2010

Perceptually grounded faithfulness in Harmonic Serialism

John J. McCarthy, *University of Massachusetts - Amherst*

Perceptually Grounded Faithfulness in Harmonic Serialism

John J. McCarthy

University of Massachusetts Amherst

1 Statement of the problem

Steriade 2001/2008 argues that faithfulness constraints in Optimality Theory are perceptually grounded: the faithfulness of a phonological mapping is directly proportional to the perceptual similarity between the input and output of that mapping. For example, when a phonological process like place assimilation, voice assimilation, or deletion affects a medial consonant cluster /VC_1C_2V/, it usually targets C_1 rather than C_2.[1] The idea is that changing C_1 is less obtrusive perceptually than changing C_2, because C_2's prevocalic position gives it stronger perceptual cues than C_1. Formally, this difference in strength of perceptual cues is reflected in the ranking of faithfulness constraints: processes affecting C_1 violate lower-ranking faithfulness constraints than processes affecting C_2.

A mapping has an input and an output, and faithfulness constraints require an input and an output to compare. In the standard parallel version of Optimality Theory, referred to here as P-OT, the input to every mapping is the underlying representation and the output is the surface representation (Prince and Smolensky 1993/2004).

When this property of P-OT is combined with perceptually grounded faithfulness, a problem arises (Blumenfeld 2006, Flemming 2006, 2008a, b, Gallagher 2006, Jun 2002, McCarthy 2008a, Wilson 2001): underlying representations lack information that is important for perception. For example, the release of a stop consonant contains important perceptual cues for its place of articulation. In most if not all languages, the distribution of release is determined by the grammar, not the lexicon: stops are released prevocalically, but they may be unreleased (depending on the language) preconsonantally. If important perceptual cues like release are not already determined in underlying representation, how can faithfulness be perceptually grounded?[2]

In Steriade's original proposal, this problem does not arise because the connection between perception and faithfulness is indirect. Faithfulness constraints are sensitive to the contexts in which perceptual cues are found, not to the perceptual cues themselves. For example, C_2's greater resistance to change is attributed to universally ranking IDENT(place)/__V, IDENT(voice)/__V, and MAX/__V above IDENT(place)/__C, IDENT(voice)/__C, and MAX/__C, respectively. A mechanism called the P-Map links the perceptual cues with the contexts and ranking of the faithfulness constraints.

This approach has a problem that was first recognized by Wilson 2001. The problem arises whenever a phonological process changes the conditions controlling the distribution of the relevant perceptual cues. Syncope is an example of such a process. When the medial vowel of /VC_1VC_2V/ deletes, it changes C_1 from prevocalic (strong cues) to preconsonantal (weak cues) position. The effect that syncope will have on constraints like IDENT(place)/__V depends on whether they check their contexts at underlying or surface representation. I will consider each of these options in turn. (See Jesney (to appear) for a similar analysis of positional faithfulness constraints.)

First, let us suppose that the constraints check their contexts at underlying representation. This predicts that clusters derived by syncope will behave differently than otherwise identical clusters that are already present in underlying representation. The two rankings that will produce regressive assimilation in underlying clusters are given in (1).

(1) *Rankings for regressive assimilation (indirect approach)*

a. IDENT(place)/__V >> AGREE(place) >> IDENT(place)/__C

b. LICENSE(place) >> AGREE(place)/__V >> IDENT(place)/__C,

Although both of these rankings will map /amta/ to [anta], neither will guarantee the mapping /amita/ → [anta] in a language with syncope. Under (1)a, there is an opaque, counter-feeding interaction of syncope and assimilation: no assimilation in /amita/ → [amta] because underlying prevocalic

/m/ is protected by top-ranking Ident(place)/__V. Under (1)b, there is a different kind of opacity: regressive and progressive assimilation are equally good in clusters derived by syncope (/amita/ → [anta] ~ [ampa]) because both /m/ and /t/ are protected equally by Ident(place)/__V. In sum, context-checking at underlying representation predicts that transparent interaction of syncope and assimilation will not occur.

This prediction is incorrect. Transparent interaction of assimilation and syncope is common cross-linguistically, as shown by (2). In these examples, the vowel that syncopates is underlined in the underlying representation, and the assimilated consonant is underlined in the surface representation.

