

The Diachronic Link between Onset Clusters and Codas*

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0. Introduction

Is there a link between onset clusters and coda consonants such that the presence of a complex onset in a language implies the presence of a coda in that language (as claimed by Kaye and Lowenstamm 1981, henceforth K&L)? Do languages that lack or restrict coda consonants also lack (or restrict) onset clusters? If so, what are the diachronic implications of this? In some of our recent work (Baertsch and Davis 2003, Davis and Baertsch 2004), we explore links between onset clusters and coda consonants. Here we consider the diachronic implications of such a link. In Section 1 we discuss this link, pointing out its consequences for syllable typology, and offer an Optimality-Theoretic explanation for the link. In Sections 2 and 3 we pursue its diachronic implications by examining two cases where languages have developed restrictions on codas with concomitant restrictions on onset clusters. Specifically, we consider the change in syllable structure between Campidanian Sardinian and Latin in Section 2 and between Pali and Sanskrit in Section 3. We conclude the paper in Section 4 by raising issues for future research.

1. The Link between Onset Clusters and Codas

K&L (1981:291) claim that “the existence of syllables with branching onsets implies the existence of syllables with branching rimes.” We will refer to this as K&L’s generalization. Since K&L are clear in their article that by branching rime they mean branching into a coda, we can restate their generalization as “the presence of a branching onset in a language implies the presence of codas in that language.” An interesting implication of K&L’s generalization for syllable typology is that maximal syllable types would be as in (1a-c), while (1d) would be ruled out (contra Blevins 1995).

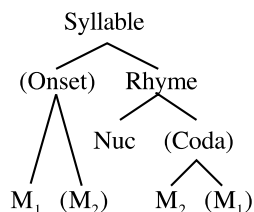
- (1) Maximal syllable types under K&L’s generalization
a. CV b. CVC c. CCVC d. *CCV

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K&L base their generalization not on a typological survey of syllable types across different languages, but on the formal property of syllable markedness. Specifically, they note that rimes are less marked than onsets since the rime is the required component of the syllable. They assume that there is a formal constraint on the syllable that the onset cannot be more marked than the rime; consequently, if a language allows for a marked onset (i.e. branching), then it must allow for a marked (branching) rime. That is, just as the presence of an onset implies the presence of a rime, the presence of branching in the onset implies the presence of branching in the rime. While the typological basis for K&L's generalization has yet to be fully explored (see our discussion in Section 4), Baertsch and Davis (2003) point to a variety of apparently unrelated phenomena that can be understood from the perspective of K&L's generalization. This includes acquisition data that in languages having codas and complex onsets, children acquire codas before acquiring complex onsets. They do not go through a stage in which the syllable type in (1d) is attested (ignoring the separate issue of s-clusters which often do not behave like true onset clusters in acquisition; see, for example, Barlow (1997).)

In order to account for the link between a coda consonant and the second member of an onset, Baertsch and Davis (2003) make reference to the *Split Margin* approach to the syllable developed in Baertsch (2002) and shown in (2).

(2) The *Split Margin* approach to the syllable (Baertsch 2002)



As background to this approach to the syllable, it is worth recalling that researchers such as Zec (1988), Clements (1990), and Orgun (2001) have noted the preference for coda consonants to be of high sonority and have suggested constraints on coda sonority that give preference to coda consonants with high sonority. Other researchers, such as Gouskova (2001) and Green (2003), who focus on onset clusters, posit constraints on sonority distance that have the effect of favoring a high sonority consonant as the second member of an onset. Further, we note that Prince and Smolensky's (2004) (henceforth P&S) Margin Hierarchy gives low sonority preference to all margin consonants, and this (as P&S themselves note) has no way of capturing the high sonority preference for a coda consonant and the second member of an onset cluster. Since both a single coda consonant and the second member of an onset cluster prefer a high sonority consonant, Baertsch (2002) splits the Margin Hierarchy into two: an M_1 hierarchy in (3) that governs the first member of an onset, giving priority to low sonority consonants (like P&S's Margin Hierar-

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chy), and an M_2 hierarchy in (4) that governs a single coda as well as the second segment of an onset, giving priority to high sonority consonants. (Note here that low vowels and very often high vowels as well are parsed as peaks rather than M_2 segments due to low-ranking *Peak/Vowel.)

