Where did the Derived Environment Condition Go?

1. The Morphologically Derived Environment Condition

(1) A MDEE is "a process that takes place only when its conditions are crucially met by virtue of material from two different morphemes" [McCarthy 2003]

2. Canonical examples

Canonical MDEE: stem-final consonant undergoes alternation triggered by following suffix-initial vowel; comparable CV sequence within the base does not undergo the alternation

(2) Finnish Assibilation: *ti* → *si* (e.g. Keyser & Kiparsky 1983; Kiparsky 1993).

a.	/halut-i/	→ halusi	'want-3P.SG.PRET'	
	/halut-a/	→ haluta	'want-INF'	
b.	/æiti/	→ æiti	'mother'	(*æisi)
c.	/tilat-i/	→ tilasi	'order-3P.SG.PRET'	(*silasi)
	/tilat-a/	→ tilata	'order-INF'	(*silata)

(3) Polish Palatalization: *k, x, g* → *č, š, ž* before *i, e* (Lubowicz 2002).

a.	'to step'	kro[k]-i-ć	→ kro[č]ić	
	'to frighten'	stra[x]-i-ć	→ stra[š]ić	
	'to weigh'	va[g]-i-ć	→ va[ž]ić	
b.	'kefir'	[k]ef'ir		*[č]ef'ir
	'jelly'	[k']iśel		*[č']iśel
	'agent'	a[g]ent		*a[ž]ent
c.	'chemist-DIM'	[x]em'i[k]-ek	→ [x]emi'[č]ek	*[š]emi'[č]ek

(4) Korean Palatalization: *t, t^h* → *c, c^h* before *i, y* (T. Cho 1998, Y. Cho 2009)

a.	mat-i	→	maci	'eldest-NML = eldest son'	
	put^h-i	→	puc^{h}i	'adhere-CAUS = to affix'	
	kyət^h-i	→	kyəc^{h}i	'side-NOM = side'	
	pat^h-ita	→	pac^{h}ita	'field-COP = to be the field'	
b.	mati				'joint'
	titi-ta				'to tread'
	nit^{h}i-namu				'zelkova tree'

(5) Turkish Velar Deletion (Lewis 1967, Zimmer & Abbott 1978, Sezer 1981)

a.	bebek	'baby'	bebe-e	'baby-DAT'
	inek	'cow'	ine-i	'cow-ACC'
	katalog	'catalog'	katalo.u	'catalog-3sg.poss'
	matematik	'mathematics'	matemati.in	'mathematics-GEN'
b.	avukat	'lawyer'		
	hareket	'motion'		
	sigorta	'insurance'		
c.	sokak	'street'	soka.a	'street-DAT'
	dakik	'precise'	daki.i	'precise-ACC'
	ʧøkek	'low spot, hollow'	ʧøke.in	'low spot, hollow-GEN'

There are other types of MDEE's but these are the canonical ones that every theory aspires to capture.

3. The basic intuition

An early generalization that has resisted direct theoretical modeling for over 40 years:

(6) The Alternation Condition: Obligatory neutralization rules cannot apply to all occurrences of a morpheme (Kiparsky 1973)

The problem with this insight is that if all the learner knew was this → the learner would be compelled to produce *silas-i*. AC cannot protect the *ti* of *tilat* once there is another environment in which the morpheme can occur.

halut-a	halus-i
tilat-a	

(7) The Revised Alternation Condition: Obligatory neutralization rules apply only in derived environments (Kiparsky 1982b:148, 152)

(8) Questions addressed here:

Is the RAC true?	As an implicational generalization
Can the RAC be modeled within Optimality Theory?	Yes, with new notion of **'confidence strength scales'**
Why is the RAC true (to the extent that it is true)	Because of the way speakers learn

4. Proposal: Confidence-based strength scales

Basic intuition behind MDEEs: segments occurring in variable contexts have a higher propensity to alternate than segments occurring in invariant contexts

Proposal: capture this intuition directly by specifying degrees of confidence in the representations of individual phonological structures (here, segments and syllables).