(2) *Assimilation in clusters derived by syncope*

a. Afar (Bliese 1981)

/n-ene̲b-ˈe/	nem̲ˈbe	‘we grew’
/ˈma ugu̲t-inˈna/	ˈmuk̲tinˈna	‘he/she didn’t get up’

b. Carib[3] (Gildea 1995, Hoff 1968)

/kɨn-ekaːnumɨ̲-taŋ/	kɨneːkaːnun̲daŋ	‘he will run’
/aj-ekaːnumɨ̲-ko/	ajeːkaːnuŋ̲go	‘run!’

c. Keley-i (Hohulin and Kenstowicz 1979)

/h-in-e̲puŋ/	him̲puŋ	‘broke a stick’
/d-in-e̲geh-an/	diŋ̲gehan	‘was sick’

d. Telugu (Krishnamurti 1957, Wilkinson 1974)

/paːta̲ daːram/	paːd̲daːram	‘old thread’
/raːti̲ ʤæːɖiː/	raːʤ̲ʤæːɖiː	‘stone jar’

e. Sudanese Arabic (Hamid 1984:173-175)

/kutu̲b aħmad/	kud̲baħmad	‘Ahmad’s books’
/ʕallamu ni̲ʤaːra/	ʕallamu ñ̲ʤaːra	‘he taught him carpentry’

There may be cases where productive syncope and assimilation processes interact opaquely, but the prediction that syncope and assimilation will never interact transparently is clearly wrong.

Since context-checking at underlying representation does not work, I will now consider the other possibility: perceptually grounded faithfulness constraints check their contexts at surface representation. This move solves the problem with (2): the underlying difference between /amta/ and /amita/ is invisible to the surface-checking faithfulness constraints. It introduces another problem, however. The perceptually grounded faithfulness ranking MAX/__V >> MAX/__C accounts for the observation that medial clusters are usually simplified by deleting the first consonant, not the second: /apta/ → [ata], *[apa]. The problem is that MAX constraints cannot check their contexts at surface representation because the consonant they are supposed to protect is absent from surface representation. MAX constraints have to check their contexts at underlying representation, and this brings back the syncope problem: /apita/ → [ata] ~ [apa] because MAX/__V is equally protective of /p/ and /t/, both of which are prevocalic in underlying representation. Wilson 2001 cites several languages where clusters derived by syncope are simplified in exactly the same way as underlying clusters. Besides Tangale, which is exemplified in (3), the languages are Carib, Erromangan, and Tunica.[4]

(3) *Tangale (Kidda 1985)*

/ɗindí ɓasúm/	ɗinɓasúm	‘Basum’s pot’
/kɔldɔ mɛ́ɛ/	kɔlmɛ́ɛ	‘pen for goats’

Syncope presents similar problems for another approach to perceptual grounding of faithfulness constraints. This approach establishes a direct connection between perception and faithfulness, but it does so by shifting the focus of faithfulness constraints from the underlying representation to a derived representation called the Inferred or Realized Input (RI) (Flemming 2006, 2008a, b, Gallagher 2006, Jun 2002). The RI is a phonetically realized version of the underlying representation. This means that the RI is the optimal candidate that violates no faithfulness constraints (Jun 2002) or has no neutralizations (Flemming 2008b). Because the RI is a derived representation, it can have properties that are determined by the grammar and may differ from language to language. Release of plosives is an example. Preconsonantal plosives are released in some languages and unreleased in others: Zoque [pʿetʿkʿuy] 'broom' (Wonderly 1951:105) vs. Yakut [akʾkʿa] 'to a horse' from /at-ka/ (Krueger 1962).[5] Faithfulness constraints like IDENT(place)/release look at the RI rather than the underlying representation, so they see the release feature with its proper, grammar-determined distribution in the language in question. Thus, in Jun's analysis of Yakut, IDENT(place)/release favors [akʾkʿa] over *[atʾtʿa] because *t* is unreleased and *k* is released in the RI [atʾkʿa].

