1998

Morpheme structure constraints and paradigm occultation

John J McCarthy

McCarthy, John J. (1998). Morpheme structure constraints and paradigm occultation. In M. Catherine Gruber, Derrick Higgins, Kenneth Olson and Tamra Wysocki (eds.) *CLS 32, Part 2: The Panels*. Chicago, IL: Chicago Linguistic Society. 123-150.

Morpheme Structure Constraints and Paradigm Occultation

John J. McCarthy
University of Massachusetts, Amherst

1. Introduction

Imagine two languages L and L′ that differ as follows. In L, a process of final devoicing applies dynamically, leading to voicing alternations in paradigms. But in L′, the same process applies statically, leveling the voiceless consonant across the paradigm:

(1) a. Paradigms in L
  gat̲ gat̲+i
  gat̲ gad̲+i
 b. Paradigms in L′
  gat̲ gat̲+i i.e., no paradigms like **gat̲/gad̲+i*

According to the premises of classic generative phonology, final devoicing in L is a result of a phonological rule. In L′, though, devoicing is attributed to a *morpheme structure constraint* (MSC), the name given to restrictions on underlying representations. By filtering the contents of the lexicon, MSC's limit the inputs to the phonological rules. Both MSC's and rules are needed to define the range of phonologically well-formed expressions.

The situation in (1), where a single process acts as a dynamic rule in one language and a static MSC in the other, is not unusual. "In many respects, [MSC's] seem to be exactly like ordinary phonological rules, in form and function" (Chomsky & Halle 1968: 382). Indeed, within a single language, exactly the same generalization may need to be expressed twice, once as a MSC and once again as a rule, in what has been referred to as a conspiracy (Kisseberth 1970) or the duplication problem (Clayton 1976, Kenstowicz & Kisseberth 1977). This formal similarity and functional redundancy between MSC's and rules is a significant liability of the classic theory. If MSC's and rules really are distinct components of linguistic theory, then they should be cleanly differentiated in form and function, but they are not.

Discomfiture with MSC's has led to various proposals for their elimination. Of these, the most interesting and successful is Stampe's (1969, 1973ab) idea that the effect of MSC's can be derived from the rules of the phonology.[1] Suppose some rule consistently replaces the structure /A/ by *B*. Finding no surface *A*'s, language learners will not be tempted to set up underlying /A/'s in the lexicon, positing only underlying /B/'s instead. In this way, /B/ hides or "occults" /A/, obtaining the same descriptive effect as an anti-/A/ MSC without invoking any actual restrictions on the lexicon. Prince & Smolensky (1993) eponymously dub this the logic of "Stampean occultation", showing how the basic idea can be worked out formally within Optimality Theory.

On first inspection, the difference between L and L′ seems inexpressible in a theory without MSC's. Since L and L′ have exactly the same process, final devoicing, where in the grammar is the difference between these two languages to be recorded? It looks as if L′ requires a MSC to capture its special generalization that no *root* can end in a voiced obstruent.

In this paper, I will apply Stampean occultation under OT to systems like L′, showing how the putative MSC can be dispensed with. The key is that _*gat̲/gad̲+i_, though it consists of phonotactically possible *words* of L′, is an impossible *paradigm* of L′, which never permits intra-paradigmatic voicing alternations. The notion "impossible paradigm" is obtained, following Tesar & Smolensky (1996: 40f.), by integrating the logic of Stampean occultation with *output-output faithfulness constraints* (Benua 1997 and others), which hold between surface forms within a paradigm. Ranking permutation, the locus of language typology in OT, accounts for the difference between L and L′; these two systems differ precisely in the relative ranking of input-output and output-output faithfulness constraints.

The paper is organized as follows. Section 2 sketches Stampean occultation under OT and presents a simple example. Section 3 does the same for output-output faithfulness. Expanding on Tesar & Smolensky's proposals, section 4 shows how to bring together Stampean occultation and output-output faithfulness in an account of systems like L and L′. In this context, connections are also made with diachronic matters and with ideas about the learning of OT grammars. Sections 5 and 6 then present applications of these proposals to real-life examples: word- vs. root-minimality effects in dialects of Kansai Japanese and restrictions on root-final consonants in Makassarese. Section 7 sums up the results.

2. Stampean Occultation

Optimality Theory (Prince & Smolensky 1993) asserts that the set of possible underlying forms is universal, a principle called *richness of the base*. Thus, there are no language-particular constraints on underlying representations, and hence no mechanism like the classic MSC. Rather, observed restrictions on underlying representations follow from constraints on the output through the logic of *Stampean occultation.*

Suppose that in principle there could be two distinct underlying forms, U_1 and U_2. Suppose too that the grammar always neutralizes the distinction between U_1 and U_2, mapping both onto a single output form O. Then learners will achieve nothing by positing a lexical contrast between U_1 and U_2, since it is always neutralized. If having a determinate underlying representation for O is important, then the choice can be made during language learning. Prince & Smolensky propose a learning procedure called *lexicon optimization*:[2] choose the underlying representation U that gives the most harmonic U→O mapping. For example, if the $U_1 \rightarrow O$ mapping is more harmonic (=incurs less serious marks) than the $U_2 \rightarrow O$ mapping, then U_1 is chosen as the underlying representation for O. The underlying form U_1 is then said to *occult* the underlying form U_2. The effect is the same as an anti-U_2 MSC in the classic theory, but without positing constraints on inputs. Any apparent restriction on inputs is an epiphenomenon of the constraints on outputs (interacting with input-output faithfulness) that are responsible for the $U_1/U_2 \rightarrow O$ mapping.

A concrete example drawn from Stampe's work is the prohibition on initial *ŋ* in English. In principle, there could be distinct underlying representations /ŋɑw/ and /nɑw/, but in fact this distinction is neutralized in surface [nɑw]. Neutralization of a potential underlying distinction indicates crucial domination of an input-output (IO) faithfulness constraint, as in the following tableau.

(2) /ŋɑw/ → [nɑw]

/ŋɑw/	*[*ŋ*	IO-Faith
a. ☞ nɑw		*
b. ŋɑw	* !	

In this way, the grammar asserts that there are no initial *ŋ*'s in surface forms of English, mapping them onto *n*'s (e.g., *Nguyen*). The actual underlying representation of [nɑw] can be selected by lexicon optimization, applying the *tableau des tableaux* technique introduced by Itô, Mester, & Padgett (1995):

(3) Tableau des Tableaux Showing /nɑw/ → [nɑw] ≻ /ŋɑw/ → [nɑw]

		*[*ŋ*	IO-Faith
a. ☞ /nɑw/	☞ nɑw		
	ŋɑw	* !	*
b. /ŋɑw/	☞ nɑw		*
	ŋɑw	* !	

The mapping from underlying /nɑw/ to [nɑw] is more harmonic than the mapping from underlying /ŋɑw/, since /nɑw/ incurs a subset of /ŋɑw/'s marks (indeed, none at all). Therefore, /nɑw/ is selected as the actual underlying form for [nɑw], occulting /ŋɑw/. The descriptive effect is like that of an anti-[*ŋ* MSC, but without imposing restrictions on the input.

Stampean occultation and lexicon optimization were first applied to individual words. But situations like L′ require that they be applied to whole paradigms. Tesar & Smolensky show how to extend lexicon optimization to paradigms by using output-output faithfulness constraints, to which we now turn.

3. Output-Output Faithfulness

In classic generative phonology and related developments like lexical phonology, the cycle and levels are used to account for otherwise unexplained resemblances between morphologically related words. Within OT, a significant body of work has emerged that seeks to account for these resemblances directly, in terms of constraints demanding faithfulness among surface forms within a paradigm (Archangeli 1996, Benua 1995, 1997, Buckley to appear, Burzio 1994ab, 1996, 1997, Crosswhite 1996, Kager to appear, Kenstowicz 1996, Kraska-Szlenk 1995, Orgun 1994, 1996, Pater 1995). There are obvious connections with traditional ideas of surface analogy and more recent developments along these lines such as Bybee (1985).

