9

Extrasyllabic Consonants and Onset Well-Formedness

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9.1. Introduction

In many languages it has been observed that not all consonants are conveniently assigned a position within a syllable; those that fall outside a syllable are called extrasyllabic. A small sample of researchers who have examined the treatment of extrasyllabic consonants includes Steriade (1982), Clements and Keyser (1983), Borowsky (1986), Ito (1986), Rubach and Booij (1990a, 1990b), Lamontagne (1993), Rialland (1994), Sherer (1994), and Rubach (1997); the chapters by Cho and King, Féry, Kiparsky, and Wiltshire in this volume; and of course many others too numerous to mention here. These researchers have argued that when the potential for an extrasyllabic consonant exists, the consonant may become syllabified through vowel epenthesis, or may be deleted through stray erasure, or may be incorporated into higher prosodic structure. Only in the last case are the consonants in question extrasyllabic on the surface. The members of the prosodic hierarchy considered here include, from bottom to top: syllable (σ), foot (f), and prosodic word (henceforth pword, symbolized ω). See Selkirk 1980, 1984, 1995, Booij 1983, Inkelas and Zec 1995, and many others for discussion of the roles of these elements in the prosodic hierarchy.

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In this chapter I examine the behavior of consonant clusters at the left edges of prosodic categories from the perspective of Optimality Theory (OT – Prince & Smolensky 1993), presenting evidence from Icelandic, Attic Greek, and Munster Irish to show that clusters that are not licit syllable onsets may nonetheless be licit left-edge clusters at higher prosodic levels. In some of these cases, the first consonant in such clusters will surface as extrasyllabic by being attached directly to the foot or pword.

Since I follow moraic theory (Hyman 1985 et al.) in assuming that there is no constituent node within the syllable called the onset, my definition of "syllable onset" is the string between $_{\sigma}[$ and the syllable peak. But in this chapter I will assume that the other levels of the prosodic hierarchy have their own onsets too; thus for any constituent π (varying over syllable, foot, pword, phonological phrase, etc.), the onset of π is the string between $_{\pi}[$ and the first syllable peak within π. Clearly this definition presupposes that not all consonants at prosodic left edges are attached to the σ node. Further, according to this definition, prosodic edges can occur within the onsets of higher elements (e.g., $_{\sigma}[$ can occur within the onset of a foot). As we shall see, these assumptions play a crucial role in my analysis.

I argue for a universally and intrinsically ranked set of Onset Well-Formedness (OWF) constraints against specific onset clusters, in which constraints against onset clusters with falling sonority (e.g., $*_{\sigma}$[Sonorant^Obstruent [the symbol ^ means "immediately followed by"]) are ranked above those against onset clusters with shallow-rising sonority (e.g., $*_{\sigma}$[Stop^Nasal), which in turn are ranked above those against onset clusters with steep-rising sonority (e.g., $*_{\sigma}$[Stop^Liquid). Furthermore, there are separate OWF constraints for the various prosodic categories, such as $*_{\sigma}$[Stop^Nasal, $*_{ft}$[Stop^Nasal, and $*_{\omega}$[Stop^Nasal. Exactly which onsets a particular language tolerates will be determined by the ranking of the OWF constraints with respect to faithfulness constraints, or to a constraint against syllable codas, or to a constraint against rising sonority across a syllable boundary.

The structure of the chapter follows: in section 9.2 I present data from Icelandic showing that shallow-rising consonant clusters that are permitted word initially are syllabified heterosyllabically when word-internal. I argue that this is due to the placement of the constraint NoCoda within the ranking of the OWF constraints. In section 9.3 I extend the analysis to Attic Greek, where there is evidence that the first consonant of word-initial heterosyllabic clusters surfaces as extrasyllabic, and argue that not only NoCoda but also the constraint against consonant extrasyllabicity is ranked below some OWF constraints but above others. In section 9.4 I analyze data from Munster Irish and show that, in this language, the syllable, foot, and pword each permit increasingly marked clusters at their left edges. Illicit clusters are broken up by epenthesis, indicating that the constraint against epenthesis is ranked

below the OWF constraints against the clusters illicit at any given prosodic level but above the OWF constraints against the licit clusters at that level. Section 9.5 concludes the chapter.