(9) Confidence scale: 0 1
Weak *Strong*

5. Factors contributing to confidence in a segment's representation

Weaker…	**…Stronger**
Alternates	Invariant
Variable context	Invariant context
(weak phonetic perceptual cues)	(strong phonetic perceptual cues)
(morph is infrequent)	(morph is frequent)
(sparse lexical neighborhood)	(dense lexical neighborhood)

(10) Universal fixed ranking: FAITH_S » FAITH_W

MDEEs result from this ranking: FAITH_S » MARKEDNESS » FAITH_W

(11) Finnish Assibilation

/tilat-i/	FAITH_S	ASSIB	FAITH_W
☞ tilati		**!	
tilasi		*	*
silasi	*!		*

Turkish VD

/sokak-a/	MAX_S	*VGV	MAX_W
sokaka		**!	
☞ soka.a		*	*
so.a.a	*!		*

Korean Palatalization

/mati/	FAITH_S	PAL	FAITH_W
☞ mati		*	
maci	*!		
/mat-i/	FAITH_S	PAL	FAITH_W
☞ mati		*!	
maci			*

6. Broadening the phonological variety of MDEEs

(12) Finnish Vowel Coalescence: stem-final V is trigger, suffix-initial V is target (Anttila 2009; see also Kiparsky 1993). Optional across morpheme boundary; inapplicable within roots

	alternant without VC	alternant with VC	
a.	mini-ä	mini-i	'mini-PAR'
	lasi-a	lasi-i	'glass-PAR'
	hattu-a	hattu-u	'hat-PAR'
b.	miniä	*minii	'daughter-in-law'
	rasia	*rasii	'box'
	saippua	*saippuu	'soap'

Confidence-based account: root vowels are strong, suffix vowels are weak

/miniä/	FAITH$_S$	VC	FAITH$_W$
☞ miniä		*	
minii	*!		

/mini-ä/	FAITH$_S$	R-FUSION	FAITH$_W$
miniä		*!	
☞ minii			*

(13) Chumash Pre-Coronal Laminalization (Poser 1982, 1993; Kula 2008, based on Applegate 1972, based on Harrington notes): prefix-final C is target, stem-initial coronal is trigger.

a.	/s-niʔ/	[šnʔ]	'his neck'	[117]	(cf. *s-kawẏiy* 'he cuts
	/s-tepuʔ/	[štepuʔ]	'he gambles'	[117]	a notch in it' [115])
	/s-lokin/	[šlokin]	'he cuts it'	[117]	
	/s-is-tɨʔ/	[šištɨʔ]	'he finds it'	[118]	
	/ma-l-is-tɨk-Vn/	[malištɨk^{h}ɨn]	'the first one'	[206, 529]	
b.		[wastu]	'pleat'	[162]	
		[astɨmin]	'to buzz, hum'	[259]	

Confidence-based account: root (internal) consonants are strong, prefix (edge) consonants are weak

/wastuʔ /	IDENT$_S$	PCL	IDENT$_W$
☞ wastuʔ		*	
waštuʔ	*!		

/s-ti-yep-us/	IDENT$_S$	PCL	IDENT$_W$
stiyepus		*!	
☞ štiyepus			*

(14) Norwegian /r/ fusion ~ deletion: prefix-final /r/ is target, stem-initial consonant is target and trigger (Bradley 2002, based on Kristoffersen 2000; occurs in certain dialects only)

	Nonderived environments				Derived environments		
a.	*svart*	[svɑʈ]	'black'	d.	*vår-tegn*	[vo:ʈæjn]	'spring sign'
	barn	[bɑ:ɳ]	'child'		*for noen*	[fɔɳu:.un]	'for some'
	vers	[væʂ]	'verse'		*vår-sol*	[vo:ʂu:l]	'spring sun'
b.	*sve*[ɾd]		'sword'	e.	*vår-dag*	[vo:ɖɑ:g]	'spring day'
c.	*merke*	[mæɾ.kə]	'mark'	f.	*er-klære*	[æ(ɾ)klærə]	'to declare'
	larm	[lɑɾm]	'noise'		*vær-melding*	[væ:(ɾ)mɛlliŋ]	'weather forecast'
	skarp	[skɑɾp]	'sharp'		*for-banne*	[fɔ(ɾ)bɑnnə]	'to curse'

Confidence account: root (morpheme-internal) consonants are strong, prefix consonants are weak

/sve[ɾd]/	FAITH$_S$	R-FUSION	FAITH$_W$
☞ sve[ɾd]		*	
sve[ɖ]	*!		
/vå[ɾ-d]ag/	FAITH$_S$	R-FUSION	FAITH$_W$
☞ vå[ɾd]ag		*!	
vå[ɖ]ag			*

/me[ɾk]e/	FAITH$_S$	R-DEL	FAITH$_W$
☞ me[ɾk]e		*	
me[k]e	*!		
/fo[ɾ-k]lare/	FAITH$_S$	R-FUSION	FAITH$_W$
☞ fo[ɾk]are		*!	
fo[k]are			*

7. Some past formal approaches to MDEEs (apologies to those excluded for lack of time)

- All past approaches to MDEEs have captured various insights, all important.
- Confidence-based scales capitalize on these insights, but have broader coverage

7.1 Root faithfulness

(15) $\text{FAITH}_{\text{root}}$ » $\text{FAITH}_{\text{affix}}$ (Anttila 2009, for Finnish VC)

/miniä/	$\text{FAITH}_{\text{root}}$	VC	$\text{FAITH}_{\text{affix}}$
☞ miniä		*	
minii	*!		