Here I adopt Benua's (1997) Transderivational Correspondence Theory (TCT) of output-output (OO) faithfulness as an internally consistent, fully formalized framework in which to study occultation. There are three main elements of TCT:

- *Correspondence Theory*. OO faithfulness constraints are based on correspondence theory (McCarthy & Prince 1995). Thus, there are formally identical but separately rankable constraints on the IO and OO correspondence relations.
- *Base Priority*. Evaluation of OO faithfulness respects the principle of Base Priority: a recursive constraint hierarchy evaluates a word and its immediate morphological derivative simultaneously, giving priority to the former, which is called the base. Thus, OO faithfulness effects can compel complex words to resemble simple ones, but not vice-versa.
- *Affix-Specificity of Correspondence*. OO correspondence relations are induced by affixes. Different affixes or affix-classes may induce distinct correspondence relations, which are subject to separate faithfulness constraints. Thus, the English Level 1/Level 2 distinction is attributed to two affix classes that induce distinct correspondence relations (see also Urbanczyk 1996 and Burzio 1997).

Benua shows how these principles allow TCT to account for a range of "cyclic" phenomena while making more restrictive predictions than standard derivational theories.

TCT can be illustrated with a familiar example, the derivation of *bomb/ bombing* from /bɑmb/. The *b* is lost in *bomb* for syllabic reasons, and high-ranking

OO faithfulness ensures that the loss of *b* is carried over to *bombing*, even though the syllabic conditions are different.[3]

(4) *bomb/bombing*

/bɑmb/	OO-Faith	Syllabic Constraints	IO-Faith	
a. bɑmb		* !		>>
b. ☞ bɑm			*	

/bɑmb+ɪŋ/	OO-Faith	Syllabic Constraints	IO-Faith
a. bɑm.bɪŋ	* !		
b. ☞ bɑ.mɪŋ			*

In the upper recursion, OO-Faith is irrelevant by the principle of Base Priority. Conditions on tautosyllabic clusters disfavor *mb*, and ranked above IO-Faith they select [bɑm] as the output form. In the lower recursion, the syllabic constraints are irrelevant because the suffix is vowel-initial, and IO-Faith favors conservation of the underlying /b/. But top-ranked OO-Faith is decisive: it selects [bɑmɪŋ] for its similarity to [bɑm].[4]

OO faithfulness constraints hold within paradigms, requiring resemblance between a word and its immediate morphological derivatives. To account for languages like L′ (1b), the occultation of a word must carry over to its immediate morphological derivatives. OO faithfulness constraints allow that to happen.

4. Stampean Occultation Through Output-Output Faithfulness

Let us return to the typological distinction illustrated in (1). In L, a voicing distinction is neutralized finally in simple forms but preserved in their immediate morphological derivatives. The paradigms *gat/gati* and *gat/gadi* therefore remain distinct, even if some words in those paradigms do not. In L′, on the other hand, the paradigms are merged completely, so there is no paradigm like **gat/gadi*. Neutralization of the voicing distinction in simple forms is carried over to derived forms, even if the derived forms do not meet the phonological conditions for neutralization.

To account for this typological distinction, it must be possible, through permuted ranking, to occult the paradigm *gat/gadi* in L′ but not in L. To show this with maximum clarity, I will assume a very limited set of universal constraints:

(5) Constraints Relevant to L/L′ Distinction

a. Markedness constraint: *VOICE]$_\sigma$
"No voiced obstruents syllable-finally."

b. Faithfulness constraints: IO-IDENT(voice)
OO-IDENT(voice)
"Correspondent segments agree in [voice]."

For the same reason, I will also assume that the set of potential underlying forms consists only of /gat/, /gad/, and the suffix /-i/.

We begin with the grammar of L. Underlying /gad/ receives unfaithful analysis as surface *gat*, showing that the markedness constraint *VOICE]$_\sigma$ crucially dominates the IO faithfulness constraint IO-IDENT(voice).

(6) Final Devoicing in L

/gad/	*VOICE]$_\sigma$	IO-IDENT(voice)
a. ☞ gat		*
b. gad	* !	

But the effects of devoicing are not transmitted to /gad/'s derivative *gadi* in L; instead, suffixed forms like *gadi* preserve the underlying voicing distinction. This observation shows that IO-IDENT(voice) must dominate OO-IDENT(voice), favoring preservation of underlying contrast over surface uniformity within the paradigm.

(7) Contrast Preservation in Derived Forms of L

/gad/	*VOICE]$_\sigma$	IO-IDENT(voice)	OO-IDENT(voice)	
a. ☞ gat		*		>>
b. gad	* !			
/gad+i/	*VOICE]$_\sigma$	IO-IDENT(voice)	OO-IDENT(voice)	
a. ga.ti		* !		
b. ☞ ga.di			*	

There is final devoicing, because *VOICE]$_\sigma$ dominates IO faithfulness. But IO faithfulness dominates its OO counterpart, preserving the voicing contrast elsewhere in the paradigm, where *VOICE]$_\sigma$ is not relevant. The responsible ranking is given in (8a) and is schematized in (8b):

(8) Ranking in L (Morphophonemic Alternation in Paradigm)

a. $*$VOICE$]_\sigma$ >> IO-IDENT(voice) >> OO-IDENT(voice)

b. Markedness >> IO-Faith >> OO-Faith

Now we turn to L′, which has no voicing alternations because final devoicing has metastasized throughout the paradigm. The ranking argument (6) is just as valid in L′ as it is in L; the difference lies in the role of OO faithfulness. Because the effect of final devoicing in the simple form *gat* carries over to its immediate morphological derivative *gati*, OO faithfulness must predominate over IO faithfulness.

(9) No Contrast Preservation in Derived Forms of L′

/gad/	$*$VOICE$]_\sigma$	OO-IDENT(voice)	IO-IDENT(voice)	
a. ☞ gat			*	>>
b. gad	* !			

/gad+i/	$*$VOICE$]_\sigma$	OO-IDENT(voice)	IO-IDENT(voice)
a. ☞ ga.ti			*
b. ga.di		* !	

In /gad+i/, there is a conflict between OO and IO faithfulness, with OO winning. The responsible ranking is given (10a) and it is schematized in (10b):

(10) Ranking in L′ (Avoidance of Morphophonemic Alternation in Paradigm)

a. $*$VOICE$]_\sigma$, OO-IDENT(voice) >> IO-IDENT(voice)

b. Markedness, OO-Faith >> IO-Faith

Because the markedness constraint $*$VOICE$]_\sigma$ dominates IO faithfulness, there is final devoicing. And because OO faithfulness dominates IO faithfulness, there are no voicing alternations in paradigms. The effect is like that of a classic MSC that prohibits underlying voiced obstruents in root-final position, but this effect is obtained in (9) without invoking any constraints on underlying structure. In general, grammars with the form (10b) will allow output markedness constraints to have effects similar to classic MSC's.

The final step in the analysis is to apply lexicon optimization and Stampean occultation to L and L′. Tesar & Smolensky (1996) show how to generalize lexicon optimization from words to paradigms by using OO faithfulness, applying it to the L case. For present purposes, the interesting case is rather L′, which lacks paradigms like *gat/gadi*. In L′, underlying /gad/ is thoroughly occulted by underlying /gat/:

(11) Lexicon Optimization in L′ for the *gat/gati* Paradigm

		*VOICE]$_\sigma$	OO-IDENT(voice)	IO-IDENT(voice)
a. /gad/	{gat, gadi}		*!	*
	{gad, gadi}	*!		
	☞ {gat, gati}			*, *
b. ☞ /gat/	{gat, gadi}		*!	*
	{gad, gadi}	* !		*, *
	☞ {gat, gati}			

Both inputs are mapped onto the desired output paradigm *gat/gati*, but /gat/ supplies the more harmonic mapping. Hence, /gat/ is chosen by lexicon optimization as the underlying form for paradigms like *gat/gati* in L′, while /gad/ will underlie no paradigm of L′.

