Unifying Phonotactics and Derived Environment Blocking through Prosodic Constraint Indexation

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1 Introduction

In typical forms of derived environment blocking, restrictions on segment sequences within a prosodic domain are weakened when the same segments span a prosodic juncture. In this paper, I argue that these patterns are accounted for by indexing markedness constraints to the spans of prosodic constituents. By setting domains for phonotactic restrictions, these prosodically-indexed constraints account for derived environment blocking effects in parallel Optimality Theory (Smolensky and Prince 1993; McCarthy and Prince 1995). Furthermore, where prosodic Strict Layering is violated (Selkirk 1996), these constraints correctly predict cases where more marked structures are admitted in extraprosodic affixes than in root morphemes. The predictions of the proposal are compared with those of edge-based theories of domain restrictions, such as CRISPEDGE constraints (Ito and Mester 1999), which I argue do not account for the same range of blocking effects.

This paper is organized as follows. Section 2 presents the basic schema for prosodic constraint indexation. Section 3 discusses a pattern of constraint interaction that arises under Strict Layering violations, where extraprosodic material admits more marked structures than stem segments. Section 4 presents the inadequacies of purely edge-based constraints to account for these patterns. Section 5 concludes the paper.[*]

2 Prosodic domain constraint indexation

Previous research on morphology-phonology interactions has shown that a range of juncture-sensitive phenomena are accounted for by markedness constraints that make reference to prosodic context (Côté 2000; Flack 2009; Ito and Mester 2009a; Bennett and Henderson 2013). For instance, Côté (2000) defines constraints against consonant clusters at prosodic boundaries, and Flack (2009) proposes constraints on onsets and codas that target syllables at the ends of prosodic constituents. In these approaches, the evaluation of segmental and syllabic markedness constraints depends on where their violations occur with respect to constituents of the prosodic hierarchy (Nespor and Vogel 1986; Selkirk 1981a; among others), a version of which is given below.

(1) *The Prosodic Hierarchy*
Utterance (Utt)
Intonational Phrase (IP)
Phonological Phrase (PPh)
Phonological Word (PWd)
Foot (Ft)

Crucially, previous analyses within Optimality Theory have defined markedness constraints with reference to prosodic edges; that is, they are violated when a marked structure is found at the left or right edge of an

[*] This work is indebted to valuable feedback from Karen Jesney, Rachel Walker, Khalil Iskarous, and participants of PhonLunch/Phonetics Lab at USC. I must further thank Elisabeth Selkirk and Brian Smith for their very helpful comments during the poster session at Phonology 2013. This work was partially supported by the Dornsife Doctoral Fellowship.

indexed prosodic constituent.

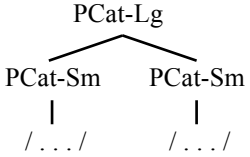
In this paper (and Hsu 2013), I argue that it is additionally necessary for certain markedness constraints to be evaluated within the entire spans of prosodic categories, that is, in the full set of segments dominated by a prosodic constituent. For the remainder of the paper, this domain-based theory will simply be referred to as *prosodic constraint indexation*. I propose that markedness constraints are indexed to categories of the prosodic hierarchy such that each constraint assigns violations to marked structures that are fully contained in the span of the indexed prosodic constituent. The general constraint schema is given in (2).

(2) *M-PCat
Given marked structure M and prosodic domain PCat, assign a violation mark for each instance of M that is fully contained in the span of a single PCat.

It is crucial that prosodically-indexed constraints are only violated when the locus of violation is fully within a single constituent of the indexed category. This formulation is akin to domain span rules in early Prosodic Phonology, which apply only to segments dominated by a specified prosodic category (Selkirk 1980). Note that this particular locality requirement for violation is more restrictive than what is proposed for lexically-indexed markedness constraints, which simply require the locus of violation to include a portion of the indexed morpheme (Pater 2000; Pater 2010).