- (3) The M_1 Hierarchy
* M_1 /[+lo] >> * M_1 /[+hi] >> * M_1 /r >> * M_1 /l >> * M_1 /Nas >> * M_1 /Obs
- (4) The M_2 Hierarchy
* M_2 /Obs >> * M_2 /Nas >> * M_2 /l >> * M_2 /r >> (* M_2 /[+hi] >> * M_2 /[+lo])

One benefit of the split margin hierarchy is that it captures the high sonority preference for a single coda and the second member of an onset, since these are both governed by the M_2 Hierarchy. The split margin approach also formally accounts for K&L's generalization that the presence of an onset cluster in a language implies the presence of a coda in that language, but in order to see this, we must first discuss the analysis of onset clusters.

In the split margin approach, onset clusters are accounted for in an optimality-theoretic grammar by the local conjunction of the M_1 constraints (in (3)) with the M_2 constraints (in (4)). The conjoined constraints are intrinsically ranked with respect to each other (reflecting the ranking of the component M_1 and M_2 hierarchies). Given this, an obstruent-rhotic cluster will be the favored onset cluster because * M_1 /Obs is the lowest ranking M_1 constraint and * M_2 /r is the lowest ranking relevant M_2 constraint. Consequently, the conjunction * M_1 /Obs&* M_2 /r is the lowest ranking of the conjoined * M_1 &* M_2 constraints. Consider the Spanish data in (5). As these data show, Spanish allows for obstruent-sonorant onset clusters but not obstruent-obstruent ones. An underlying obstruent-obstruent cluster that could potentially surface in syllable-initial position (5c) actually surfaces with a prothetic vowel (a violation of DEP), but the underlying obstruent-sonorant sequences of (5a-b) surface as complex onsets.

- (5) Exemplification from Spanish
- | | | |
|-------------|------------|---------|
| a. /blanka/ | [blaŋ.ka] | 'white' |
| b. /pronto/ | [pron.to] | 'soon' |
| c. /sposa/ | [es.po.sa] | 'wife' |

The patterning of (5) reflects the constraint ranking in (6), with the relevant tableaux shown in (7) and (8). The Spanish analysis in (6)-(8) shows how the split margin approach neatly accounts for onset clusters, especially the preference for obstruent-sonorant onset clusters.

- (6) Constraint ranking for Spanish
* M_1 /Obs&* M_2 /Obs >> DEP >> * M_1 /Obs&* M_2 /l >> * M_1 /Obs&* M_2 /r

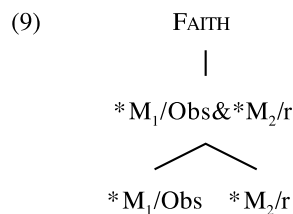
(7) /bla/ [bla]

/bla/	*M ₁ /Obs& *M ₂ /Obs	DEP	*M ₁ /Obs& *M ₂ /l	*M ₁ /Obs & *M ₂ /r
☞ a. bla			*	
b. εb.la		*!		

(8) /spo/ [εs.po]

/spo/	*M ₁ /Obs& *M ₂ /Obs	DEP	*M ₁ /Obs& *M ₂ /l	*M ₁ /Obs & *M ₂ /r
a. spo	*!			
☞ b. εs.po		*		

What is interesting is that this approach provides a natural explanation for K&L's generalization that the presence of a complex onset in a language implies the presence of codas in that language. Given the logic of constraint conjunction, a conjoined constraint must dominate the individual conjuncts. If the conjoined constraint *M₁/Obs&*M₂/r is ranked low enough (below the relevant faithfulness constraints) so as to allow for onset clusters (as in Spanish), then it must follow that rhotics be allowed as single codas, given that a conjoined constraint outranks each of the single conjuncts. This is shown in (9).