To sum up, the ranking OO-IDENT(voice) >> IO-IDENT(voice) gives the descriptive effect of a MSC in L′. Root-final voiced obstruents are occulted by root-final voiceless ones, and so learners will never posit an underlying root-final voicing distinction. The neutralization of the voicing distinction pervades the paradigm, just as a MSC would, because of OO-IDENT's high rank. In L, however, lexicon optimization gives a different result because OO-IDENT is crucially dominated. The underlying voiced/voiceless distinction is maintained in L because underlying voicing yields the most harmonic mapping to L's paradigm *gat/gadi*.

This is how paradigms are occulted or not, depending on the language-particular ranking of OO relative to IO faithfulness. Before turning to further applications of these results, I would like to make some remarks about how language learning and language change can be understood in this context.

Elaborating on a suggestion due to Alan Prince, Tesar & Smolensky (1998: 253) observe that some OT grammars are unlearnable from primary data and propose a solution to this problem. Suppose a language L″ has only voiceless obstruents finally, but no suffixes to condition alternations between voiceless and voiced. The grammar of L″ must contain the ranking (6), but the primary data will offer no direct positive evidence for it. Tesar & Smolensky argue that this unlearnable ranking must therefore be part of the learner's initial state. The initial state will change by demotion of *VOICE]$_\sigma$ if final voiced obstruents are encountered in the primary data (as in English), but otherwise it persists into maturity. In general, markedness dominates IO faithfulness in the initial state, an assumption that simultaneously solves learnability problems like this one and accounts for the Jakobsonian observation that children's productions are unmarked relative to adult models.

The same reasoning can be extended to systems like L′. The ranking in (10a) is unlearnable for essentially the same reason: it is inferrable only from the absence of a pattern (the *gat/gadi* paradigm) in the primary data. The unlearnability of (10a) means that this ranking too must be part of the learner's initial state. In general, then, OO faithfulness dominates IO faithfulness in the initial state, establishing a bias toward surface resemblance within paradigms over resemblance to a shared underlying representation. Together, these two conditions on the initial state — markedness dominates IO faithfulness, and OO faithfulness dominates IO faithfulness — ensure that faithfulness to the input emerges as a relevant factor only in the course of acquisition, through contact with data that cannot be otherwise accommodated. The lexicon, then, is emergent in the course of acquisition, under pressures from the developing vocabulary and morphology.

These considerations have obvious implications for language change. In its simplest form, analogical leveling turns systems like L into systems like L′, replacing alternating paradigms with non-alternating ones. Superficially, leveling looks like promotion of OO faithfulness, moving from (8b) to (10b). In terms of learning, though, the real change is a failure to *demote* OO faithfulness. All learners start out with the ranking (10b) as the initial state. If some learners exposed to L fail to attend to alternating paradigms like *gat/gadi*, then they will not proceed beyond this initial state, and so the OO faithfulness constraint will remain high-ranking. This change is facilitated when the alternating paradigms are less conspicuous to the learner and so more easily ignored — because, for example, the relevant forms are scarce in the primary data (Burzio 1997) or the morphological link between the alternating members of the paradigm is unproductive or non-compositional.

5. Application: Word and Root Minimality in Kansai Japanese

In this section I will show how Stampean occultation at the level of the paradigm accounts for a requirement on minimal root size in Kansai Japanese. I will moreover argue that this phenomenon cannot be revealingly analyzed with a classic MSC because relevant information is not present at the level where the MSC would be in force.

Restrictions on the minimal size of words are derived from general principles of prosodic theory, specifically the Prosodic Hierarchy in (12) and a constraint on one level of the Prosodic Hierarchy, Foot Binarity (13):

(12) Prosodic Hierarchy (Selkirk 1980ab)

Prosodic Word	PrWd
Foot	Ft
Syllable	σ
Mora	μ

(13) FT-BIN (Prince 1980, McCarthy & Prince 1986, 1993, Hayes 1995)
Feet are binary under syllabic or moraic analysis.

The Prosodic Hierarchy and FT-BIN, taken together, derive the notion *minimal word* (Prince 1980, Broselow 1982, McCarthy and Prince 1986, 1991ab, 1993, Mester 1994). According to the Prosodic Hierarchy, any instance of the category PrWd must contain at least one foot, its head.[5] If FT-BIN is to be obeyed, then that foot must be bimoraic or disyllabic. Word minimality follows as a kind of transitivity effect: a properly headed PrWd must contain a foot, and that foot is most harmonically binary according to FT-BIN.

Kansai Japanese enforces a bimoraic word minimum.[6] Where Tokyo Japanese has monomoraic content words like *ka* 'mosquito', Kansai has *kaa*. Assuming that the headedness requirement on PrWd is undominated, we are justified in saying that Kansai Japanese has the constraint ranking in (14), while the Tokyo dialect has the opposite ranking:

(14) FT-BIN >> IO-IDENT-WT

/ka/	FT-BIN	IO-IDENT-WT
a. ☞ kaa		*
b. ka	* !	

The faithfulness constraint IO-IDENT-WT asserts that correspondent segments must agree in their moraic associations; it therefore militates against lengthening (and shortening).

This much is entirely routine. The interest of the Kansai case lies with the role of minimality in paradigms. Two dialects may be distinguished. In Kansai A, there is a distinction between /CV/ and /CVV/ roots. That distinction is neutralized by lengthening in simple forms (/ka/ → *kaa*), but it is maintained under affixation (/ka+ga/ → *kaga*). In Kansai B, the distinction has been neutralized throughout the paradigm, and so the effect of lengthening has extended even to the affixed forms (*kaaga*), where bimoraic word minimality is not at stake. Thus, Kansai B looks like it requires a classic MSC demanding bimoraicity of underlying roots.

The analysis of this difference between Kansai A and B is much the same as the analysis of the L/L′ difference. Kansai A and B share the ranking in (14), but they differ in how OO-IDENT-WT is deployed relative to that ranking. In Kansai A, which allows intra-paradigmatic length alternations, OO-IDENT-WT is ranked below IO-IDENT-WT:

(15) Kansai Dialect A: Markedness >> IO-Faith >> OO-Faith

/ka/	FT-BIN	IO-IDENT-WT	OO-IDENT-WT	
a. ☞ kaa		*		>>
b. ka	* !			
/ka+ga/	FT-BIN	IO-IDENT-WT	OO-IDENT-WT	
a. kaaga		* !		
b. ☞ kaga			*	

In Kansai B, however, the ranking of OO-IDENT-WT is just the opposite:

(16) Kansai Dialect B: Markedness, OO-Faith >> IO-Faith

/ka/	FT-BIN	OO-IDENT-WT	IO-IDENT-WT	
a. ☞ kaa			*	>>
b. ka	* !			
/ka+ga/	FT-BIN	OO-IDENT-WT	IO-IDENT-WT	
a. ☞ kaaga			*	
b. kaga		* !		

In this way, Kansai B does not permit length to alternate in paradigms. Underlying /kaa/ occults underlying /ka/, since /kaa/ produces the more harmonic mapping.

The Kansai B case is of special interest because, although at first it looks as if it demands a classic MSC to account for the root's invariance, it cannot be sensibly analyzed with one. The theory of word minimality relies on *derived* properties of prosodic constituency, the PrWd and the foot. A classic MSC cannot refer to derived prosodic constituency precisely because it is derived, and hence not (reliably or consistently) present at the underlying level where classic MSC's are in force. Thus, the committed proponent of the classic theory must either project all prosodic constituency back into the lexicon (the duplication problem) or resort to descriptive stipulation by simply asserting that roots must be bimoraic, thereby giving up any hope of explaining minimality requirements in terms of prosodic theory. Either way there is a serious loss of generality.