The RI approach has the same problem as the indirect approach when syncope interacts with assimilation or deletion. The RI does not show the effects of neutralizing phonological processes like syncope. The RI of /apita/ will therefore assign all of the perceptual characteristics of prevocalic consonants to both [p] and [t]. In the RI of /apta/, on the other hand, [p] will be assigned the perceptual characteristics of a preconsonantal consonant. The RI approach therefore predicts different assimilation or deletion behavior in [apta] from /apita/ and [apta] from /apta/. The discussion of the indirect approach with underlying context-checking has already shown that this prediction is wrong.

To sum up, perceptually grounded faithfulness constraints do not work as intended when processes like syncope (or epenthesis or metathesis — see section 3) alter the conditions relevant to perceptual grounding. The source of this failure, I claim, is not perceptually grounded faithfulness itself but rather the P-OT framework in which it is usually embedded. The problem is that P-OT conflates the effects of various phonological processes into a single mapping. I will return to this point in the conclusion.

2 Proposal

The problem described in the previous section can be eliminated by introducing an intermediate level of representation that shows the effects of syncope but is not identical to the surface form. Perceptually grounded faithfulness constraints would be faithful to this intermediate level of representation, rather than the underlying representation or RI. This intermediate level is where IDENT(place)/__V would check its context or IDENT(place)/release would look for a release specification.

The existence of an intermediate level of representation with the requisite properties is a consequence of adopting Harmonic Serialism (HS), a derivational version of OT. In HS, the OT candidate-generating component GEN is limited to making one change at a time. Since inputs and outputs may differ in many ways, the output of each pass through HS's GEN and candidate-evaluating component EVAL is submitted as the input to another pass through GEN and EVAL, until no further changes are possible. (For further information about HS and related developments, see McCarthy 2000, 2002, 2007a, b, c, 2008a, b, Elfner 2009, Jesney to appear, Kimper 2008, Pater to appear, Pruitt 2008, Wolf 2008, and Prince & Smolensky 1993/2004:94-95.)

In HS, faithfulness constraints compare candidates with the input to the current step of the derivation; they do not look back to the original underlying representation (except at the beginning of the derivation, of course).[6] Because the input to the current evaluation can be the output of previous applications of the grammar, some of its properties can be determined by the grammar, so they can differ from the underlying representation. Hence, perceptually grounded faithfulness constraints in HS can check their contexts at the input yet still have access to information derived by the grammar.

3 Exemplification: Indirect Approach

I will illustrate this proposal with a fragment of an analysis of voicing assimilation in Sudanese Arabic (2)e using the P-Map-mediated indirect approach to perceptual grounding in Steriade 2001/2008. At the first relevant step of the HS derivation, unstressed high vowels are deleted in a VC__CV context. To save space, syncope will be attributed to an ad hoc markedness constraint SYNC; for a serious proposal. SYNC must dominate MAX. Furthermore, because syncope can create clusters that disagree in voicing, SYNC has to dominate AGREE(voice):

(4) *Step 1 in Sudanese Arabic*[7]

	kutub aħmad	SYNC	ID(vce)/__V	MAX	AGR(vce)	ID(vce)/__C
a. →	kutb aħmad			1	1	
b.	kutub aħmad	1 **W**		**L**	**L**	

HS's GEN cannot produce candidates at step 1 that are more than one change away from the underlying representation. That is why [kudb aħmad] is not a candidate in (4), and also why SYNC must dominate AGREE(voice).

Voicing assimilation occurs at step 2 because AGREE(voice) dominates IDENT(voice)/__C. Furthermore, because IDENT(voice)/__V universally dominates IDENT(voice)/__C — because the perceptual cues for voicing are more prominent prevocalically — assimilation is regressive:

(5) *Step 2 in Sudanese Arabic*

	kutb aħmad	SYNC	ID(vce)/__V	MAX	AGR(vce)	ID(vce)/__C
a. →	kudb aħmad					1
b.	kutb aħmad				1 **W**	**L**
c.	kutp aħmad		1 **W**			**L**

Tableau (5) shows how HS solves the problem identified in section 1. In HS, faithfulness constraints always consult the most recent input, not the underlying representation. Since syncope occurred at step 1, the input to (5) has preconsonantal [t] and prevocalic [b]. The perceptually grounded faithfulness constraints IDENT(voice)/__V and IDENT(voice)/__C check their contexts on this input, and so [t] assimilates to [b] rather than the other way around.