The consequence of this ranking is that if a language allows for an onset cluster, it also allows for the presence of a coda, thus giving a formal explanation for K&L's generalization, that the presence of a complex onset implies the presence of a coda. If we then consider syllable typology, we would expect to find languages whose maximal syllable is CV (constraint ranking 10a), CVC (10b), and CCVC (10c).

- (10) Accounting for syllable typology
- ranking for a CV language
*M₁/Obs&*M₂/Son >> (*M₂/Obs) >> *M₂/Son >> FAITH
 - ranking for a CVC language
*M₁/Obs&*M₂/Son >> FAITH >> (*M₂/Obs) >> *M₂/Son
 - ranking for a CCVC language
FAITH >> *M₁/Obs&*M₂/Son >> (*M₂/Obs) >> *M₂/Son

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However, a language whose maximal syllable is CCV with the hypothetical ranking in (11) is a formal impossibility given the logic of constraint conjunction. The ranking in (11) fails on several accounts. First, it would require a conjoined constraint to be lower ranked than one of the individual conjuncts. And second, a surface obstruent-sonorant onset cluster incurs violations of both $*M_2/\text{Son}$ and the conjoined constraint. The violation of $*M_2/\text{Son}$ would be fatal.

- (11) Hypothetical ranking of a CCV language
 $(*M_2/\text{Obs}) \gg *M_2/\text{Son} \gg \text{FAITH} \gg *M_1/\text{Obs} \& *M_2/\text{Son}$

Notice that this situation also correctly predicts the observation from language acquisition noted earlier that the acquisition of onset clusters occurs after the acquisition of codas. That is, the ranking in (10c) has (10b) as a preliminary stage, while the ranking in (11) is impossible.

In the next two sections we consider diachronic implications of the split margin approach. If a CCVC language (10c) starts to lose or restrict its coda consonants, it should also lose or restrict its onset clusters accordingly. As far as we are aware, this diachronic link has not been previously noted. In the next two sections we will consider two cases that exemplify this diachronic link. In Section 2 we will consider Campidanian Sardinian, a daughter of Latin in which laterals have become rhotics both in coda position and as the second member of an onset. And in Section 3 we will consider the development of Pali from Sanskrit.

2. Campidanian Sardinian

Campidanian Sardinian (Bolognesi 1998, Alber 2001, Smith 2003, Frigeni 2004, 2005) descends from Latin, a CCVC language (ignoring the issue of s-clusters and certain cases of complex codas) in which basically any consonant (regardless of sonority value) could be a single coda. Latin codas can be accounted for by the constraint ranking in (12), where the entire M_2 hierarchy is dominated by FAITH.

- (12) Ranking of the M_2 Hierarchy in Latin
 $\text{FAITH} \gg *M_2/\text{Obstruent} \gg *M_2/\text{Nasal} \gg *M_2/l \gg *M_2/r \dots$

Latin allows for onset clusters of an obstruent followed by a sonorant. This means that the relevant conjoined constraints are also ranked below FAITH, as in (13).

- (13) Ranking permitting obstruent-sonorant onset clusters in Latin
 $\text{FAITH} \gg *M_1/\text{Obs} \& *M_2/l \gg *M_1/\text{Obs} \& *M_2/r \gg \dots \gg *M_2/l \gg *M_2/r$

Campidanian Sardinian (henceforth Sardinian), on the other hand, has a syllable structure that is more restricted than Latin's, with respect to the nature of both the coda and the onset clusters. Moreover, the language distinguishes initial syllables, which allow onset clusters, from non-initial syllables, which lack them for the most

part. (See Alber 2001 on the importance of the initial syllable in Sardinian.) We focus on the initial syllable. In Sardinian, the only (unassimilated) singleton coda allowed is the rhotic. Coda laterals from Latin have rhotic reflexes in Sardinian, as exemplified in (14). (The lateral can occur syllable-initially in Sardinian, a position governed by the M_1 hierarchy.)