6. Application: Root-Final Consonants in Makassarese

We now turn to a considerably more complex example, a restriction on root-final consonants in Makassarese and its nearby relatives Selayarese and Konjo. The data and descriptive generalizations all come from Aronoff et al. (1987); additional relevant material and discussion can be found in Basri et al. (1997), Friberg & Friberg (1991), Goldsmith (1990, 1993), McCarthy & Prince (1994), and Mithun & Basri (1986).

Makassarese roots sort into three classes on the basis of their phonological behavior before a vowel-initial suffix: roots like (17), which end in a vowel; roots like (18), which end in *ŋ* or *ʔ* (the latter alternates with *k* prevocalically); and roots like (19), which end in *r, l,* or *s* and have an epenthetic vowel in the simple form:

(17) Roots Ending in a Vowel

/lompo/	lómpo	‘big’	lompóaŋ	‘bigger’

(18) Roots Ending in *ŋ* and *ʔ* (~*k*)

/lantaŋ /	lántaŋ	‘deep’	lantáŋaŋ	‘deeper’
/bajiʔ/	bájiʔ	‘good’	bajíkaŋ	‘better’

(19) Roots Ending in *r, l, s*

/rantas/	rántasaʔ	‘dirty’	rantásaŋ	‘dirtier’
/tetter/	téttereʔ	‘quick’	tettéraŋ	‘quicker’
/jamal/	jámalaʔ	‘naughty’	jamálaŋ	‘naughtier’

Stress normally falls on the penult, but epenthetic vowels (underlined throughout) do not count for stress purposes.[7] Place distinctions are not licensed in the coda (Goldsmith 1990: 132); medial codas are either homorganic nasals or the first half of geminates, while word-final codas are limited to place-neutralized *ŋ* and *ʔ*. The root-final consonants *r*, *l*, and *s* are therefore illicit codas; when not followed by a vowel-initial suffix, they are syllabified by supplying an epenthetic vowel that is an echo of the preceding vowel. In addition, the echo vowel is itself followed by epenthetic *ʔ* (also underlined) in Makassarese, though not in Selayarese or Konjo.[8]

The classification of Makassarese roots in (17–19) implies some kind of restriction on morpheme structure whose significance was first noted by Linda Lombardi: why are there no roots that end in other consonants at underlying representation? Concretely, why are there no paradigms like *kátopoʔ/katópaŋ*, based on the root /katop/ and paralleling the alternations seen with *r*-, *l*-, and *s*-final roots in (19)? Evidently Makassarese has no roots ending in *p*, *t*, or any other consonants besides those in (18–19).

This restriction, it will be shown, emerges from the phonology of the language without invoking a MSC. The key insight, due to Gafos & Lombardi (in prep.), is that independently motivated constraints on echo-vowel epenthesis permit only *r*, *l*, and *s* to intervene between a vowel and its echo in Makassarese. Other constraints rule out epenthesis of a non-echo vowel, and OO faithfulness completes the picture, restricting possible intra-paradigmatic alternations to exactly those seen in (17–19). Putting the matter in fully concrete terms once again, I will develop an account here that rules out all of the logically possible but non-occurring paradigms in (20):

(20) Some Impossible Paradigms from the Hypothetical Root /katop/

a. With deletion of the root-final consonant:

káto	katópaŋ

b. With epenthesis of a fixed vowel:

kátopiʔ	katópaŋ

c. With epenthesis of an echo vowel:

kátopoʔ	katópaŋ

Under the hypothesis of richness of the base, we must assume that roots like /katop/ are in principle available, though they never survive faithfully at the surface. The question then is how the grammar disposes of them. We can be sure that they are not disposed of by epenthesis, because then we would expect to find words like **kátopiʔ* or **kátopoʔ*, with the antepenultimate stress and final *ʔ* that are diagnostic of epenthesis. By elimination, then, we have to conclude that the grammar maps /katop/ onto *káto*, which is certainly a possible word of Makassarese. This mapping is obtained from the following ranking:

(21) /katop/ → *káto*: CODA-COND >> IO-MAX-C

/katop/	CODA-COND	ℂ	IO-MAX-C
a. ☞ káto			*
b. kátop.	* !		
c. káto.poʔ		* !	
d. káto.piʔ		* !	

CODA-COND asserts that codas do not license place distinctions (Itô 1989; Goldsmith 1990: 132). By dominating the faithfulness constraint IO-MAX-C, it favors deletion over faithful preservation of the root-final *p*. The remaining candidates (21c, d) involve epenthesis of an echo or fixed vowel. Postponing consideration of the details of epenthesis, I will temporarily use $\mathbb{C}$ to designate the constraints which, by dominating IO-MAX-C, rule out these epenthetic candidates.

The next step is to extend this result to explain why Makassarese has no paradigmatic alternations like (20a) **káto/katópaŋ*, where the root-final consonant is deleted in the simple form but retained before a vowel-initial suffix. The impossible **káto/katópaŋ* paradigm must be occulted by some possible paradigm of the language. The only available occulting body is the V-final paradigm *káto/katóaŋ* (cf. (17)). We have just seen why /katop/ becomes *káto*, deleting the root-final consonant; the impossibility of **káto/katópaŋ* shows that deletion carries over, for OO faithfulness reasons, to *káto*'s immediate morphological derivatives — a direct parallel to *bomb/bombing* in (4).

The crucial ranking locates OO-DEP-C above IO-MAX-C, as in the following recursive tableau:

(22) /katop/ → *káto/katóaŋ*: OO-DEP-C >> IO-MAX-C

/katop/	CODA-COND	OO-DEP-C	IO-MAX-C	
a. ☞ káto			*	>>
b. kátop.	* !			
/katop+aŋ/	CODA-COND	OO-DEP-C	IO-MAX-C	
a. ☞ katóaŋ			*	
b. kató.paŋ		* !		

CODA-COND is irrelevant in the lower recursion, because root-final *p* can be syllabified as an onset to the vowel-initial suffix *-aŋ*. Nevertheless, *katóaŋ* is optimal, since it is more faithful in the OO dimension, though less faithful in the IO dimension.

Schematically, the ranking here is identical to the other cases of paradigm occultation, L′ (10) and Kansai B (16). Likewise, this ranking makes it possible to apply the lexicon optimization procedure to Makassarese.

(23) Lexicon Optimization in Makassarese for the *káto/katóaŋ* Paradigm

		CODA-COND	ℂ	OO-DEP-C	IO-MAX-C
a. ☞ /kato/	☞ {káto, katóaŋ}				
	{kátop, katópaŋ}	* !			
	{káto, katópaŋ}			* !	
	{kátopoʔ, katópaŋ}		* !		
b. /katop/	☞ {káto, katóaŋ}				*, *
	{kátop, katópaŋ}	* !			
	{káto, katópaŋ}			* !	*
	{kátopoʔ, katópaŋ}		* !		

The root /kato/ occults the root /katop/ with respect to the *káto/katóaŋ* paradigm, because /kato/ produces the more harmonic mapping to this paradigm.

The argument so far shows that V-final roots will correctly occult C-final roots ending in illicit codas. But this is only appropriate with roots which end in non-coronals or non-continuants, such as /katop/. Roots ending in *r*, *l*, and *s* (19) have echo-vowel epenthesis rather than deletion of the illicit coda. Sorting all this out is a little complicated but very useful in the end.