Prosodically-indexed constraints additionally have multiple instantiations, corresponding to different prosodic levels (e.g. *M-PWd, *M-PPh, *M-Utt). Furthermore, these indexed markedness constraints are freely rankable with each other and with the set of faithfulness constraints. The basic predicted typology is schematically illustrated with two prosodic constituents, PCat(Lg) and PCat(Sm), where PCat(Lg) is hierarchically greater. The principle of Strict Layering is assumed (Selkirk 1981b), such that all segments are dominated by both categories, as represented in (3). A different pattern that emerges when Strict Layering is violated is discussed in section 3.

(3)



Two prosodically-indexed markedness constraints are defined, *M-PCat(Lg) and *M-PCat(Sm), violated by each instance of a marked structure M within the indexed domain. Based on the possible rankings of these two constraints with basic faithfulness constraints, three patterns are generated.

(4) *Basic predicted typology*
a. *M-PCat(Lg) >> FAITH, *M-PCat(Sm)
M does not map faithfully within the PCat(Lg) domain.
b. FAITH >> *M-PCat(Lg), *M-PCat(Sm)
M maps faithfully within the PCat(Lg) domain.
c. *M-PCat(Sm) >> FAITH >> *M-PCat(Lg)
Any M that is not fully contained in PCat(Sm) maps faithfully.

The rankings (4a) and (4b) duplicate the patterns derived by general markedness and faithfulness constraints that make no reference to prosodic structure. For all rankings where *M-PCat(Lg) >> FAITH, the marked structure M does not map faithfully anywhere in the whole domain. The relative ranking of *M-PCat(Sm) is made irrelevant by Strict Layering, since all segments are contained within PCat(Lg). Under ranking (4b), where faithfulness outranks all indexed markedness constraints, M maps faithfully within the entire domain. These rankings predict no sensitivity to prosodic boundaries, and are equivalent in their effects to the basic rankings *M >> F and F >> *M.

The critical predictions of prosodic constraint indexation emerge from the ranking in (4c): *M-PCat(Sm) >> FAITH >> *M-PCat(Lg). If the structure M is one that potentially spans a prosodic boundary, such as a sequence of segments or a multiply-linked segment, it surfaces faithfully across

PCat(Sm) boundaries, but not within individual PCat(Sm) constituents. This is schematically illustrated in figure 1, where the linear string of input segments includes two instances of a marked sequence AB. The second sequence does not map faithfully since it is fully contained within a PCat(Sm), violating high-ranked *AB-PCat(Sm). The other instance of AB is faithfully mapped in the output since the sequence spans a PCat(Sm) boundary. While it incurs a violation *AB-PCat(Lg), that constraint is outranked by faithfulness.

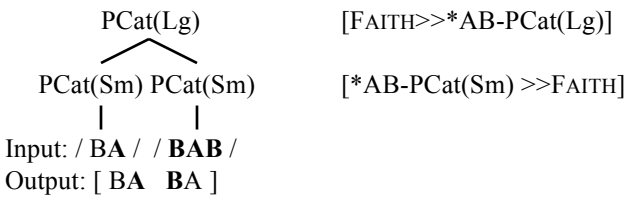


Figure 1. Marked sequence AB only maps faithfully across PCat(Sm) boundaries

Given this ranking schema, markedness constraints indexed to prosodic domains account for numerous patterns where segment sequences contained within a single prosodic constituent are subject to more phonotactic restrictions than sequences broken up by a prosodic boundary. Furthermore, where markedness-reducing processes are observed to apply within some domain, prosodically-indexed constraints predict that they will be blocked at sufficiently large junctures.

2.1 *Italian nasal assimilation* Derived environment blocking under prosodic constraint indexation is illustrated with an account of Italian nasal assimilation, described by Nespor and Vogel (1986). Stem-internally, a static phonotactic restriction prohibits sequences of nasal consonants followed by non-nasal sonorants; sequences like *[nl], *[nr], *[ml], and *[mr] are unattested. Where such sequences would potentially emerge via the concatenation of a nasal-final prefix with a sonorant-initial stem, the prefix nasal fully assimilates to the following consonant.