- (14) ALBUS > arba ‘white’
 (ORKU > orku ‘ogre’)

We can account for this by the ranking in (15), whereby the relevant faithfulness constraint, ID[Manner], is ranked below $*M_2/l$. ID[Manner] is violated if a lateral liquid changes to a rhotic liquid or vice-versa. The relevant tableau is shown in (16), where we assume (given richness of the base) an input lateral.

- (15) Ranking for Sardinian: $*M_2/l \gg \text{ID[Manner]} \gg *M_2/r$

- (16) /alba/ [ar.ba] ‘white’

/alba/	$*M_2/l$	ID[Manner]	$*M_2/r$
a. al.ba	*!		
☞ b. ar.ba		*	*

In comparison to the ranking in Latin (17), the Sardinian ranking in (15) ranks the FAITH constraint ID[Manner] below $*M_2/l$, disallowing lateral codas, but still above $*M_2/r$, thus permitting rhotic codas.

- (17) Ranking for Latin: $\text{ID[Manner]} \gg *M_2/l \gg *M_2/r$

What is interesting in Sardinian, and what previous researchers have noted but have viewed as an independent change, is the loss of the lateral when it is the second member of an onset cluster, as in (18a). Rhotics in clusters remained (18b).

- (18) Onset clusters
- | <u>Latin</u> | <u>Sardinian</u> | <u>Gloss</u> |
|--------------|------------------|--------------|
| a. PLUS | prus | ‘more’ |
| CLAVE | krai | ‘key’ |
| (LONGUS) | longu | ‘long’ |
| b. PRIMU | primu | ‘first’ |
| CRAS | krazi | ‘tomorrow’ |

The change follows naturally from the ranking in (15) under the split margin approach. In (19), we expand the ranking from (15) by adding the relevant conjoined constraints. The domination of ID[Manner] by $*M_2/l$ also entails its domination by $*M_1/\text{Obs} \& *M_2/l$. Thus, it is expected that if Latin /l/ has become [r] in coda

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position in Sardinian, then it should also become [r] as the second member of a complex onset, as we see in the tableau in (20).

- (19) Fuller ranking for Sardinian
 $*M_1/\text{Obs} \& *M_2/l \gg *M_2/l \gg \text{ID}[\text{Manner}] \gg *M_1/\text{Obs} \& *M_2/r \gg *M_2/r$

- (20) /plus/ [prus] ‘more’

/plus/	*M ₁ /Obs & *M ₂ /l	*M ₂ /l	ID[Manner]	*M ₁ /Obs & *M ₂ /r	*M ₂ /r
a. plus	*!	*			
b. prus			*	*	*

Given the ranking in (19), Latin obstruent-rhotic onset clusters are unchanged in Sardinian, in (21). Thus, our analysis under the split margin approach connects the historical change in the coda (14) with the change in onset clusters (18a).

- (21) /primu/ [primu] ‘first’

/primu/	*M ₁ /Obs & *M ₂ /l	*M ₂ /l	ID[Manner]	*M ₁ /Obs & *M ₂ /r	*M ₂ /r
a. primu				*	*
b. plimu	*!	*	*		

Sardinian codas, though, are more complicated in that, in addition to the sonority constraint that only allows the highly sonorous singleton rhotic in coda position, Sardinian has also witnessed the rise of the Coda Condition (in the sense of Ito (1986), where a coda shares place features with a following onset) in comparison to Latin. Specifically, with the exception of a singleton coda [r], as in *arba* ‘white’ in (14), Sardinian obeys the coda condition. The other possible codas in Sardinian include obstruents only if they are geminate (ignoring certain problems regarding the syllabification of s-clusters) and homorganic nasals. Sardinian thus offers an interesting interplay of coda (M₂) constraints that reference high sonority (Zec 1988) and the classic Coda Condition (Ito 1986).