Structurally, epenthesis of a fixed vowel (**kátopiʔ*, **jámaliʔ*) or an echo vowel (**kátopoʔ*, *jámalaʔ*) both involve insertion of a vocalic root-node that is not present in the input, thereby violating IO-DEP-V. These two types of epenthesis differ, however, on the provenance of the vocalic place-node. When a fixed vowel is epenthesized, its vocalic place features must be added too, so IO-DEP-VPL is also violated. But when an echo vowel is epenthesized, its vocalic place features are obtained by autosegmental spreading from a nearby vowel, thereby violating a very different faithfulness constraint, IO-NO-SPR-VPL (McCarthy to appear).

From these structural and faithfulness considerations, we can proceed to develop some ranking arguments, which I present here in compact form:

(24) Rankings Dispositive of /katop/ and /jamal/

	Candidate Comparison	Ranking
a.	**jama* ≺ *jamalaʔ*	IO-MAX-C >> IO-DEP-V
		IO-MAX-C >> IO-NO-SPREAD-VPL
b.	**jamaliʔ* ≺ *jamalaʔ*	IO-DEP-VPL >> IO-NO-SPREAD-VPL
c.	**kátopiʔ* ≺ *káto*	IO-DEP-VPL >> IO-MAX-C

Echo-vowel epenthesis incurs violations of two faithfulness constraints, IO-Dep-V and IO-No-Spread-VPl. The alternative of deleting the offending consonant is worse, however, as (24a) shows. Echo-vowel and fixed-vowel epenthesis differ on how vocalic place is obtained, by insertion or spreading. The comparison of their relative faithfulness is made in (24b). Finally, (24c) shows why consonant deletion is preferred to fixed-vowel epenthesis. It accounts for the impossibility of the paradigm (20b) and supplies a partial solution to the identity of ℂ in (21).

Unlike consonant deletion, echo-vowel epenthesis does not carry over from the simple form to the complex one: /jamal/ → *jámalaʔ/jamálaŋ*, **jámalaʔ/jamálakaŋ*.[9] Differences like this are determined by details of the ranking of OO faithfulness and IO faithfulness. Consonant deletion carries over in the paradigm because OO-Dep-C dominates IO-Max-C (see (22)). But the /jamal/ paradigm requires the opposite ranking for a different OO/IO faithfulness pair:

(25) /jamal/ → *jámalaʔ/jamálaŋ*: IO-No-Spread-VPl >> OO-Max-V

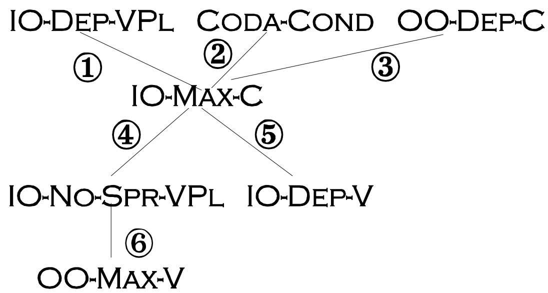
/jamal/	Coda-Cond	IO-No-Spread-VPl	OO-Max-V	
a. ☞ jáma.laʔ		*		>>
b. jámal.	* !			

/jamal+aŋ/	Coda-Cond	IO-No-Spread-VPl	OO-Max-V
a. ☞ jamá.laŋ			*
b. jamá.lakaŋ		* !	

Because IO-No-Spread-VPl dominates OO-Max-V, preserving vocalism within the paradigm is subordinated to avoiding echo-vowel epenthesis. This is just the opposite of the situation with deletion of illicit codas, where paradigmatic resemblance takes precedence over faithfulness to the input. Distinctions like this emphasize one of the main tenets of Transderivational Correspondence Theory: OO faithfulness constraints are expressed within Correspondence Theory, and so they may be as nuanced as other faithfulness constraints.[10]

In summary, the evidence discussed thus far supports the following rankings:

(26) Ranking Summary



Explication of Rankings:

① Consonant deletion is preferable to epenthesis of a non-echo vowel.

② CODA-COND can compel deletion (and echo-vowel epenthesis, by transitivity through ④).

③ Deletion of the root-final consonant in the simple form is transmitted to the morphologically derived form.

④, ⑤ Echo-vowel epenthesis is preferred to consonant deletion.

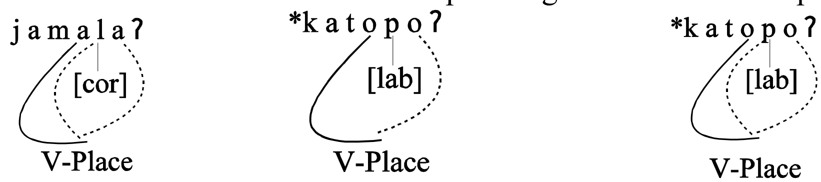
⑥ Echo-vowel epenthesis in the simple form is not transmitted to the morphologically derived form.

This conspectus of the grammar reveals a not unanticipated problem. The rankings designated by ④ and ⑤ in (26) entail that a candidate with deletion of the root-final consonant will always lose to a candidate that preserves the consonant by echo-vowel epenthesis. Yet from the input /katop/, the output is *káto* and not **kátopoʔ* (see (20c)). Succinctly, the issue is this: echo-vowel epenthesis is possible only when the consonant over which the vowel spreads is one of the coronal continuants *r*, *l*, and *s*, as in (19). When the root-final consonant is non-coronal and/or non-continuant, such as *p*, echo-vowel epenthesis is not allowed, and the root-final consonant deletes instead. The grammar developed thus far does not support this distinction.

Gafos & Lombardi (in prep.) address this issue in the context of a general theory of coronal and laryngeal "transparency" effects. Building on some proposals in McCarthy (1994), they argue that the intervening consonant is not transparent at all, but rather is itself a target of autosegmental spreading, as in (27a). Skipping the intervening consonant, as in (27b), is prohibited by locality requirements. Therefore, any case of echo-vowel epenthesis involves spreading vocalic place from the first vowel to the rest of the VCV sequence, *including the consonant*. The difference between coronal continuants (27a) and other consonants (27c) is that only coronal continuants will accept the spreading feature in Makassarese:

(27) Licit and Illicit Structures for Echo-Vowel Epenthesis

a. Licit Structure b. Non-Local Spreading c. Blocked Spreading



There are, then, two main elements of the analysis: categorical exclusion of non-local spreading, as in (27b), and differences among consonants in ability to accommodate the spread feature, as in (27a) vs. (27c). Limitations of space preclude giving a complete account here, but I will briefly sketch the general approach.

According to Gafos (1996), Ní Chiosáin & Padgett (1997), and others, autosegmental spreading is always strictly local, without exception and under all circumstances. In their view, spreading represents extension of a single articulatory gesture in the time domain, a process that is by its very nature strictly local. If this view is correct, then structures like (27b) are not even in the candidate set.[11]

The contrast between (27a) and (27c) shows that coronal continuants accept spreading of vocalic place but other consonants do not. This difference makes sense when we look at other languages that also permit only a subset of their consonants to participate in VCV spreading.

(28) Consonants That Accept Spreading of Vocalic Place in VCV

a. Laryngeals *ʔ, h*	Aoki 1968: Nez Perce
	Steriade 1987: many cases
b. Gutturals *ʔ, h, ʕ, ħ, χ, ʁ*	McCarthy 1991: various Semitic cases
c. (b) plus coronal sonorants *l, r, n*	McCarthy 1991: Bedouin Arabic
d. Coronal continuants *l, r, s*	Makassarese, Selayarese, Konjo
e. Liquids *l, r*	Paradis & Prunet 1989: Mau
f. Various coronals	Paradis & Prunet 1989: Gere
	Paradis & Prunet 1989: Fula
g. All consonants	Clements & Hume 1995: Servigliano Italian

Two factors are important in determining whether a consonant can accommodate VCV spreading: place and stricture. Consonants with unmarked place — that is, laryngeals and coronals — and consonants with vowel-like stricture — that is, continuants and sonorants — are favored in VCV spreading situations.