The same kind of analysis can be applied to cases where the relevant faithfulness constraints are MAX/__V and MAX/__C. It can also be applied to cases where, instead of syncope, metathesis or epenthesis changes whether a consonant is prevocalic or preconsonantal: Afar /geɖ-n-a/ → [genɖa] → [geɳɖa] 'we go' (Bliese 1981:236, 240); Mekkan Arabic /katab-t-lu/ → [katabtalu] → [kataptalu] (Mahasen Abu-Mansour, pers. comm.).

4 Exemplification: Direct Approach

HS also solves the syncope problem in the direct approach to perceptually grounded faithfulness, while eliminating the need for the RI. To show this, I first sketch an analysis of a non-syncope case and then show how it extends to syncope. The non-syncope case is a revision of Jun's (2002) analysis of Yakut.

The distribution of release is determined by the interaction of two constraints. One of them, LICENSE-PLACE, is based on ideas about licensing by cue (Steriade 1999a, b and others):

(6) *LICENSE-PLACE (LIC-PL)*

Assign a violation mark for every place feature that is not associated with a released consonant.

LICENSE-PLACE can be satisfied by making a consonant released. It can also be satisfied by place assimilation: in a homorganic cluster like [amʾpʿa], the shared place feature [labial] is licensed by its association with the released [pʿ], and unreleased [mʾ] goes along for the ride (Goldsmith 1990:335-336, Ito 1989).

One antagonist to LICENSE-PLACE is a constraint requiring preconsonantal consonants to be unreleased:

(7) *UNRELEASE/__C (UNREL/__C) (after Jun 2002)*

Assign one violation mark for every consonant in preconsonantal position that is not marked as unreleased.

In Yakut, the HS derivation proceeds like this, starting with consonants that are unspecified for release in underlying representation: /atka/ → [atʾka] → [atʾkʿa] → [akʾkʿa]. This derivation improves satisfaction of (in order) UNRELEASE/__C, LICENSE-PLACE, and LICENSE-PLACE again. The ranking that yields this derivation can be seen in tableaux (8)–(10).

Because HS's GEN can make only one change at a time, the options at step 1 in (8) include determining the release feature of one stop or assimilating it, but not both. Under this ranking, the most harmonic option is to mark the first consonant as unreleased (8)a. Doing nothing (8)b is harmonically bounded by the winner. Assimilating (8)e,f is harmonically bounded by marking a consonant as released (8)c, d:

(8) *Step 1 in Yakut*

atka	UNREL/__C	ID(place)/rel	LIC-PL	ID(place)
a. → at˺ka			2	
b. atka	1 **W**		2	
c. atkʿa	1 **W**		1 **L**	
d. atʿka	1 **W**		1 **L**	
e. akka	1 **W**		1 **L**	1 **W**
f. atta	1 **W**		1 **L**	1 **W**

At step 2 in (9), all losing candidates are harmonically bounded by the winner. Thus, the only viable option at step 2 is the one that is actually taken, assigning release to *k*:

(9) *Step 2 in Yakut*

at˺ka	UNREL/__C	ID(place)/rel	LIC-PL	ID(place)
a. → at˺kʿa			1	
b. at˺ka			2 **W**	
c. ak˺ka			1	1 **W**
d. at˺ta			1	1 **W**

Step 3 is the point in the derivation where IDENT(place)/release does crucial work. Because of it, regressive assimilation in (10)a harmonically bounds progressive assimilation in (10)c:

(10) *Step 3 in Yakut*

atˀkˁa	UNREL/__C	ID(place)/rel	LIC-PL	ID(place)
a. → akˀkˁa				1
b. atˀkˁa			1 **W**	**L**
c. atˀtˁa		1 **W**		1

After step 3, the derivation converges. No further harmonic improvement is possible under this ranking of these constraints. Every place feature is licensed, and (un)release has the right surface distribution.

