade-off rather than a trade-down
- Not SPN, but FN: [.ja.] and [.i̯a.] never contrast in any position: former can only be unstressed, latter can only be stressed; in complementary distribution.

3 Contrast asymmetries are emergent

3.1 Emergentism

- Probabilistic explanation: SPN is not impossible, but unlikely, because the phonetic changes that would give rise to it are rare.
- Such is the approach to typology pursued in OT by Myers (2002) and Barnes (2006); outside OT, by Ohala (1992), McMahon (2000), Blevins (2004).
- If this view is right, then part of the explanation for the lack of SPN might not be cognitive/analytic (as the PCM is), but based on channel bias (Moreton 2008)
- We can test for this

3.2 Artificial Grammar Learning experiment

3.2.1 Method

- Regarding the question of whether there is an analytic/cognitive bias against SPN, I wanted to test whether learning SPN is more difficult than learning WPN
- Employed the AGL paradigm (Reber 1967), also recently used in phonology (Wilson 2007; Moreton 2008)
- Greater than chance ability to recognize some patterns after very little exposure

- Subjects in my experiment were exposed to one of four patterns

(35) Four patterns of positional contrast

a. Weak-Position Lowering (WPL)
High vowels lower, neutralize with mid in $\breve{\sigma}$
Unnatural: lowering is fortition, expected in $\acute{\sigma}$

b. Weak-Position Raising (WPR)
Mid vowels raise, neutralize with high in $\breve{\sigma}$
Natural, well-attested

c. Strong-Position Lowering (SPL)
High vowels lower, neutralize with mid in $\acute{\sigma}$
Natural, but not attested

d. Strong-Position Raising (SPR)
Mid vowels raise, neutralize with high in $\acute{\sigma}$
Unnatural: raising is lenition, expected in $\breve{\sigma}$

(36) Only widely attested pattern: WPR

	Natural Process	Unnatural Process
WPN (accords with bias?)	WPR	WPL
SPN (counter to bias?)	SPL	SPR

- SPR and WPL are control conditions: ascertain whether vowel raising or lowering is a source of difficulty in learning a pattern

- Exposure phase: hear 56 tokens conforming to the pattern, repeat aloud

- Testing phase: given 16 pairs of words; only one word from each pair conforms to the pattern; subject is asked to say which word seems like it belongs in the toy language

- **Bolded**: Testing phase only. *Italicized*: Both in exposure and testing.

(37) SPL tokens

Frount Unrounded		Back Rounded	
Initial Stress	Final Stress	Initial Stress	Final Stress
képe	**kepé**	kópe	*kepó*
kéte	keté	kóte	**ketó**
péte	peté	póte	petó
téke	teké	tóke	tekó
képi	kipé	kópi	kipó
péti	**pité**	póti	pitó
téki	tiké	tóki	tikó
tépi	*tipé*	tópi	tipó
képo	kopé	*kópo*	kopó
péko	poké	**póko**	pokó
péto	poté	póto	potó
téko	*toké*	tóko	tokó
képu	kupé	*kópu*	kupó
pétu	puté	kótu	*kutó*
kétu	kuté	pótu	putó
téku	tuké	**tóku**	**tukó**

- There were 32 subjects (8 per condition), all culled from beginning level linguistics courses

3.2.2 Results

- Raw results by subject

(38) Correct responses out of 32, by condition

Condition:	WPL	SPL	WPR	SPR
	23	14	23	23
	25	20	22	22
	16	23	16	24
	19	29	19	29
	20	15	18	27
	17	18	22	17
	20	19	16	17
	25	17	28	25
Mean:	20.63	19.38	20.56	23
Standard deviation:	3.42	4.81	4.12	4.31

- Statistical analysis (using R stats package)

(39)

Condition	t	df	p-value	95% conf. interval	mean	sd
WPL	3.83	7	0.003	18.33 – 32	20.63	3.42
SPL	1.99	7	0.044	16.15 – 32	19.38	4.81
WPR	3.13	7	0.008	17.80 – 32	20.56	4.12
SPR	4.59	7	0.001	20.11 – 32	23	4.31

- Each of the four patterns were learned: observed means significantly higher than expected (16), with p-values all below 0.05, and three below 0.01.
- But were there significant differences in learnability?: Welch two-sample t-test determines whether two samples are demonstrably from different populations

(40)

Conditions	t	df	p-value	95% conf. interval
WPL-WPR	0.03	13.54	0.97	-4.01 – 4.13
WPR-SPL	0.53	13.68	0.60	-3.62 – 6.00
SPL-WPL	0.60	12.64	0.56	-5.77 – 3.27
SPR-WPL	1.22	13.31	0.24	-1.82 – 6.57
SPR-WPR	1.16	13.97	0.27	-2.08 – 6.96
SPR-SPL	1.59	13.84	0.13	-1.28 – 8.53

- Finding: none of the conditions were significantly different. P-values for all six pairs are above 0.05. No pattern was any easier to learn than any other.
- Failed to disconfirm null hypothesis, i.e., that all patterns would be equally learnable.