There are other interesting details of Sardinian codas discussed in Davis and Baertsch (2004) and in our work in progress that space limitations prevent us from discussing. Nonetheless, the relevant point of our analysis is presented in (14)-(21). Namely, Sardinian provides a clear illustration of the diachronic implication of K&L’s generalization under the split margin approach to the syllable. A restriction on codas is necessarily mirrored in onset clusters because both are M₂ positions. Latin laterals in both M₂ positions have /r/ reflexes in Sardinian.

3. Pali

We now briefly consider another case where a diachronic change in the coda has implications for onset clusters. Sanskrit, like Latin, is a CCVC language with relatively unrestricted codas and obstruent plus sonorant onset clusters. (As with Sardinian, we will not discuss s-clusters.) Pali, like many other Indic languages descended from Sanskrit, restricts codas and bans onset clusters (Vaux 1992). The development of a more restricted syllable structure in Pali in relation to Sanskrit has been discussed widely by phonologists, including Vaux (1992) and Zec (1995). Changes have occurred in both codas and in onset clusters, but researchers have not formally connected these changes. In addition to the loss of onset clusters, Pali has developed a strict coda condition (henceforth CODACON) in the classical sense of Ito (1986). All codas share place with a following onset. There are no word-final codas in Pali.

(22)	<u>Sanskrit</u>	<u>Pali</u>	<u>Gloss</u> (Zec 1995)
	a. mudga	mugga	'bean'
	b. sarpa	sappa	'snake'
	c. dharma	dhamma	'righteousness'
	d. danta	danta	'tamed'
	e. traana	taana	'protection'

The data in (22a-c) show that original coda consonants from Sanskrit geminate with a following consonant in Pali, even if this means losing a sonorant feature. Therefore, CODACON outranks the M_2 constraints in Pali. (22d) shows that no change occurs in a coda that is already place-assimilated. (22e) shows the loss of a complex onset in the development of Pali from Sanskrit. While the full range of data on the loss of onset clusters is not shown here, the generalization observed by researchers is that the least sonorous consonant of the cluster survives in Pali.

Is there a link between the rise of CODACON and the loss of onset clusters in the development of Pali from Sanskrit? While previous researchers have not formally connected these developments, we make the tentative suggestion in (23) that CODACON can be expressed as a constraint on M_2 positions more generally. CODA/ M_2 CON would be low-ranked in Sanskrit but high-ranked in Pali.

- (23) CODACON as a constraint on the M_2 position (CODA/ M_2 CON)
 M_2 segments must share place features with a following consonant.

Let us first consider Sanskrit. As a CCVC language, Sanskrit has the constraint ranking in (24), similar to Latin. Sample tableaux are given in (25) and (26).

- (24) Ranking for Sanskrit
 FAITH >> * M_1 /Obs & * M_2 /Son >> (* M_2 /Obs) >> * M_2 /Son (>> CODA/ M_2 CON)

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(25) /mudga/ [mudga] ‘bean’

/mudga/	MAX	ID[Feat]	*M ₁ /Obs& *M ₂ /Son	*M ₂ /Obs	*M ₂ /r	CODA/M ₂ CON
☞ a. mud.ga				*		*
b. mu.ga	*!					
c. mug.ga		*!		*		

(26) /prati/ [prati] ‘against’

/prati/	MAX	ID[Feat]	*M ₁ /Obs& *M ₂ /Son	*M ₂ /Obs	*M ₂ /r	CODA/M ₂ CON
☞ a. pra.ti			*		*	*
b. pa.ti	*!					

In (25) and (26) we see that the relevant faithfulness constraints are high-ranked, so that CODA/M₂CON is violated by the winners. Candidate (25a) violates it since the coda contains a consonant [d] that does not share place of articulation with the following velar onset [g]. Candidate (26a) violates it because the second member of the onset, in M₂ position, also does not share place features. However, since CODA/M₂CON is low ranked, these violations are not fatal.