This HS analysis of Yakut does not require a special RI level of representation because the input to step 3 effectively *is* the RI. HS has intermediate steps by its very nature. Unlike the RI, which is ad hoc, these intermediate steps have solid support from phenomena that have nothing to do with the problem at hand, as the literature cited in section 2 attests.

Another difference from the RI approach is that the HS analysis makes the right prediction about how assimilation or deletion will interact with syncope. If SYNC dominates LICENSE-PLACE, syncope will take priority at step 1:

(11) *Step 1 with syncope*

atika	UNREL/__C	ID(place)/rel	SYNC	LIC-PL	MAX	ID(place)
a. → atka				2	1	
b. atika			1 **W**	2	**L**	
c. atikˁa			1 **W**	1 **L**	**L**	
d. atˁika			1 **W**	1 **L**	**L**	

From this point onward, the derivations of /atika/ and /atka/ are identical, and both will surface as [akʾkʿa] under this ranking. The HS analysis therefore correctly predicts that syncope will interact transparently with assimilation or deletion.[8] The RI cannot do this because, as we saw in section 1, the RI cannot show the effects of any neutralizing process like syncope.

5 Conclusion

In this squib, I have argued that HS resolves a problem with perceptually grounded faithfulness. In this conclusion, I suggest why HS is a better framework for studying perceptual grounding than P-OT.

Perceptual grounding is one part of a research program sometimes known as functional or phonetically-based phonology. Phonetically-based phonology seeks to account for phonological patterns and processes in terms of factors like perceptual distinctiveness or articulatory ease. It is a theory of phonological naturalness, in the dual sense that it proposes to explain which processes are natural (=frequently observed) in terms of directly observable properties of nature (=the inertia of the tongue, the frequency response characteristics of the basilar membrane, etc.).

P-OT is a relatively uncongenial host for this mode of explanation because the notion “process” is not reconstructable in P-OT. Neither HS nor P-OT offers any way of isolating a process from a constraint hierarchy, because the ranking conditions that can prevent or allow a specific unfaithful mapping are too complex (McCarthy 2002:67-68, 91-93). It is equally impossible to locate a specific process in P-OT’s underlying→surface mappings. These mappings conflate the effects of many processes, such as syncope, assignment of release, and assimilation.

In HS, however, a process can be identified as a step in a derivation. Because different processes compete but do not co-occur in a step, the input and output of an individual step differ by the effect of some process.

This distinction between P-OT and HS is important in phonetically-based phonology because it is specifically a theory of the naturalness of processes and not the naturalness of underlying→surface mappings. This aspect of phonetically-based phonology was recognized long ago, in the context of discussions about how natural rules are diachronically “telescoped” into seemingly unnatural ones (Bach and Harms 1972, Wang 1968). If the naturalness of processes is phonetically-based phonology’s *explanandum*, then a theory without anything resembling a process cannot be part of the *explanans*. For this reason, HS is a better framework than P-OT for crafting analyses and exploring ideas about the phonetic bases of phonological phenomena.

Notes

This research was supported by grant BCS-0813829 from the National Science Foundation to the University of Massachusetts Amherst. I am grateful for comments received from Michael Becker, Emily Elfner, Minta Elsman, Clint Hartzell, Karen Jesney, Shigeto Kawahara, Wendell Kimper, Claire Moore-Cantwell, Kevin Mullin, Joe Pater, Presley Pizzo, Clàudia Pons, Kathryn Pruitt, Brian Smith, Robert Staubs, and Anne-Michelle Tessier. Special thanks are due to two *LI* reviewers, one of them self-identified as Donca Steriade. Their comments and questions led to significant improvements.

[1] The observation about place assimilation targeting C_1 is discussed in Hyman 2001, Jun 1995, 2004, McCarthy 2008a, Mohanan 1993, Ohala 1990, and Webb 1982. The observation about voice assimilation is the focus of Lombardi 1999. The observation about consonant deletion is discussed in McCarthy 2008a, Steriade 2001/2008, and Wilson 2001.

[2] Specifying underlying representations for release will not solve this problem because the distribution of release is decided by the grammar, not the lexicon. See McCarthy 2008c:88-95 on richness of the base in OT.