/mini-ä/	$\text{FAITH}_{\text{root}}$	VC	$\text{FAITH}_{\text{affix}}$
miniä		*!	
☞ minii			*

7.2 Parasitic alternations: tying markedness to Align-R

(16) $[\text{MARKEDNESS} \ \& \ \text{R-ANCHOR}(\text{Stem}, \sigma)]_{\text{D}}$ » FAITH » MARKEDNESS (Lubowicz 2002)

/tilat-i/	ASSIB & R-ANCHOR	IDENT	ASSIB
tilati	*! (t-i)		**
☞ tilasi		*	*
silasi		**!	

☞ *Captures insight that segments in invariant positions (and in stem middles) are more protected than those in variable positions (and stem-final)*

7.3 Sequence faithfulness:

Itô & Mester (1996, 1998), Burzio (1997): Sequential faithfulness constraints protect stem middles

(17) Neighborhood (Itô & Mester 1996):
- The neighborhood of a segment must be preserved
- If α [immediately — SI] precedes/follows β, then the correspondent of α precedes/follows β

/sokak-a/ FAITH-VCV » *VGV » FAITH-VC, FAITH-C
/tilat-i/ FAITH-CV » ASSIB » FAITH-C

☞ *Captures insight that segments in stem middles are more protected than peripheral segments*

7.4 Underspecification

Kiparsky 1993: stem-final segments alternate because they are underspecified and undergo different default fill-in rules as their righthand context varies.

☞ *Captures insight that segments in invariant positions are more protected than those in variable positions. Doesn't extend readily to deletion*

7.5 Gestural timing

T. Cho 1998: "the timing between two gestures created by morpheme concatenation is not lexically specified and is therefore potentially subject to any phonological change which can be produced by varying gestural overlap" (p. 5)

(18) From Bradley 2002, on Norwegian:

(16) Obligatory merger versus optional deletion in heteromorphemic /ɾC/

	IDENT(timing)	OVERLAP	MAX(apical)
a. /Vɾ/ + /d/ → $\text{V}\text{ɾ}^{\text{ə}}\text{d}$		*!	
☞ b. /Vɾ/ + /d/ → Vd̠			
c. /Vɾ/ + /d/ → Vd			*!
☞ d. /Vɾ/ + /b/ → $\text{V}\text{ɾ}^{\text{ə}}\text{b}$		*	
☞ e. /Vɾ/ + /b/ → Vb			*

☞ *Captures insight that segments in invariant positions are more protected than those in variable positions. Doesn't extend readily to deletion*

7.6 Comparative Markedness

McCarthy (2003): 'New' (derived) structures and 'old' (inherited) structures are protected differently

- OO-$_N$P prohibits output P which is not present in the output of the unaffixed base of a derived word ('new' by virtue of morphology). (A similar approach is taken by Y.-m. Cho 2009).
- IO-$_O$P prohibits output P which *is* present in the fully faithful candidate (i.e. 'old' markedness).

(19) Korean illustration

	/mat/	OO-$_N$PAL	IDENT	IO-$_O$PAL
☞ (FFC)	mat			
	mac		*!	

	/mat-i/	OO-$_N$PAL	IDENT	IO-$_O$PAL
(FFC)	mati	*!		
☞	maci		*	

☞ Captures insight that segments in invariant morphological contexts are more protected than those in variable positions. Requires unaffixed base to be possible word; problematic in case of bound roots.

8. DEES in the context of morphologically conditioned phonology (MCP)

All MDEEs are cases of MCP. But not all cases of MCP are described as MDEEs. Why not?