On the other hand, in Pali (27), relevant faithfulness constraints such as ID[Feat] and MAX are dominated by CODA/M₂CON. That is, Pali has witnessed the rise of CODA/M₂CON, affecting M₂ positions both in codas and onset clusters.

(27) Ranking for Pali

CODA/M₂CON >> MAX (>> *M₁/Obs&*M₂/Son) >> (*M₂/Obs) >> *M₂/Son

Sample tableaux are given in (28) and (29). We give underlying forms that reflect the historical Sanskrit, since these are possible underlying forms given richness of the base. The faithful candidate in (28a) now incurs a fatal violation of high-ranked CODA/M₂CON. The selection of (28c) over (28b) shows that it is preferable to satisfy CODA/M₂CON by place assimilation rather than by deletion.

(28) /mudga/ [mugga] ‘bean’

/mudga/	CODA/M ₂ CON	MAX	*M ₁ /Obs& *M ₂ /Son	*M ₂ /Obs	*M ₂ /r	ID[Feat]
a. mud.ga	*!			*		
b. mu.ga		*!				
☞ c. mug.ga				*		*

However, the winning candidate in (29b) shows that deletion is possible when assimilation is not. This candidate violates MAX but respects CODA/M₂CON. The

faithful candidate with an onset cluster in (29a) incurs a fatal violation of CODA/M₂CON. Thus, on the analysis reflected in the tableaux in (28) and (29), the feature change in the coda consonant and the deletion in the onset cluster are formally connected, because they both come about by avoiding a violation of CODA/M₂CON.

(29) /prati/ [prati] ‘against’

/prati/	CODA/M ₂ CON	MAX	*M ₁ /Obs& *M ₂ /Son	*M ₂ /Obs	*M ₂ /r	ID[Feat]
a. pra.ti	*!		*		*	
☞ b. pa.ti		*				

One question that arises from the analysis presented above is whether it is always the case that languages which obey the coda condition in the classical sense lack onset clusters. The use of CODA/M₂CON as proposed above seems to assume such. Many languages that strictly obey the coda condition, such as Japanese and Selayarese (Goldsmith 1990), also lack onset clusters. However, this is an empirical question that we leave for future research.

4. Conclusion

Diachronic changes reflected in languages like Sardinian and Pali constitute an interesting link between coda consonants and onset clusters. Changes in the coda can and do affect onset clusters. This diachronic connection has previously gone unrecognized. It may not have a natural phonetic explanation but is systemic, explained formally under the split margin approach to the syllable. This paper really sets an agenda for future research, since it raises a host of questions. Languages may restrict codas in ways not discussed here. As an example, modern Korean requires all coda consonants to be unreleased. Is it an accident then that the language also does not allow onset clusters? A larger issue concerns whether K&L’s generalization (the presence of a branching onset in a language implies the presence of codas in that language) is, in fact, typologically correct. We believe that it is a strong tendency. In addition to the Sardinian and Pali, one can point to modern Tibetan dialects in support of this generalization. Old Tibetan allowed for complex onsets and codas. Modern Tibetan dialects that allow onset clusters (e.g. western dialects like Balti spoken in Pakistan) also allow for codas, but those dialects that lack or restrict codas (such as Lhasa Tibetan) seem also to lack true onset clusters (see Baertsch 1999 for a survey). On the other hand, we are aware of potential counterexamples to K&L’s generalization such as the many West African languages (e.g. Ewe and Vata) (Kaye 1985) which seem to have a maximal CLV syllable (where L stands for ‘liquid’). Despite possible counterexamples to K&L’s generalization, we maintain that the previously unrecognized diachronic link between codas and onset clusters as seen in languages like Sardinian and Pali is an intriguing one, explainable under the split margin approach to the syllable.