[3] Hoff's (1968:59-60) description of syncope in Carib — that it is applicable presuffixally to "the vast majority of verbs ending in *pɨ, tɨ, kɨ,rɨ, mɨ, ku,* and *ru*" — might seem to suggest a process that is marginal or unproductive. Examination of Hoff's extensive Carib index shows that the list of syllables affected by syncope is just exactly a list of all verb-root-final syllables with a high vowel. The qualifier "vast majority" is explained in a footnote: "the few instances in which reduction does not take place are all bivocalic" (Hoff 1968:59).

[4] Optional schwa syncope similarly feeds coda *r* deletion in my dialect of English: [ˌvɛɾəɹ̲ə̲ˈnejɹijən] ~ [ˌvɛɾəˈnejɹijən] *veterinarian*; [ˌvʌlnəɹ̲ə̲ˈbɪlə̲ɾi] ~ [ˌvʌlnəˈbɪlə̲ɾi] 'vulnerability'.

[5] The symbols ˀ and ˁ mark unreleased and released consonants respectively.

If neither mark is present, the consonant is unspecified for release.

[6] In McCarthy 2008a, b, I assume that faithfulness constraints in HS refer to the underlying representation, but I also observe that the same results could be obtained with faithfulness constraints that refer to the input to the current step. Subsequent work in HS (such as Becker et al. 2009, Jesney to appear, Kimper to appear, McCarthy 2010a, b) conforms to the assumption adopted here: faithfulness constraints refer to the input to the current step.

[7] Tableaux are in the comparative format introduced in Prince 2002. The number of violations is indicated by an integer. In loser rows, a cell may contain **W**, **L**, or neither depending on whether the constraint favors the winner, the loser, or neither. Because every loser-favoring constraint must be dominated by some winner-favoring constraint, in a properly ranked tableau every **L** is preceded in the same row by a **W** across a solid line.

[8] The factorial typology predicted by the constraints in this section was checked with OT-Help 2.0 (Becker et al. 2009). Starting from an underlying representation /atka/ with no release specifications, the possible languages are [atˀkˤa], [akˀkˤa], and [atˤkˤa]. All languages with syncope produce the same result for /atika/ as they do for /atka/. Release specifications must not be permitted in the lexicon, or else the typology expands in unwanted ways. This conclusion is consistent with other work showing the need to eliminate universally predictable structure from the lexicon in HS (McCarthy and Pruitt to appear).

References

Bach, Emmon, and Robert Harms. 1972. How do languages get crazy rules? In *Linguistic Change and Generative Theory*, ed. by Robert Stockwell and Ronald Macaulay, 1-21. Bloomington, IN: Indiana University Press.

Becker, Michael, Patrick Pratt, Christopher Potts, Robert Staubs, John J. McCarthy, and Joe Pater. 2009. OT-Help 2.0 [computer program]. Amherst, MA: University of Massachusetts Amherst.

Bliese, Loren F. 1981. *A Generative Grammar of Afar*. Dallas: The Summer Institute of Linguistics and the University of Texas at Arlington.

Blumenfeld, Lev. 2006. Constraints on Phonological Interactions, Doctoral dissertation, Stanford University, Stanford, CA. Available on Rutgers Optimality Archive, ROA-877.

Elfner, Emily. 2009. Harmonic serialism and stress-epenthesis interactions in Levantine Arabic. Ms. University of Massachusetts Amherst, Amherst, MA. Available at http://www.people.umass.edu/eelfner/elfner_arabic.pdf.

Flemming, Edward. 2006. The role of distinctiveness constraints in phonology. Ms. MIT, Cambridge, MA.

Flemming, Edward. 2008a. Asymmetries between assimilation and epenthesis. Ms. MIT, Cambridge, MA.

Flemming, Edward. 2008b. The realized input. Ms. MIT, Cambridge, MA.

Gallagher, Gillian. 2006. Coalescence and 'marked' faithfulness in West Greenlandic Eskimo. Ms. MIT, Cambridge, MA.

Gildea, Spike. 1995. A comparative description of syllable reduction in the Cariban language family. *International Journal of American Linguistics* 61:62-102.

Goldsmith, John. 1990. *Autosegmental and Metrical Phonology*. Oxford and Cambridge, MA: Blackwell.