These classes of consonants devolve from the intersection of two constraint hierarchies. One is based on the universal place harmony scale:

(29) Place Harmony Scale (Prince & Smolensky 1993: 181, Lombardi 1997)
Pl/Phar ≻ Pl/Cor ≻ Pl/Lab, Pl/Dors

According to this scale, coronals and laryngeals are less marked than labials and dorsals. Smolensky (1993/4) and McCarthy (1994) propose that this ordering is preserved in complex segments which combine one of the major articulations in (29) with some secondary vocalic place (VPl) articulation:[12]

(30) Place+V-Place Harmony Scale
Pl/Phar ≻ Pl/Cor ≻ Pl/Lab, Pl/Dors ≻ Pl/Phar+VPl ≻Pl/Cor+VPl ≻ Pl/Lab, Pl/Dors

The scale (30) makes the desired distinction between (27a) and (27c). According to this scale, it is less harmonic for a labial to bear secondary V-place (27c) than for a coronal (27a). Since the constraint that ultimately compels VCV spreading in Makassarese is IO-MAX-C, we correctly rule out (27c) and kindred examples by ranking IO-MAX-C as follows in a constraint hierarchy based on (30):

(31) Ranking of IO-MAX-C in Makassarese
... >> *PL/LAB+VPL, *PL/DORS+VPL >> IO-MAX-C >> *PL/COR+VPL >> *PL/PHAR+VPL

Thus, VCV spreading is possible when C is a coronal, but not when C is a labial or a dorsal.[13] This is part of the story for Makassarese.

The other kind of constraint that is relevant to spreading in VCV configurations expresses the familiar observation that assimilation tends to affect segments that are already rather similar to one another — see Itô, Mester, & Padgett (1995: 600) for a review. For the present case, we can rank consonants based on their similarity to vowels in the values of the stricture features [sonorant], [continuant], and [approximant] (on the latter, see Clements 1990: 293)).

(32) Similarity of Consonant Classes to Vowels in Stricture

	l, r	*l, r, s*	*l, r, n*	*l, r, n, s, t*
[approximant]	✓			
[sonorant]	✓		✓	
[continuant]	✓	✓		

The check-marks indicate where all members of a set of consonants agree with vowels in the value of the given feature. A partially ordered implicational hierarchy becomes evident when the typological data in (28) are reviewed in light of this table:

if *x* shares more of these stricture features with vowels than *y* does, no language will allow spreading in V*y*V unless it also allows spreading in V*x*V.

Itô, Mester, & Padgett propose to analyze implicational scales of assimilability in terms of a hierarchy of markedness constraints prohibiting autosegmental linkage between segments according to their degree of dissimilarity. Here, dissimilarity is measured in terms of features shared and unshared in (32).

(33) VC Linkage Constraints

NO-VS-LINK >> NO-VN-LINK, NO-VF-LINK >> NO-VL-LINK

where

S = [–approx, –son, –cont] (obstruent stops)
N = [–approx, +son, –cont] (nasals)
F = [–approx, –son, +cont] (fricatives)
L = [+approx, +son, +cont] (liquids)

NO-VN-LINK and NO-VF-LINK are not in a universally fixed ranking with respect to one another because they share equal numbers of stricture features in (32). They are therefore free to be ranked in a language-particular grammar, and in fact they are in Makassarese, which places NO-VN-LINK above and NO-VF-LINK below the constraint that compels echo-vowel epenthesis, IO-MAX-C.

(34) Ranking of VC Linkage Constraints in Makassarese
NO-VS-LINK >> NO-VN-LINK >> IO-MAX-C >> NO-VF-LINK >> NO-VL-LINK

With IO-MAX-C deployed like this, echo-vowel epenthesis, which presupposes VCV linkage, is preferred when the intervening C is a fricative or a liquid, but deletion of C is preferred when it is a nasal or a stop.

It is now possible to give a fairly complete account of the distinctions in (27). As we have seen, illicit root-final codas are resolved by echo-vowel epenthesis whenever possible, and otherwise they are deleted. Under strict locality, echo-vowel epenthesis entails VCV linkage, as in (27a, c). Restrictions on VCV linkage therefore determine when echo-vowel epenthesis is possible or not. Specifically, the constraints dominating IO-MAX-C in the hierarchies (31) and (34) determine when spreading to the consonant is worse than deleting it. The following tableau shows a typical application of these constraints:

(35) /katop/ → *káto*

/katop/	OO-DEP-C	IO-DEP-VPL	CODA-COND	NO-VS-LINK	*PL/LAB+VPL	IO-MAX-C
a. ☞ káto						*
b. káto.piʔ		* !				
c. kátop.			* !			
d. káto.poʔ				* !	* !	

Only the relevant parts of the hierarchies in (31) and (34) are given in this tableau. Form (35d) incurs a worse violation from these hierarchies than its competitor (35a) does, so (35d) is not optimal. In contrast, only the low-ranking portions of these hierarchies are violated in mappings like /jamal/ → *jámalaʔ*, so echo-vowel epenthesis is required with roots ending in *r, l,* or *s*:

(36) /jamal/ → *jámalaʔ*

/jamal/	OO-DEP-C	IO-DEP-VPL	CODA-COND	IO-MAX-C	NO-VL-LINK	*PL/COR+VPL
a. jáma				* !		
b. jáma.liʔ		* !				
c. jámal.			* !			
d. ☞ jáma.laʔ					*	*

We are now in a position to assess the results. The significance of this case, like Kansai B, is that the restriction on inputs only makes sense in terms of restrictions on outputs. Any putative MSC in Makassarese would somehow have to limit root-final segments to the set {V, *ʔ, ŋ, r, l, s*}. This is obviously a rather heterogeneous class, and so the MSC would be just a descriptive stipulation. The important insight of Gafos & Lombardi (in prep.) is that these restrictions on root-final segments can be revealingly analyzed in terms of the *output* phonology: the segments observed root-finally are exactly those that can be analyzed faithfully (vowels, *ʔ, ŋ*) or that, for independently motivated reasons, tolerate echo-vowel epenthesis (*r, l, s*). Once the phonology of echo-vowel epenthesis is disposed of, the putative MSC follows from the ranking OO-DEP-C >> IO-MAX-C in (22). It is a typical case of paradigm occultation, as (23) shows. No classic MSC is necessary or even possible.

7. Conclusion

The morpheme structure constraints of classic generative phonology impose language-particular restrictions on underlying representations. It has long been known that MSC's often duplicate the functions of rules or output constraints, and so Stampe, Prince & Smolensky, and others have proposed to eliminate them. In OT, the descriptive effects of MSC's are obtained from rankings that compel neutralization of potential underlying distinctions. One input is said to occult the other when both map onto a common output.

This paper has focused on MSC's that prevent alternations within a paradigm. Absence of alternation is an effect of high-ranking output-output faithfulness constraints which enforce intra-paradigmatic invariance. By the proper deployment of OO faithfulness, neutralization of a potential underlying distinction is carried over from a simple form to words derived from it. In this way, occultation is extended from the word to the paradigm.

Two examples were studied in detail, word minimality in Kansai Japanese and the phonology of root-final consonants in Makassarese. By their very nature, these phenomena make sense only in terms of output constraints. Except by stipulation, they cannot be analyzed with classic MSC's, and so they support this overall approach.

Notes

I am pleased to acknowledge the comments and suggestions I have received from John Alderete, Luigi Burzio, Caroline Jones, Ania Łubowicz, and Jen Smith in preparing this paper. Special thanks are due to Linda Lombardi for raising the question that first prompted this work and to Linda, Laura Benua, Alan Prince, and Paul Smolensky for extensive and indispensable advice along the way. This research was supported by the National Science Foundation under grant SBR-9420424.