9.2. Sonority Restrictions at Syllable Contact: Icelandic

In Icelandic (Kress 1963, 1982, Vennemann 1972, Orešnik and Pétursson 1977, Pétursson 1978, Thráinsson 1978, 1994, Kiparsky 1984, Booij 1986, Ito 1986), only steep-rising clusters of *s* or stop + *r* or glide are tautosyllabic internally; all others that are permitted initially (e.g., *s* or stop + *l/n*; fricative + sonorant; *s* + stop; nasal or liquid + *j*) are heterosyllabic internally. The diagnostic for syllabification in Icelandic is this: vowels in initial (stressed) open syllables are lengthened; in closed syllables stressed vowels are not lengthened.[1] For example, the *tr* sequence in *sœ:.tra* 'to slurp' is tautosyllabic, while the *kn* sequence in *ɛk.na* 'to bait' is heterosyllabic, even though *kn* is permissible word-initially; compare *knaiva* 'to project'. Researchers agree the reason that *kn* is heterosyllabic word-internally while *tr* is tautosyllabic is that *kn* is a shallow sonority rise while *tr* is a steep rise. I therefore propose a family of constraints against onset clusters, intrinsically ranked according to the degree of sonority rise, thus: $*_{\sigma}$[Sonorant^Obstruent >> . . . >> $*_{\sigma}$[Stop^Nasal >> . . . >> $*_{\sigma}$[Stop^Liquid. See Smolensky 1995 for a formalized justification of this intrinsic ranking.

The set of tautosyllabic clusters in a particular language will be determined by the rank of NoCoda (syllables have no coda: syllables are open) with respect to these OWF constraints. For languages like Icelandic, NoCoda will come in between $*_{\sigma}$[Stop^Nasal and $*_{\sigma}$[Stop^Liquid, thus compelling the observed syllabifications:

(1)

/ɛkna/	$*_{\sigma}$[Stop^Nas	NoCoda	$*_{\sigma}$[Stop^Liq
.ɛ:.kna.	*!		
☞ .ɛk.na.		*	

(2)

/sœtra/	$*_{\sigma}$[Stop^Nas	NoCoda	$*_{\sigma}$[Stop^Liq
☞ .sœ:.tra.			*
.sœt.ra.		*!	

Assuming that both consonants in word-initial clusters like *knaiva* 'to project' are linked to the first σ node (and in the absence of convincing

evidence of consonant extrasyllabicity this seems a reasonable assumption to make), we need only postulate that the faithfulness constraints DEP-IO against insertion and MAX-IO against deletion (McCarthy and Prince 1995) are ranked above *$_{\sigma}$[Stop^Nasal in Icelandic. (See section 9.3 on Attic Greek for constraints against consonant extrasyllabicity, which are presumably also high ranked in Icelandic.)

(3)

/knaiva/	DEP-IO	MAX-IO	*$_{\sigma}$[Stop^Nas
☞ .knai.va.			*
.nai.va.		*!	
.kə.nai.va.	*!		

To conclude this section, I would like to show that an alternative analysis that refers only to the sonority of the individual segments, rather than to the degree of sonority climb in the cluster, will not correctly account for the Icelandic data. Ito and Mester (1994) argue that the hypothetical syllabifications *a.tri* and *ar.ti* can be derived by ranking the constraint ALIGN-L (T, σ) ("obstruents are syllable-initial") above ALIGN-L (R, σ) (resonant consonants are syllable-initial) since in both forms the obstruent *t* is syllable-initial. Ito and Mester (1994: 33) point out that "the ranking of the various segment-to-syllable alignment constraints with respect to each other is intrinsic and determined by the sonority hierarchy," a point made also by Smolensky (1995). In other words, the ranking ALIGN-L (T, σ) >> ALIGN-L (R, σ) is universal and can never be reversed. Some languages prefer the syllabification *at.ri* to *a.tri*, however; Ito and Mester argue that in such languages high-ranking NOCOMPLEXONSET prohibits complex onsets, and therefore *at.ri* is preferred to *a.tri*.