Hamid, Abdel Halim M. 1984. A Descriptive Analysis of Sudanese Colloquial Arabic Phonology, Doctoral dissertation, University of Illinois, Urbana, IL.

Hoff, B. J. 1968. *The Carib Language*. The Hague: M. Nijhoff.

Hohulin, E. Lou, and Michael Kenstowicz. 1979. Keley-i phonology and morphophonemics. In *South-East Asian Linguistic Studies 4*, ed. by Nguyen Dang Liem, 241-254. Canberra: Australian National University. Pacific Linguistics, Series C, no. 49.

Hyman, Larry. 2001. On the limits of phonetic determinism in phonology. In *The Role of Speech Perception in Phonology*, ed. by Elizabeth Hume and Keith Johnson, 141-185. San Diego: Academic Press.

Ito, Junko. 1989. A prosodic theory of epenthesis. *Natural Language & Linguistic Theory* 7:217-259.

Jesney, Karen. to appear. Positional faithfulness, non-locality, and the Harmonic Serialism solution. In *Proceedings of the 39th Annual Meeting of the North East Linguistic Society*, ed. by Suzi Lima, Kevin Mullin and Brian Smith. Amherst, MA: GLSA Publications. Available on Rutgers Optimality Archive, ROA-1018.

Jun, Jongho. 1995. Perceptual and Articulatory Factors in Place Assimilation: An Optimality Theoretic Approach, Doctoral dissertation, UCLA, Los Angeles. Available at http://ling.snu.ac.kr/jun/.

Jun, Jongho. 2002. Positional faithfulness, sympathy, and inferred input. Ms. Yeungnam University, Kyongsan, South Korea.

Jun, Jongho. 2004. Place assimilation. In *Phonetically Based Phonology*, ed. by Bruce Hayes, Robert Kirchner and Donca Steriade, 58-86. Cambridge: Cambridge University Press.

Kidda, M. 1985. Tangale Phonology: A Descriptive Analysis, Doctoral dissertation, University of Illinois, Champaign.

Kimper, Wendell. 2008. Local optionality and harmonic serialism. Ms. University of Massachusetts Amherst, Amherst, MA.

Kimper, Wendell. to appear. Locality and globality in phonological variation. *Natural Language & Linguistic Theory*. Available on Rutgers Optimality Archive, ROA-988.

Krishnamurti, Bh. 1957. Sandhi in modern colloquial Telugu. *Indian Linguistics* 17:178-188.

Krueger, John R. 1962. *Yakut Manual*. Bloomington, IN: Indiana University Press.

Lombardi, Linda. 1999. Positional faithfulness and voicing assimilation in Optimality Theory. *Natural Language & Linguistic Theory* 17:267-302.

McCarthy, John J. 2000. Harmonic serialism and parallelism. In *Proceedings of the North East Linguistics Society 30*, ed. by Masako Hirotani, 501-524. Amherst, MA: GLSA Publications. Available on Rutgers Optimality Archive, ROA-357.

McCarthy, John J. 2002. *A Thematic Guide to Optimality Theory*. Cambridge: Cambridge University Press.

McCarthy, John J. 2007a. *Hidden Generalizations: Phonological Opacity in Optimality Theory*. London: Equinox Publishing.

McCarthy, John J. 2007b. Restraint of analysis. In *Freedom of Analysis*, ed. by Sylvia Blaho, Patrik Bye and Martin Krämer, 203-231. Berlin and New York: Mouton de Gruyter. Also appears in Eric Bakovic, Junko Ito, and John J. McCarthy, eds. (2006) Wondering at the Natural Fecundity of Things: Essays in Honor of Alan Prince. Linguistics Research Center, UC Santa Cruz. Available at http://repositories.cdlib.org/lrc/prince/10.

McCarthy, John J. 2007c. Slouching towards optimality: Coda reduction in OT-CC. In *Phonological Studies 10*, ed. by Phonological Society of Japan, 89-104. Tokyo: Kaitakusha. Available on Rutgers Optimality Archive, ROA-878.

McCarthy, John J. 2008a. The gradual path to cluster simplification. *Phonology* 25:271-319. doi:10.1017/S0952675708001486.