1. Similar ideas are also pursued by Hudson (1974) and Myers (1991).

2. On lexicon optimization, also see Inkelas (1994), Itô, Mester, & Padgett (1995), Tesar & Smolensky (1996, 1998), and Yip (1996).

3. The underlying final /b/ of /bɑmb/ is justified by *bombard*. As was noted in the text, different affixes can define distinct correspondence relations, which then lead to distinct OO faithfulness constraints. The triplet *bomb/bombard/bombing* shows that $OO_{\textit{-ing}}$-Faith >> IO-Faith >> $OO_{\textit{-ard}}$-Faith — reflecting general properties of the affix classes known traditionally as Level 1 and Level 2 (see Benua 1997 and Burzio 1997 for discussion).

4. Benua (1997) assumes that affixation itself also incurs OO-Faith violations. We can safely ignore this here since all interesting candidates share these violations equally.

5. On the decomposition of the prosodic hierarchy into rankable constraints, see Itô & Mester (1992) and Selkirk (1995).

6. On foot structure and word minimality in Japanese, see Itô (1991), Itô, Kitagawa, & Mester (1996), Itô & Mester (1992), and Poser (1990),

7. On the transparency of epenthetic vowels to stress, see Alderete (to appear).

8. For analysis of the final epenthetic *ʔ*, see McCarthy & Prince (1994). It will be systematically disregarded in this paper.

9. Forms like this do occur with enclitics, which are stress-neutral: /rantas/ → *rántas<u>aki</u>* 'it is dirty' (Basri et al. 1997). This shows that clitics like /-i/ and true suffixes like /-aŋ/ induce different OO correspondence relations associated with differently ranked faithfulness constraints. See section 3 and note 3.

10. A satisfactory analysis of these facts within a serial, lexical phonology model may be impossible. In lexical-phonological terms, the mapping /katop/ → *káto/katóaŋ* shows that consonant deletion is cyclic, while the mapping /jamal/ → *jámal<u>aʔ</u>/jamálaŋ* shows that echo-vowel epenthesis is post-cyclic. Since cyclic processes happen before post-cyclic ones, deletion of illicit codas precedes the resolution of illicit codas by echo-vowel epenthesis.

This ordering, which is entailed by the basic serial orientation of the theory of lexical phonology, is not compatible with the special case/default case relation between these two processes. The insight of Gafos & Lombardi (in prep.) is that echo-vowel epenthesis occurs under restricted conditions definable by independently motivated constraints, while consonant deletion is the default, applicable whenever echo-vowel epenthesis is blocked. In rule-ordering terms, this means that echo-vowel epenthesis must precede consonant deletion — just the opposite of the ordering given by considerations of cyclicity.

As a parallel theory, TCT encounters no comparable difficulties because it does not tie cyclicity to the special case/default case relation between the two processes. Cyclicity is controlled by the ranking of OO faithfulness constraints relative to IO faithfulness (22, 25), while the special vs. default is determined by the ranking between two IO faithfulness constraints (24a). In a fully parallel architecture like TCT, multiple sources of faithfulness (OO and IO) can interact in ways that are impossible in a serial architecture like lexical phonology.

11. Non-local spreading, as in (27b), could also be ruled out by a rankable constraint, which would then be undominated in Makassarese.

12. Two elementary harmony scales are combined to yield (30). The elementary scales are (29) and the non-complexity scale (simple ≻ complex — Prince & Smolensky 1993: 180). They are combined by taking their *lexicographic product* (Prince & Smolensky 1991: (28)): the elementary scales are ranked, and the complex scale forms all pairs from the elements of the two scales, giving ranking priority to the higher-ranking scale. In (30), the non-complexity scale takes priority.

13. VCV spreading is in principle possible when C is a laryngeal, but in fact the situation never arises in Makassarese, since *ʔ* obeys CODA-COND, eliminating the necessity for deletion or epenthesis. Generally, (31) predicts that, if VCV spreading is possible when C is coronal, then it will be possible when C is laryngeal. But (34) may militate against VCV spreading with a laryngeal C, depending on C's stricture features.

References

Alderete, John. To appear. Faithfulness to prosodic heads. The derivational residue in phonology, ed. by Ben Hermans & Marc van Oostendorp, Amsterdam: John Benjamins.

Aoki, Haruo. 1968. Toward a typology of vowel harmony. International Journal of American Linguistics 34.142–145.

Archangeli, Diana. 1996. Output identity and Javanese vowels. Handout of talk presented at the third annual meeting of the Austronesian Formal Linguistic Association, UCLA.
Aronoff, Mark, Azhar Arsyad, Hassan Basri, & Ellen Broselow. 1987. Tier configuration in Makassarese reduplication. Papers from the 23rd regional meeting. Chicago Linguistic Society, part two: parasession on autosegmental and metrical phonology, 1–15. Chicago: Chicago Linguistic Society.
Basri, Hasan, Ellen Broselow, Dan Finer, & Elisabeth Selkirk. 1997. Prosodic word and morphosyntactic word in Makassarese phonology. Talk presented at ZAS conference on the phonological word.
Benua, Laura. 1995. Identity effects in morphological truncation. University of Massachusetts Occasional Papers in Linguistics 18: Papers in Optimality Theory, 77–136. Amherst, MA: GLSA, University of Massachusetts.
Benua, Laura. 1997. Transderivational Identity: Phonological Relations between Words. Amherst, MA: University of Massachusetts dissertation.
Broselow, Ellen. 1982. On the interaction of stress and epenthesis, Glossa 16.115-32.
Buckley, Eugene. To appear. Uniformity in extended paradigms. The derivational residue in phonology, ed. by Ben Hermans & Marc van Oostendorp, Amsterdam: John Benjamins.
Burzio, Luigi. 1994a. Principles of English stress. Cambridge: Cambridge University Press.
Burzio, Luigi. 1994b. Metrical consistency. Language computations, ed. by Eric Ristad, Providence, RI: American Mathematical Society.
Burzio, Luigi. 1996. Surface constraints versus underlying representation. Current trends in phonology: Models and methods, ed. by Jacques Durand & Bernard Laks, 123-42. Manchester, England: European Studies Research Institute, University of Salford.
Burzio, Luigi. 1997. Strength in numbers. Ms., Johns Hopkins University.
Bybee, Joan. 1985. Morphology: A study of the relation between meaning and form. Amsterdam: John Benjamins.
Chomsky, Noam & Morris Halle. 1968. The Sound Pattern of English. New York: Harper and Row.
Clayton, Mary L. 1976. The redundance of underlying morpheme-structure conditions. Language 52.295-313.
Clements, G. N. 1990. The role of the sonority cycle in core syllabification. Papers in Laboratory Phonology I: Between the Grammar and the Physics of Speech, ed. by John Kingston & Mary E. Beckman, 283-333. Cambridge: Cambridge University Press.
Clements, G. N. and Elizabeth Hume. 1995. The internal organization of speech sounds. The Handbook of Phonological Theory, ed. by John Goldsmith, 245–306. Oxford: Blackwell.
Crosswhite, Katherine. 1996. A non-cyclic approach to Chamorro cyclicity. Handout of talk presented at the Third Annual Meeting of the Austronesian Formal Linguistic Association, UCLA.
Friberg, Timothy and Barbara Friberg. 1991. Notes on Konjo phonology. Studies in Sulawesi Linguistics, ed. by J. N. Sneddon, 71-115. Jakarta: NUSA, Studies in Indonesian and other languages of Indonesia.
Gafos, Adamantios. 1996. The Articulatory Basis of Locality in Phonology. Baltimore: Johns Hopkins University dissertation.
Gafos, Adamantios & Linda Lombardi. In prep. Coronal transparency.
Goldsmith, John. 1990. Autosegmental and Metrical Phonology. Oxford: Blackwell.
Goldsmith, John. 1993. Phonology as an intelligent system. Bridges between Psychology and Linguistics: A Swarthmore Festschrift for Lila Gleitman, ed. by Donna Jo Napoli & Judy Kegl, 247–267. Hillsdale, NY: Lawrence Erlbaum Associates.
Hayes, Bruce. 1995. Metrical Stress Theory: Principles and Case Studies. Chicago: University of Chicago Press.