(5)	/in=legal/ → [illegal]	'illegal'
	/kon=legare/ → [kollegare]	'to put together'
	/kon=rispondere/ → [korrispondere]	'to correspond'

As observed by Nespor and Vogel, nasal assimilation has the effect of maintaining stem-internal phonotactic restrictions in the morphologically complex word, an argument for the inclusion of prefixes within the same prosodic words as their stems. To account for this by prosodic constraint indexation, a markedness constraint is defined to penalize nasal-sonorant sequences in the prosodic word domain. This constraint is defined as *N[SON]-PWd.

(6) *N[SON]-PWd
Assign a violation mark for each sequence of a nasal consonant and non-nasal sonorant fully contained in the span of a single PWd.

To prevent faithful mappings of word-internal nasal-sonorant sequences, *N[SON]-PWd outranks the faithfulness constraint favoring segment identity, simply formulated as IDENT. The ranking *N[SON]-PWd >> IDENT establishes the phonotactic constraint on root morphemes. Nasal assimilation occurs at prefix boundaries since prefixes are incorporated into their stem's PWd.

This domain restriction to the prosodic word span is necessary since nasal assimilation is blocked across word and phrasal boundaries. For instance, assimilation does not apply between a preposition and its complement.

(7)	/in#rime/ → [in rime]	cf. *[ir rime]	'in rhyme'
	/kon#loro/ → [kon loro]	cf. *[kol loro]	'with them'

The blocking of nasal assimilation at word boundaries is due to the fact that nasal-sonorant sequences spanning word junctures incur no violation of *N[SON]-PWd, since the two segments are contained in separate prosodic words. It is additionally necessary for the versions of *N[SON] indexed to the prosodic phrase and all larger categories to be ranked below IDENT. The constraint ranking *N[SON]-PWd >> IDENT >> *N[SON]-PPh drives nasal assimilation within prosodic words, while blocking the process across their junctures. The application of assimilation within the prosodic word is illustrated in (8), while its blocking at word boundaries is shown in (9).

(8) [kollaterale] 'collateral'

/kon=laterale/	*N[SON]-PWd	IDENT	*N[SON]-PPh
$((\text{konlaterale})_{\text{PWd}})_{\text{PPh}}$	*!		*
☞ $((\text{kollaterale})_{\text{PWd}})_{\text{PPh}}$		*	

(9) [konloro] 'with them'

/kon#loro/	*N[SON]-PWd	IDENT	*N[SON]-PPh
☞ $((\text{kon})_{\text{PWd}}\ (\text{loro})_{\text{PWd}})_{\text{PPh}}$			*
$((\text{kol})_{\text{PWd}}\ (\text{loro})_{\text{PWd}})_{\text{PPh}}$		*!	

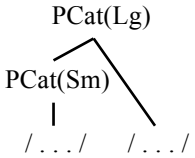
Where the input /nl/ sequence would be fully contained within a single prosodic word, full assimilation takes place to avoid violation of *N[SON]-PWd. However, *N[SON]-PWd is no longer relevant where the sequence spans a prosodic word boundary. Thus, the winning candidate in (9) is decided by the ranking IDENT >> *N[SON]-PPh.

To summarize the analysis of Italian, the constraint ranking *N[SON]-PWd >> IDENT >> *N[SON]-PPh generates the phonotactic restriction that bans sequences like *[nl] and *[nr] morpheme-internally. This ranking further ensures that nasal assimilation applies at morpheme junctures within the prosodic word, while blocking its application across word boundaries.

3 Strict layering violations

As noted by Flack (2009), the patterns generated by markedness constraints with prosodically-defined domains depend crucially on the hierarchical organization of prosodic constituents. One prinicple of Strict Layering, Exhaustivity, requires each prosodic constituent to exclusively dominate instances of the immediately lower category (Selkirk 1996). This in turn ensures that all segments are dominated by at least one instance of every prosodic category. Conversely, where Exhaustivity is violated, individual segments need not be dominated by every prosodic level. For instance, an affix can be dominated directly by a prosodic phrase, but no prosodic word. This sort of free clitic representation (Selkirk 1996) is given in (10).