(20) Turkish VV: Repaired at morpheme boundaries by glide epenthesis or by vowel deletion

	'understand'	'say'
	anla	söyle
Facilitative/-Iver/:	anl**a-y**ıver	söyl**e-y**iver
Progressive/-Iyor/:	anl-ıyor	söyl-üyor

(21) Yine Syncope (Kisseberth 1970, Pater 2009): some suffixes are triggers, some are undergoers

a.	Suffix triggers				
	/yimaka-lu/	→	yimaklu	'teaching'	
	/hata-nu/	→	hatnu	'light, shining'	
b.	Suffix nontriggers				
	/meyi-ta/	→	meyita	'to celebrate'	*meyta
	/heta-nu/	→	hetanu	'going to see'	*hetnu

(22) Hausa tone-integrating vs. non-tone-integrating suffixes (Newman 2000)

a.	Suffixation, no tone replacement				
	dáfà:	→	dáfà:-wá	'cook-ppl'	-LH
	gàjé:ré:	→	gàjé:r-ìyá:	'short-fem'	-LH
	hù:lá:	→	hù:lâ-ř	'hat-def'	-L
b.	Suffixation with tone replacement				
	má:làm	→	mà:làm-ái	'teacher-pl'	-LH
	rì:gá:	→	rí:g-únà:	'gown-pl'	-HL
	tàmbáyà:	→	támbáy-ó:yí:	'question-pl'	-H

Effects tend not to be described as MDEEs if they are specific to particular constructions.
But in fact most/all MDEEs have this property.

(23) Turkish velar deletion: fails to apply to verb roots (but applies to noun roots and all stems)

a	/gerek-Ijor/	gerekijor	'be necessary -PROGRESSIVE'	
	/bɯrak-r/	bɯrakɯr	'drop out-AORIST'	
	/birik-en/	biriken	'gather-REL'	
	/gerek-AdʒAk/	gerekedʒek	'be necessary-FUT'	
b.	/gel-AdʒAk-A/	geledʒe.e	'come-FUT-DAT'	(geledʒek)
	/anla-mAk-A/	anlamaa	'understand-INF-DAT'	(anlamak)
	/bademCIk-I/	bademdʒii	'almond-DIM-ACC = tonsil (ACC)'	(bademdʒik)

(24) Finnish Assibilation: triggered by some but not all suffixes (Kiparsky 2003, Anttila 2006)

a.	Suffix triggers:	Plural *-i*	/vuote-i-nA/	vuosina	'year-PL-ESS'
		Past *-i*	/huuta-i-vAt-kO/	huusivatko	'shout-PAST-3P.PL-QUE'
		Superlative *-impA*	/uute-impA-nA/	uusimpana	'new-SUP-ESS
b.	Suffix nontriggers:	*-iiv*		vokat-iivi-lla	'vocative'
		Instrumental *-ime*	/lentä-ime-n/	lentimen	'fly-instrument-GEN'
		Conditional *-isi*	/tunte-isi/	tuntisi	'feel-COND'

- Assumption underlying early statements of the Derived Environment Condition (Mascaro 1976, Kiparsky 1982): DEC applies across the board, is a true cross-linguistic generalization.
- We know now: it's only an implicational generalization. There are many exceptions.
- No language thus far has been demonstrated to really obey the DEC across the board

9. Cophonologies vs. confidence-based segment scales

- Cophonologies and confidence-based segment scales are both needed.
- Cophonologies: reranking of constraints for different morphological constructions (Orgun 1996; Inkelas 1998; Inkelas & Zoll 2009; Anttila 1997, 2002). Roughly equivalent to morphological constraint indexation. Accounts for whether or not a given alternation is applicable. Confidence scales say *where* it is applicable.

(25)

Turkish:	V deletion cophonology DEP-C » MAX-V	Glide insertion cophonology MAX-V » DEP-C	"MCP"
Yine	Syncope cophonology Align-suffix-C » Max-V	Nonsyncope cophonology Max-V » Align-suffix-C	"MCP
Finnish:	Assibilation cophonology IDENT_S » ASSIB » IDENT_W	Nonassibilation cophonology IDENT_S, IDENT_W » ASSIB	"MDEE"
Turkish:	Velar deletion cophonology MAX_S » *VGV » MAX_W	Non-velar deletion cophonology MAX_S, MAX_W » *VGV	"MDEE"

10. Summary so far

Essentially, MDEEs pose the question of why, when an alternation is multiply conditioned within a stem, it often applies only once, at the affixation site. Why?