Hudson, Grover. 1974. The role of SPC's in Natural Generative Phonology. Papers from the Parasession on Natural Phonology, 171-83. Chicago: Chicago Linguistic Society.

Inkelas, Sharon. 1994. The consequences of optimization for underspecification. Berkeley: University of California, ms.

Itô, Junko. 1989. A prosodic theory of epenthesis. Natural Language and Linguistic Theory, 7. 217–260.

Itô, Junko. 1991. Prosodic minimality in Japanese. CLS 26-II: Papers from the Parasession on the Syllable in Phonetics and Phonology, 213-40. Chicago: Chicago Linguistic Society.

Itô, Junko, Yoshihisa Kitagawa & R. Armin Mester. 1996. Prosodic Faithfulness and Correspondence: Evidence from a Japanese Argot. Journal of East Asian Linguistics 5.217-294.

Itô, Junko & Ralf-Armin Mester. 1992. Weak layering and word binarity. UCSC ms.

Itô, Junko, Armin Mester, & Jaye Padgett. 1995. Licensing and underspecification in Optimality Theory. Linguistic Inquiry 26.271–613.

Kager, René. To appear. Surface opacity of metrical structure in Optimality Theory. The derivational residue in phonology, ed. by Ben Hermans & Marc van Oostendorp. Amsterdam: John Benjamins.

Kenstowicz, Michael. 1996. Base-identity and uniform exponence: Alternatives to cyclicity. Current trends in phonology: Models and methods, ed. by Jacquest Durand & Bernard Laks, 363-93. Manchester, England: European Studies Research Institute, University of Salford.

Kenstowicz, Michael & Charles Kisseberth. 1977. Topics in Phonological Theory. New York: Academic Press.

Kisseberth, Charles. 1970. On the functional unity of phonological rules. Linguistic Inquiry 1.291-306.

Kraska-Szlenk, Iwona. 1995. The phonology of stress in Polish. University of Illinois dissertation.

Lombardi, Linda. 1997. Why Place and Voice are different: Constraint interactions and feature faithfulness in Optimality Theory. College Park:University of Maryland, ms.

McCarthy, John. 1991. The phonology of Semitic pharyngeals. Amherst, MA: University of Massachusetts, ms.

McCarthy, John. 1994. On coronal "transparency". Talk presented at TREND, UCSC.

McCarthy, John. To appear. Faithfulness and Prosodic Circumscription, Optimality Theory: Syntax, Phonology, and Acquisition, ed. by Joost Dekkers, Frank van der Leeuw & Jeroen van de Weijer, Oxford: Oxford University Press.

McCarthy, John, & Alan Prince. 1986. Prosodic Morphology. University of Massachusetts, Amherst and Brandeis University, ms. [Issued in 1996 as Technical Report #32, Rutgers University Center for Cognitive Science.]

McCarthy, John & Alan Prince. 1991a. Prosodic minimality. Lecture presented at University of Illinois Conference The Organization of Phonology.

McCarthy, John & Alan Prince. 1991b. Linguistics 240: Prosodic Morphology. Lectures and handouts from 1991 LSA Linguistic Institute Course. University of California, Santa Cruz.

McCarthy, John & Alan Prince. 1993. Prosodic Morphology I: Constraint Interaction and Satisfaction. University of Massachusetts, Amherst, and Rutgers University, ms.

McCarthy, John & Alan Prince. 1994. "The Emergence of the Unmarked: Optimality in Prosodic Morphology," Proceedings of the North East Linguistics Society 24, ed. by Mercè Gonzàlez, 333-79. Amherst, MA.: GLSA.

McCarthy, John & Alan Prince. 1995. Faithfulness and reduplicative identity. University of Massachusetts Occasional Papers in Linguistics 18: Papers in Optimality Theory, 249-384. Amherst, MA: GLSA, University of Massachusetts.

Mester, R. Armin. 1994. The quantitative trochee in Latin. Natural Language and Linguistic Theory 12.1–62.

Mithun, Marianne & Hasan Basri. 1986. The phonology of Selayarese. Oceanic Linguistics 25.210-254.

Myers, Scott. 1991. Persistent rules. Linguistic Inquiry 22.314–344.

Ní Chiosáin, Máire & Jaye Padgett. 1997. Markedness, segment realization, and locality in spreading. University College Dublin and University of California, Santa Cruz, ms.

Orgun, C. Orhan. 1994. Monotonic cyclicity and Optimality Theory. Proceedings of the NELS 24, ed. by Mercè Gonzàlez, 461-74. Amherst, MA: GLSA, University of Massachusetts.

Orgun, C. Orhan. 1996. Sign-based morphology and phonology with special attention to Optimality Theory. Berkeley: University of California dissertation.

Paradis, Carole & Jean-François Prunet. 1989. On coronal transparency. Phonology 6.317–348.

Pater, Joe. 1995. On the non-uniformity of weight-to-stress and stress preservation effects in English. McGill University, ms.

Poser, William. 1990. Evidence for foot stucture in Japanese. Language, 66.78–105.

Prince, Alan. 1980. A metrical theory for Estonian quantity. Linguistic Inquiry, 11.511–562.

Prince, Alan & Paul Smolensky. 1991. Optimality. Handout of talk presented at the University of Arizona, Tucson.

Prince, Alan & Paul Smolensky. 1993. Optimality Theory: Constraint Interaction in Generative Grammar. Rutgers University and University of Colorado, ms.

Selkirk, Elisabeth. 1980a. Prosodic domains in phonology: Sanskrit revisited. Juncture, ed. by Mark Aronoff & Mary-Louise Kean, 107–129. Saratoga, CA: Anma Libri.

Selkirk, Elisabeth. 1980b. The role of prosodic categories in English word stress. Linguistic Inquiry, 11.563–605.

Selkirk, Elisabeth O. 1995. The prosodic structure of functional elements: affixes, clitics, and words. University of Massachusetts Occasional Papers in Linguistics 18: Papers in Optimality Theory, 439-470. GLSA, Amherst, MA: University of Massachusetts.

Smolensky, Paul. 1993/4. Harmony, markedness, and phonological activity. Handout from Rutgers Optimality Workshop 1. Revised.

Stampe, David. 1969. The acquisition of phonetic representation. Papers from the Fifth Regional Meeting, Chicago Linguistics Society., 443-54. Chicago: Chicago Linguistic Society.

Stampe, David. 1973a. How I Spent My Summer Vacation [A Dissertation on Natural Phonology]. Chicago: University of Chicago dissertation..

Stampe, David. 1973b. On chapter 9. Issues in Phonological Theory, ed. by Michael Kenstowicz & Charles Kisseberth. The Hague: Mouton.

Steriade, Donca. 1987. Locality conditions and feature geometry. Proceedings of North Eastern Linguistics Society 17, 595-618. Amherst, MA: GLSA.

Tesar, Bruce & Paul Smolensky. 1996. Learnability in Optimality Theory (long version). Technical report, Department of Cognitive Science, Johns Hopkins University.

Tesar, Bruce & Paul Smolensky. 1998. Learnability in Optimality Theory. Linguistic Inquiry 29.229–268.

Urbanczyk, Suzanne. 1996. Patterns of Reduplication in Lushootseed. Amherst, MA: University of Massachusetts dissertation.

Yip, Moira. 1996. Lexicon optimization in a language without alternations. Current trends in phonology: Models and methods, ed. by Jacques Durand & Bernard Laks. Manchester, England: European Studies Research Institute, University of Salford.