(10)



If a morpheme is not dominated by some prosodic constituent, its segments escape potential violation of markedness constraints indexed to that domain. Thus, extraprosodic segments which violate Exhaustivity can permit more marked structures than strictly layered material.

To illustrate this using syllable structure constraints, Flack presents the case of Tzutujil (Dayley 1985), where all root morphemes have initial onsets; underlyingly vowel-initial roots surface with epenthetic glottal stops. However, proclitics like /in=/ are uniquely able to surface faithfully without onsets. In other words, by permitting onsetless syllables, proclitics show a greater number of syllable shapes than roots.

(11) *Tzutujil*

/ak'/ → [ʔak']		'chicken'
/oxqat/ → [ʔoxqat]		'deer-hunter'
/in=winak/ → [inwinak]	(*[ʔinwinak])	'I am a person'
/aː=tz'iːʔ/ → [aːtz'iːʔ]	(*[ʔaːtz'iːʔ])	'your dog'

In Flack's analysis, the requirement that roots have onsets is derived by a high-ranked constraint ONS/Wd, which requires the first syllable of each prosodic word to have an onset. Proclitics are not contained in any prosodic word, and are instead directly dominated by a higher prosodic constituent. Consequently, onsetless proclitics surface faithfully since they incur no violations of ONS/Wd.

In addition to the onset constraints discussed by Flack, a similar pattern is reported by Albright (2004) for Lakhota, in which codas are banned in roots but admitted in suffixes and function words. The asymmetric pattern favoring greater markedness in affixes has also been observed for phoneme inventories. In Arramba, the voiced dental fricative /ð/ occurs only in a series of absolutive verbal prefixes (Parker 2009). These effects are contrary to the more frequently analyzed pattern, where stems admit a greater number of marked structures due to positional faithfulness constraints (Beckman 1998; McCarthy and Prince 1995).

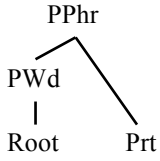
In this section, I show that the same pattern is attested with constraints on segment sequences, presenting data from Japanese and French where restrictions that apply to root morphemes no longer hold within extraprosodic affixes. Because these weakened restrictions are present within the spans of the affixal morphemes themselves, these effects do not result from the presence of a prosodic juncture. Consequently, it is necessary for indexed markedness constraints to reference the full spans of prosodic constituents, and not only their edges.

3.1 *Japanese /wo/* In Japanese, the bilabial glide /w/ is highly constrained in its distribution. It occurs only as a syllable onset, and is strictly limited in the vowels that it precedes. Root-internally, /w/ occurs only before the low front vowel /a/; sequences *[wi], *[wɛ], *[wo], and *[wu] are unattested. However, the restriction is slightly loosened for the prosodically weak accusative case particle. While the particle is typically pronounced [o] in Standard Japanese, its pronunciation as [wo] is maintained by certain speakers.

Evidence for the extraprosodic status of Japanese case particles is found in their inert status with respect to word-level pitch accent. As described by Poser (1984), individual morae carry either high or low pitch. Root morphemes come in two prosodic types: tonic words carry underlying high pitch specifications, while atonic words do not. Affixes vary in how they affect the pitch accent patterns of their stems. Dominant affixes realize their own specified accent, while deleting accent on their stems. Recessive affixes realize their own pitch accent only on atonic stems, but are otherwise unaccented. Crucially, monomoraic case particles (including *wo*) form a distinct class of both atonic and recessive affixes, which have no underlying accent specification and never affect the accent of their preceding stems (Labrune 2012).

Following Selkirk (1996), I assume that the relevant alignment constraints and constraints on prosodic domination require root morphemes and some affixes to be contained in prosodic words. Case particles, however, are directly dominated by the prosodic phrase, in violation of Exhaustivity. The prosodic representation of a noun followed by a case particle is shown in (12).