(26)

Fake Turkish

NOM	DAT
bebek	bebe.e
sokak	*Why not so.a.a?*

Fake Finnish

INF	3SG.PRET
halut-a	halus-i
tilat-a	*Why not si.la.si?*

so.a.a and *ti.la.si* could be derived cophonologically, by ranking Markedness so high that even Faith-S is outranked:

(Tk) nominative cophonology:	MAX_S » MAX_W » *VGV	/sokak/ → [sokak]
(Tk) dative cophonology:	*VGV » MAX_S » MAX_W	/sokak-a/ → [so.a.a]
(Fi) infinitive cophonology:	IDENT_S » IDENT_W » ASSIB	/tilat-a/ → [tilata]
(Fi) 3sg.preterite cophonology:	ASSIB » IDENT_S » IDENT_W	/tilat-i/ → [silasi]

(27) Maybe the question isn't what the theory allows, but what the learner will posit when hearing

halut-a	halus-i
tilat-a	

Hypothesis A: one cophonology, IDENT_S » ASSIB » IDENT_W	Prediction: *tilasi*
Hypothesis B: two cophonologies *-a* cophonology: IDENT_S, IDENT_W » ASSIB *-i* cophonology: IDENT_S » ASSIB » IDENT_W	Prediction: *tilasi*
Hypothesis B: two cophonologies *-a* cophonology: IDENT_S, IDENT_W » ASSIB *-i* cophonology: IDENT_S, IDENT_W » ASSIB	Prediction: *silasi*

Proposal: learner are more likely to posit one cophonology than two. There is thus a bias in favor of Hypothesis A, which predicts *tilasi*.

11. Summary

- Confidence-based strength scale: FAITH_S » FAITH_W
- Cophonological variation in where markedness is ranked:

FAITH_S » MARKEDNESS » FAITH_W	Edges alternate, middles don't
FAITH_S » FAITH_W » MARKEDNESS	No alternations
MARKEDNESS » FAITH_S » FAITH_W	Alternations everywhere

Rankings are learned from available evidence, with a bias toward minimizing cophonological variation.

12. Independent evidence for confidence-based strength scales

- Young children show evidence for confidence-based strength scales in lexical representations
- Storkel (2002): words in high density neighborhoods have finer-grained representations than words in low density neighborhoods (ages 3;7-5;11)
- Munson, Edwards & Beckman 2004, Edwards, Munson & Beckman 2005: repetition accuracy, fluency are better for more frequent sequences and for children with larger vocabularies. MEB/EMB: larger vocabularies yield more robust generalizations (= confident representations?)

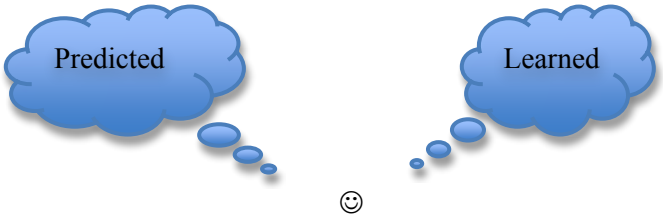
13. Other kinds of strength scales

- Positional faithfulness (e.g. Beckman 1997, Smith 2002): predict neutralization asymmetries
- Quality-based strength scales (Foley 1970, Lass 1971, Venneman 1972): prediction lenition, sonority-based distributional patterns
- Quality-based markedness and faithfulness scales (Gnanedesikan 1997, DeLacy 2002)
- Effort-based faithfulness scales (Kirchner 1998): predict lenition patterns
- Logical scales (Mortensen 2006): predict direction of tone sandhi, ordering (by vowel or tone quality) in coordinate compounds
- Morphological strength scales (Pycha 2008): predict whether junctural alternations will strengthen or weaken root or affix, phonologically
- Quality-based vowel strength scales: capture 'neutrality' of vowels which are transparent to harmony (Rhodes 2011)

Kirchner 1998: "It is, of course, conceivable that lenition involves some abstract scale of "strength," which bears no straightforward relation to any phonetic dimension, which is distinct from sonority, and which may even vary from language to language. Lenition then is characterizable in terms of an operation of promotion on this scale… However, this view of the "strength" scale does not appear to offer anything more than a bare restatement of the facts." p. 18

(28) /tilat/ 'order'

(29)



14. Conclusions and implications

- FAITH_S » FAITH_W: may obviate morpheme-based faithfulness (FAITH-root » FAITH-affix, e.g. McCarthy & Prince 1995, Anttila 2009). This is good in two ways: (a) sometimes roots cede to affixes, and (b) it is not always practical to assign output segments morphological allegiances
- Makes connections between exemplar and other network models of storage (where frequency conveys strength) and phonological theoretical models
- Useful for child phonology as well as for adult phonology
- Confidence-based strength is part of a system of morphologically conditioned phonology, co-existing with cophonological variation

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