3.2.3 Discussion

- If all patterns were equally learnable, then the lack of SPN cannot be attributable solely to analytic bias
- It must be possible to rank constraints consistent with SPN, hence the ranking of cue-based over general faithfulness is not fixed by UG
- Instead, it may be an emergent (semi-)fixed ranking (Kochetov 2002, 2003); that is, channel bias and listener-based naive miscommunication (Ohala 1981, 1992) may be most likely to result in ranking cue-based over general

4 Correlate suppression

- What's the advantage of differentiating PC constraints by prosodic level?
- Straightforward analysis of correlate suppression in languages like Creek and Cairene Arabic
- Creek (Haas 1977) shows evidence of feet without phonetic correlates
- Word-prominent syllable receives a high tone, foot-heads do not. PC-Wd $\gg$ PC-Ft

- Evidence for secondary feet: location of the word-prominent syllable can only be determined by counting from the left edge: quantity-sensitive iambs constructed from the left, word-prominence to rightmost foot (Hayes 1995)

(41) Creek: foot-prominence has no correlates (Haas 1977)

(ifá)	'dog'
(ifó)ci	'puppy'
(ami)(focí)	'my puppy'
(hicí)ta	'one to see one'
(ahi)(citá)	'one to look after, watch one'
(ima)(hicí)ta	'one to look after for (someone)'
(isi)(mahi)(citá)	'one to sight at one'
(iti)(wana)(yipí)ta	'to tie to one another'
(isi)(mahi)(citá)	'one to sight at one'
(al)(pató)ci	'baby alligator'
(hok)(takí)	'women'
(cá:)lo	'trout, bass'
(sók)ca	'sack, bag'
(pocós)wa	'axe'
(famí:)ca	'canteloupe, muskmelon; perfume'
(ak)(kóyc)ka	'appreciation'
(ak)(topá)	'bridge'
(wa:)(kocí)	'calf'

- High pitch associated only with word-prominent syllable: $\text{P}(\sigma,\ \text{W}) \leftrightarrow \text{H} \gg$ Dep-Tone, Max-Tone

(42) Word-prominent ↔ High pitch

/ahicíta/	$\text{P}(\sigma,\ \text{W}) \leftrightarrow \text{H}$	Dep-Tone	Max-Tone
☞ A .(a.ˌhi).(ci.ˈtá).		*	*
B .(a.ˌhi).(ci.ˈta).	*!		*
C .(a.ˌhi).(cí.ˈta).	*!*		

- Other foot-heads not assigned high pitch: $\text{P}(\sigma,\ \text{W}) \leftrightarrow \text{H} \gg \text{P}(\sigma,\ \text{F}) \leftrightarrow \text{H}$

(43) No foot-level prominence correlates

/ahicita /	$\text{P}(\sigma,\ \text{W}) \leftrightarrow \text{H}$	$\text{P}(\sigma,\ \text{F}) \leftrightarrow \text{H}$
☞ A .(a.ˌhi).(ci.ˈtá).		*
B .(a.ˌhí).(ci.ˈtá).	*!	

- The need to explain correlate suppression of this sort is an argument in favor of distinguishing PC constraints by level (such as foot and word, in this case)
- This is preferable to approaches involving gridmarks (Halle and Vergnaud 1987; Hyde 2002). The gridmark is a middle man that can be cut out (see Teeple (2009:ch. 4)).

5 Independent augmentation and reduction?

- What do we lose by conflating augmentation and reduction? NOTHING.
- Need to account for stress shift, reduction, and augmentation. PCM still allows for this; caveat: augmentation entails reduction.

(44) Stress shift: PC ≫ Stress placement

/CV:CV/	MAX-μ	DEP-μ/$\acute{\sigma}$	P(σ, W) ↔ LONG	STRESS-R
☞ A .ˈCV:.CV.				*
B .CV:.ˈCV.			*!*	
C .CV:.ˈCV:.		*!	*!	
D .CV.ˈCV	*!			

(45) Reduction: PC ≫ Faith$_{weak}$

/CV:CV/	STRESS-R	DEP-μ/$\acute{\sigma}$	P(σ, W) ↔ LONG	MAX-μ
A .ˈCV:.CV.	*!		**	
B .CV:.ˈCV.			**!	
C .CV:.ˈCV:.		*!	*	
☞ D .CV.ˈCV.			*	*

(46) Augmentation (and reduction): PC ≫ Faith$_{strong}$ ≫ Faith$_{weak}$

/CV:CV/	P(σ, W) ↔ LONG	DEP-μ/$\acute{\sigma}$	MAX-μ
☞ A .CV.ˈCV:.		*	*
B .CV:.ˈCV.	**!		
C .CV:.ˈCV:.	*!	*	
D .CV.ˈCV.	*!		*

- No reason to believe that augmentation and reduction should be kept independent
- Different effects attributable to particular constraints with which PCCs interact

6 Conclusion

- Strong-position neutralization is avoided in natural language. Apparent exceptions are subject to reanalysis.

- Formally, this requires two things: (1) conflation of augmentation and reduction constraints; and (2) fixing the ranking of cue-based faithfulness (as a block) over general faithfulness.

- An AGL experiment has shown that SPN is probably not eliminated by analytic bias, because it is just as learnable as attested patterns. This suggests that the fixed faithfulness ranking emerges from channel bias, not from UG or general cognition

- Additionally, there is good reason to distinguish PC constraints by level in the prosodic hierarchy, since this allows for straightforward modeling of so-called line conflation.

- Lastly, there is no reason to believe that augmentation and reduction need to be independent, since all of the same effects can be derived using biconditional prominence correlation constraints.

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