McCarthy, John J. 2008b. The serial interaction of stress and syncope. *Natural Language & Linguistic Theory* 26:499-546. DOI: 10.1007/s11049-008-9051-3.

McCarthy, John J. 2008c. *Doing Optimality Theory*. Malden, MA, and Oxford, UK: Blackwell.

McCarthy, John J. 2010a. Studying Gen. *Journal of the Phonetic Society of Japan* 13:3-12.

McCarthy, John J. 2010b. An introduction to Harmonic Serialism. *Language and Linguistics Compass*.

McCarthy, John J., and Kathryn Pruitt. to appear. Sources of phonological structure. In *Derivation and Filtering*, ed. by Ralf Vogel and Hans Broekhuis. London: Equinox Publishing.

Mohanan, K. P. 1993. Fields of attraction in phonology. In *The Last Phonological Rule: Reflections on Constraints and Derivations*, ed. by John Goldsmith, 61-116. Chicago: University of Chicago Press.

Ohala, John. 1990. The phonetics and phonology of aspects of assimilation. In *Papers in Laboratory Phonology*, ed. by John Kingston and Mary Beckman, 258-275. Cambridge: Cambridge University Press.

Pater, Joe. to appear. Serial Harmonic Grammar and Berber syllabification. In *Prosody Matters: Essays in Honor of Lisa Selkirk*, ed. by Toni Borowsky, Shigeto Kawahara, Takahito Shinya and Mariko Sugahara. London: Equinox Publishing.

Prince, Alan, and Paul Smolensky. 1993/2004. *Optimality Theory: Constraint Interaction in Generative Grammar*. Malden, MA, and Oxford, UK: Blackwell.

Prince, Alan. 2002. Arguing optimality. In *University of Massachusetts Occasional Papers in Linguistics 26: Papers in Optimality Theory II*, ed. by Angela Carpenter, Andries Coetzee and Paul de Lacy, 269-304. Amherst, MA: GLSA. Available on Rutgers Optimality Archive, ROA-562.

Pruitt, Kathryn. 2008. Iterative foot optimization and locality in stress systems. Ms. University of Massachusetts Amherst, Amherst, MA. Available on Rutgers Optimality Archive, ROA-999.

Steriade, Donca. 1999a. Alternatives to syllable-based accounts of consonantal phonotactics. In *Proceedings of the 1998 Linguistics and Phonetics Conference*, ed. by Osamu Fujimura, Brian Joseph and B. Palek, 205-242. Prague: Karolinum Press. Available at http://www.linguistics.ucla.edu/people/steriade/papers/Alternatives_to_Syllables.pdf.

Steriade, Donca. 1999b. Phonetics in phonology: the case of laryngeal neutralization. In *Papers in Phonology 3 (UCLA Working Papers in Linguistics 2)*, ed. by Matthew Gordon, 25-145. Los Angeles: Department of Linguistics, UCLA.

Steriade, Donca. 2001/2008. The phonology of perceptibility effects: The P-map and its consequences for constraint organization. In *The Nature of the Word: Studies in Honor of Paul Kiparsky*, ed. by Kristin Hanson and Sharon Inkelas, 151-180. Cambridge, MA: MIT Press. Originally circulated in 2001.

Wang, William S.-Y. 1968. Vowel features, paired variables, and the English vowel shift. *Language* 44:695-708.

Webb, Charlotte. 1982. A constraint on progressive consonantal assimilation. *Linguistics* 20:309-321.

Wilkinson, Robert W. 1974. A Phonetic Constraint on a Syncope Rule in Telugu. *Language* 50:478-497.

Wilson, Colin. 2001. Consonant cluster neutralization and targeted constraints. *Phonology* 18:147-197.

Wolf, Matthew. 2008. Optimal Interleaving: Serial Phonology-Morphology Interaction in a Constraint-Based Model, Doctoral dissertation, University of Massachusetts Amherst, Amherst, MA. Available on Rutgers Optimality Archive, ROA-996.

Wonderly, William L. 1951. Zoque II: Phonemes and Morphophonemes. *International Journal of American Linguistics* 17:105-123.