(12)



To account for the absence of [wo] within root morphemes, the phonotactic constraint *[wo]-PWd is ranked above faithfulness constraints like DEP, which prevents the sequence from mapping faithfully within the prosodic word. Case particles are directly dominated by the prosodic phrase due to independent constraints on prosodic alignment, and are thus irrelevant to *[wo]-PWd. To allow [wo] within the phrase domain, DEP outranks *[wo]-PPh. The constraint ranking is summarized in (13), where the winning

candidate allows a faithful mapping of /wo/ where it is directly dominated by the phonological phrase. The constraints that enforce strict layering are collapsed into the single constraint STRICTLAYER. While STRICTLAYER is included in the tableau, it is not crucially ranked with respect to the other constraints, since prosodic alignment is determined independently of segmental markedness considerations (but cf. Flack 2009 on Banawá).

(13) [karewo] 'him-ACC'

/kare=wo/	*[wo]-PWd	DEP	*[wo]-PPh	STRICTLAYER
☞ ((kare)$_{PWd}$ wo)$_{PPh}$			*	*
((kare)$_{PWd}$ o)$_{PPh}$		*!		*
((karewo)$_{PWd}$)$_{PPh}$	*!		*	
((kareo)$_{PWd}$)$_{PPh}$		*!		

It is important to reiterate that the faithful mapping of extraprosodic /wo/ is not due to the spanning of a prosodic juncture, as both segments are fully contained within the affixal morpheme itself. Rather, it results from the weakening of a phonotactic restriction in the span of the larger prosodic domain.

3.2 *French nasal vowels* As discussed in Hsu (2013), the distribution of nasal vowels in French is highly dependent on morphological structure. Generally, nasal vowels are increasingly marked before more sonorous segments. However, these restrictions become less stringent across larger junctures. In this section, I first present differences in the patterning of prefixes as compared to root morphemes, arguing that they are accounted for by an extended prosodic word structure that violates Strict Layering. Looking at one type of prefix allomorphy, I show that prefixes within extraprosodic spans allow for faithful mappings of sequences banned within roots.

The strongest restrictions against nasal vowels hold within mono-morphemic roots. Root-internally, nasal vowels generally occur only before obstruents. Most potential nasal vowel-sonorant sequences are unattested, and exceptions (e.g. [ʒɑ̃ʁ] 'genre,' [bɑ̃ljœ] 'suburb') are highly rare. Furthermore, nasal vowels do not precede glides or vowels.

(14) *Nasal vowels in mono-morphemic roots*

ɛ̃po	'tax'
ɔ̃d	'wave'
kɛ̃z	‘fifteen’
ɑ̃viʁɔ̃	‘roughly’

Unattested root-internally: *[ɛ̃n], *[ɛ̃ʁ], *[ɛ̃w], *[ɔ̃l], *[ɔ̃ʁ], *[ɔ̃j], *[ɑ̃j], *[ɑ̃e], etc.

The restriction is somewhat weakened at prefix boundaries. As will be discussed in greater detail, nasal vowels associated with prefixes and clitics surface faithfully before non-glide sonorant consonants but not vowels or glides. Putting aside the lexically-triggered process of liaison (Côté 2011 and references therein), word-final and phrase-final nasal vowels surface faithfully before all segment types. The patterns are summarized below in Table 1.

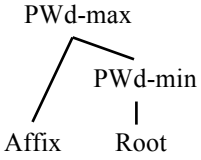
Juncture type	*Nasal vowels precede*
Root-internal (ṼX)	Obstruents
Prefix boundary (Ṽ=X)	Obstruents, non-glide sonorants
Word boundary (Ṽ#X)	Obstruents, non-glide sonorants, glides, vowels

Table 1. Restrictions on ṼX sequences spanning various junctures

In Hsu (2013), I propose that the general French pattern is accounted for using an extended, non-strictly layered prosodic word structure (Ito and Mester 2009b; Ito and Mester 2009a). Root morphemes are contained within minimal prosodic words (PWd-min), whereas maximal prosodic words (PWd-max)

contain root morphemes and their affixes, such that affixes are directly dominated by a PWd-max. This representation is given in (15). This diverges from the approach of Hannahs (1995), which groups prefixes and roots within a single PWd, and accounts for the differential patterning of prefixes by differences in their underlying representation.