References

- Alber, Birgit. 2001. Maximizing first positions. *Linguistics in Potsdam* 12:1-19.
- Baertsch, Karen. 1999. From CCCC to CV: A comparative study of initial consonant clusters in modern Tibetan dialects. Ms., Indiana University.
- . 2002. An optimality theoretic approach to syllable structure: The split margin hierarchy. Ph.D. diss., Indiana University.
- Baertsch, Karen, and Stuart Davis. 2003. The split margin approach to syllable structure. *ZAS Papers in Linguistics* 32:1-14.
- Barlow, Jessica. 1997. A constraint-based account of syllable onsets: Evidence from developing systems. Ph.D. diss., Indiana University.
- Blevins, Juliette. 1995. The syllable in phonological theory. In John Goldsmith, ed., *The Handbook of Phonological Theory*, 206-266. Cambridge, MA: Blackwell.
- Bolognesi, Roberto. 1998. The phonology of Campidanian Sardinian. Ph.D. diss., University of Amsterdam.
- Clements, G. N. 1990. The role of the sonority cycle in core syllabification. In J. Kingston and M. Beckman, eds., *Papers in Laboratory Phonology 1: Between the Grammar and Physics of Speech*, 283-333. New York: Cambridge University Press.
- Davis, Stuart, and Karen Baertsch. 2004. On explaining the link between coda consonants and onset clusters. Paper presented at McWOP 10, Chicago, IL.
- Frigeni, Chiara. 2004. Metathesis and assimilation in liquids from Latin to Campidanian Sardinian: A similarity account. To appear in *Going Romance 2003, Selected Papers*. Amsterdam: John Benjamins.
- . 2005. Parasitic /r/ in Southern Sardinian. Paper presented at MOT 2005, McGill University, Montreal.
- Goldsmith, John. 1990. *Autosegmental and Metrical Phonology*. Cambridge, MA: Blackwell.
- Gouskova, Maria. 2001. Falling sonority onsets, loanwords, and syllable contact. *Chicago Linguistic Society* 37:175-185.
- Green, Tonio. 2003. Extrasyllabic consonants and onset well-formedness. In Caroline Fery and Ruben van de Vijver, eds., *The Syllable in Optimality Theory*, 238-253. Cambridge: Cambridge University Press.
- Ito, Junko. 1986. Syllable theory in prosodic phonology. Ph.D. diss., University of Massachusetts, Amherst.
- Kaye, Jonathan Derek. 1985. On the syllable structure of certain West African languages. In D. Goyvaerts, ed., *African Linguistics: Essays in Memory of M. W. K. Semikenke*, 285-307. Philadelphia: John Benjamins.
- Kaye, Jonathan, and Jean Lowenstamm. 1981. Syllable structure and markedness theory. In Adriana Belletti, Luciana Brandi, and Luigi Rizzi, eds., *Theory of Markedness in Generative Grammar: Proceedings of the 1979 GLOW Conference*, 287-315. Pisa: Scuola Normale Superiore di Pisa.

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- Orgun, Cemil Orhan. 2001. English r-insertion in Optimality Theory. *Natural Language and Linguistic Theory* 19:737-749.
- Prince, Alan, and Paul Smolensky. 2004. *Optimality Theory: Constraint Interaction in Generative Grammar*. Malden, MA: Blackwell.
- Smith, Jennifer. 2003. Onset sonority constraints and subsyllabic structure. Ms., University of North Carolina. (Available on ROA.)
- Vaux, Bert. 1992. Gemination and syllable integrity in Sanskrit. *Journal of Indo-European Studies* 20:283-303.
- Zec, Draga. 1988. Sonority constraints on prosodic structure. Ph.D. diss., Stanford University.
- . 1995. The role of moraic structure in the distribution of segments within syllables. In Jacques Durand and Francis Katamba, eds., *Frontiers of Phonology*, 149-179. London: Longman.

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