(15)



Given the representation above, the stringent morpheme-internal pattern is accounted for by a highly-ranked markedness constraint, *Ṽ[+SON]-PWd-min, which penalizes sequences of nasal vowels and sonorant segments within the minimal prosodic word. Faithful mappings of sequences like *[ɛ̃ʁ] and *[ɔ̃j] are prevented within root morphemes by the ranking *Ṽ[+SON]-PWd-min >> IDENT.

(16) *Ṽ[+SON]-PWd-min
Assign a violation mark for each sequence of a nasal vowel followed by a [+SON] segment fully contained in the span of a single PWd-min.

The weakening of this markedness restriction across Pwd-min junctures is illustrated by prefixes *en-*, *non-*, and *bien-*, which show a pattern of allomorphy inconsistent with stem-internal phonotactics (Tranel 1981). Before vowel-initial stems, they emerge with a nasal vowel and coronal nasal consonant; they end with a nasal vowel when affixed to a consonant-initial stem, regardless of its sonority.

(17)	ɑ̃n=ivʁe	'to intoxicate'	nɔ̃n=ɛ̃skʁi	'unregistered'
	ɑ̃n=amuʁe	'to enamor'	nɔ̃n=ɑ̃plwa	'unemployment'
	ɑ̃n=ɔʁgœjiʁ	'to make proud'	nɔ̃n=inisje	'uninitiated'
(18)	ɑ̃=kɛse	'to cash'	nɔ̃=pɛmɑ̃	'non-payment'
	ɑ̃=nobliʁ	'to ennoble'	nɔ̃=ʁœspe	'non-respect'
	ɑ̃=ʁiʃiʁ	'to enrich'	nɔ̃=ljœ	'dismissal'

Crucially, nasal vowels associated with these prefixes surface faithfully before sonorant consonants, regardless of whether they are associated with the stem (e.g. [ɑ̃-nobliʁ] 'to ennoble') or with the prefix (e.g. [ɑ̃n-amuʁe] 'to enamor').

To account for the faithful mapping of prefix nasal vowels before stem-initial sonorant consonants, the version of *Ṽ[+SON] indexed to the maximal prosodic word *Ṽ[+SON]-PWd-max, is ranked below IDENT.

(19) [nɔ̃ʁœspe] 'non-respect'

/nɔ̃=ʁœspe/	*Ṽ[+SON]-PWd-min	IDENT	*Ṽ[+SON]-PWd-max
☞ (nɔ̃ (ʁœspe)$_{\text{PWd-min}}$)$_{\text{PWd-max}}$			*
(nɔ (ʁœspe)$_{\text{PWd-min}}$)$_{\text{PWd-max}}$		*!	

A closer look at the patterns of prefix allomorphy in (17) and (18) show that allomorph selection is nonetheless constrained by a restriction against nasal vowels followed by glides or vowels. I argue that this is due to a constraint against nasal vowels before [-consonantal] segments within the maximal prosodic word, *V[-CONS]-PWd-max.

(20) *Ṽ[-CONS]-PWd-max
Assign a violation mark for each sequence of a nasal vowel followed by a [-CONS] segment fully contained in the span of a single PWd-max.

Consider a hypothetical input containing the 'wrong' allomorph ending in a nasal vowel, followed by a vowel-initial stem, such as /ɑ̃=ivʁe/. I propose that the winning candidate [ɑ̃nivʁe] 'to intoxicate' is obtained by the epenthesis of a nasal consonant which prevents the violation of *Ṽ[-CONS]-PWd-max (see Côté 2008 for arguments for an epenthetic approach to linking consonants). This requires the additional ranking *Ṽ[-CONS]-PWd-max >> DEP.

(21) [ɑ̃nivʁe] 'to intoxicate'

/ɑ̃=ivʁe/	*Ṽ[-CONS]-PWd-max	IDENT(NAS)	*Ṽ[+SON]-PWd-max	DEP
(ɑ̃ (ivʁe)$_{PWd}$)$_{PPh}$	*!		*	
☞ (ɑ̃n (ivʁe)$_{PWd}$)$_{PPh}$			*	*
(ɑn (ivʁe)$_{PWd}$)$_{PPh}$		*!		*

Note that for the winning candidate, the prefix form [ɑ̃n] contains a nasal vowel followed by a sonorant consonant, which violates *Ṽ[+SON]-PWd-max. Furthermore, because both segments are associated with the prefix, the sequence is contained within the extraprosodic span dominated by PWd-max, but not PWd-min. To conclude this section, the constraint ranking *Ṽ[+SON]-PWd-min >> IDENT >> *Ṽ[+SON]-PWd-max successfully predicts two patterns in French: sequences of nasal vowels followed by sonorants are banned within roots, but permitted across affix and word boundaries. In addition, the violation of Strict Layering allows for nasal vowel and sonorant sequences to emerge faithfully within morphemes dominated directly by the maximal prosodic word.

4 Alternative accounts of domain restrictions

An alternative approach to various blocking effects at prosodic boundaries is available using CRISPEDGE constraints on alignment (Ito and Mester 1999), which are violated by the linking of features across the edges of prosodic constituents. CRISPEDGE constraints provide successful accounts of domain restrictions in a variety of phenomena, including vowel harmony (Walker 2001), consonant harmony (McCarthy 2007), and tone spreading (Selkirk 2011).

To illustrate, the domain restrictions on Italian nasal assimilation (section 2.1) can be captured by CRISPEDGE constraints, assuming that nasal assimilation involves the spreading of the second consonant's root node features to the preceding segment. The process is restricted to the prosodic word domain by a CRISPEDGE constraint that penalizes the sharing of root nodes across a prosodic word boundary, CRISPEDGE(PWd, [root]).

(22) CRISPEDGE(PWd, [root])
Assign a violation mark for each root node linked across the edge of a PWd.

As noted by Selkirk (2011), families of related CRISPEDGE constraints can account for blocking effects at sufficiently large boundaries. The ranking schema in (23) allows a general markedness restriction to compel linkages across PCat(Sm) boundaries but forbids them from crossing PCat(Lg) boundaries. The repair is thus restricted to the PCat(Lg) domain.

(23) CRISPEDGE(PCat(Lg)) >> *M >> CRISPEDGE(PCat(Sm))

Under the ranking CRISPEDGE(PWd, [root]) >> *N[SON] >> CRISPEDGE(Syll, [root]), nasal assimilation applies across syllable boundaries, but not prosodic word boundaries. Under this approach, there is no need for a domain restriction on the markedness constraint *N[SON], now evaluated independently of its prosodic context. This analysis is presented in (24) and (25).

(24) [kollaterale] 'collateral'

/kon=laterale/	CRISPEDGE(PWd,[root])	*N[SON]	CRISPEDGE(Syll,[root])
((konlaterale)/$_{PWd}$)$_{PPh}$		*!	
☞ ((kollaterale)$_{PWd}$)$_{PPh}$			*

(25) [konloro] 'with them'

/kon#loro/	CRISPEDGE(PWd, [root])	*N[SON]	CRISPEDGE(Syll,[root])
☞ ((kon)$_{PWd}$ (loro)$_{PWd}$)$_{PPh}$		*	
((kol)$_{PWd}$ (loro)$_{PWd}$)$_{PPh}$	*!		

While they successfully account for assimilation and spreading phenomena, CRISPEDGE constraints do not account for the full variety of blocking effects at prosodic junctures. Specifically, the constraints are not relevant to processes that do not link features across prosodic constituents, such as deletion and epenthesis. For instance, consider the distribution of three-consonant clusters in French, whose sensitivity to prosodic structure is discussed in Côté (2000). Within the prosodic word, underlying three-consonant clusters are obligatorily broken up an epenthetic schwa between the second and third consonant (/CCC/ → [CC̲əC]). Restrictions on consonant clusters are increasingly weakened when separated by larger prosodic junctures; schwa-epenthesis is no longer obligatory if the cluster spans a prosodic word or prosodic phrase boundary. At the larger intonational phrase boundary, schwa-epenthesis does not apply. The following data are from Côté (2000: 279).

(26) Prosodic word internal cluster

a. /ty=fɛ=k=t=muʃe/ → [tyfɛktə̲muʃe] *tu fais que te moucher* 'you only blow your nose'

Cluster with prosodic word boundary

b. /ɛ̃fɛkt#mɑ̃to/ → [ɛ̃fɛkt(ə̲)mɑ̃to] *infecte manteau* 'stinking coat'

Cluster with intonational phrase boundary

c. /l=ɛ̃sɛkt mɛ=lœ=la/ → [lɛ̃sɛktmɛlœla] *l'insecte, mets-le là* 'the insect, put it there'

The apparent problem for an attempted analysis of this domain-sensitivity using CRISPEDGE constraints is that schwa-epenthesis does not create linkages that cross prosodic boundaries, and thus violates no CRISPEDGE constraints. However, the pattern is accounted for straightforwardly using prosodically-indexed constraints against consonant clusters. While Côté analyzes the French data with constraints that require consonants at various prosodic edges to be vowel-adjacent, for the purposes of this paper, I propose that an equally effective account is available in terms of domain span constraints. While schwa-epenthesis is a probabilistic process amenable to analysis in a stochastic framework (e.g. Boersma and Hayes 2001; Hayes and Wilson 2008), I present a simplified case where epenthesis is obligatory within the prosodic word, and blocked altogether at its boundaries.

The restriction of schwa-epenthesis to prosodic word-internal clusters is achieved by the ranking *CCC-PWd >> DEP-V >> *CCC-PPh. Under this ranking, tri-consonantal clusters that span a word boundary emerge faithfully since they incur no violations of *CCC-PWd.

(27) *tu fais que te moucher* 'you only blow your nose'

/ty=fɛ=k=t=muʃe/	*CCC-PWd	DEP-V	*CCC-PPh
((tyfɛktmuʃe)$_{PWd}$)$_{PPh}$	*!		*
☞ ((tyfɛktə̲muʃe)$_{PWd}$)$_{PPh}$		*	

(28) *infecte manteau* 'stinking coat'

/ɛ̃fɛkt#mɑ̃to/	*CCC-PWd	DEP-V	*CCC-PPh
☞ ((ɛ̃fɛkt)$_{PWd}$ (mɑ̃to)$_{PWd}$)$_{PPh}$			*
((ɛ̃fɛktə̲)$_{PWd}$ (mɑ̃to)$_{PWd}$)$_{PPh}$		*!	

I will briefly note that CRISPEDGE constraints are also unable to account for patterns of the sort discussed in section 3, where morphemes that violate Exhaustivity permit more marked structures than strictly layered stems. The issue in these cases is that CRISPEDGE constraints make reference only to prosodic edges, and are indifferent to the prosodic constituents that segments are contained in. The

problematic pattern is one where a type of feature spreading applies to repair a markedness violation within strictly layered material, but fails to apply in some extraprosodic span. Nonetheless, this argument remains hypothetical in the absence of known data to this effect.

5 Conclusion

This paper has argued that families of markedness constraints are indexed to prosodic constituents. These prosodically-indexed constraints formalize the notion that prosodic categories define domains for segmental markedness restrictions. Since they only evaluate marked structures that are fully contained within a given prosodic span, marked structures banned within certain domains can emerge faithfully if they straddle a prosodic boundary. The interaction of prosodically-indexed markedness constraints with basic faithfulness simultaneously accounts for static phonotactic restrictions and derived environment blocking effects. Furthermore, these constraints successfully explain domain restrictions that cannot be accounted for by CRISPEDGE constraints. Where Strict Layering is violable, the restriction of markedness constraints to prosodic domains expands the predicted typology of root-affix asymmetries, correctly predicting that more marked sequences can be permitted in extraprosodic affixes than in roots, as seen in examples from Japanese and French.

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