Ito and Mester's (1994) analysis, however, does not account for languages like Icelandic, in which steep-rising clusters are tautosyllabic while shallow-rising clusters are heterosyllabic. The only way to achieve the Icelandic pattern of syllabification using segment-to-syllable alignment constraints would be to break ALIGN-L (R, σ) into two separate constraints, ALIGN-L (L, σ) (liquids are syllable-initial) and ALIGN-L (N, σ) (nasals are syllable-initial), and rank ALIGN-L (N, σ) above ALIGN-L (T, σ), as shown in (4).

(4)

a. sœtra	ALIGN-L (N, σ)	ALIGN-L (T, σ)	ALIGN-L (L, σ)
☞ .sœ.tra.			t
.sœt.ra.		sœ !	

b. /ɛkna/	ALIGN-L (N, σ)	ALIGN-L (T, σ)	ALIGN-L (L, σ)
.ɛː.kna.	k!		
☞ .ɛk.na.		ɛ	

The trouble, of course, is that this ranking is unavailable. As Ito and Mester (1994) and Smolensky (1995) point out, the ranking of these constraints is intrinsic and universal: obstruents always make better onsets than nasals do (cf. Vennemann 1988: 20ff., Clements 1990, Prince and Smolensky 1993), and therefore the ranking ALIGN-L (T, σ) >> ALIGN-L (N, σ) cannot be reversed. Furthermore, the ranking shown in (5) makes the extremely undesirable prediction that an Icelandic word like *ɛntɪ* 'end' should be syllabified **ɛː.ntɪ* rather than *ɛn.tɪ* in Icelandic, which is patently not the case. An appeal to high-ranking NOCOMPONS will not help us here: although it would correctly predict *ɛn.tɪ*, it would also falsely predict **sæt.ra* rather than actual *sæː.tra*. So not only does the ranking ALIGN-L (N, σ) >> ALIGN-L (T, σ) violate the intrinsic ranking of segment-to-syllable alignment constraints, it does not even correctly predict the pattern of languages like Icelandic with the syllabifications *sæː.tra*, *ɛk.na*, *ɛn.tɪ*. Thus, languages like Icelandic, where some rising-sonority clusters are heterosyllabic while others are tautosyllabic word-internally, show that reference must be made to the steepness of the sonority climb in a cluster and not merely to the sonority of the individual segments, in contrast to Ito and Mester's arguments. The Icelandic case is especially interesting since both kinds of clusters are tolerated word-initially, indicating that there is not just a single parameter of onset well-formedness. Rather, the clusters that are permitted to be onsets word-internally are a subset of those permitted word-initially. The ranking of NOCODA with respect to the OWF constraints determines which onsets are heterosyllabic and which are tautosyllabic word-internally. In the next section we see how to account for word-initial consonant extrasyllabicity, using data from Attic Greek.

9.3. Extrasyllabic Consonants in Word-Initial Position: Attic Greek

In this section I explore the constraint interaction that permits extrasyllabic consonants in word-initial position in Attic Greek. I show that NOCODA and the EXHAUSTIVITY family of constraints are ranked inside the hierarchy of OWF constraints in this language.

The EXHAUSTIVITY constraints proposed by Selkirk (1995) can be used to capture the generalization that syllabified consonants are preferable to extrasyllabic consonants.

(5) EXH(AUSTIVITY)
No category immediately dominates a constituent more than one level beneath it.

This is actually not a single constraint but a constraint family. EXH at different levels (e.g., syllable and pword) can be ranked differently. An extrasyllabic consonant (indicated here by boldface) will incur a violation of EXH_{ω} if it is linked directly to the pword, for example, in Greek $_{\omega}$[*g .nɔ́ː.mɛː.*] 'judgment'. Under the assumption that onset consonants are linked directly to the σ node rather than to the mora, EXH_{σ} is violated by the *n* and the *m* in $_{\omega}$[*g .nɔ́ː.mɛː.*]. There may be a constraint requiring consonant-to-syllable mapping that universally outranks EXH_{σ}, but I will not explore this issue further here.

We can make the following cross-linguistic generalization about surface extrasyllabic consonants: when they are allowed at all, they are more tolerated at the margins of the prosodic elements to which they are attached (Milliken 1988, Clements 1990, 1997), though if Rubach's (1997) analysis of Polish $_{\omega}$[*.ment.* **r** *.ka.*] 'crafty person' (gen.) with an extrasyllabic **r** is correct, then extrasyllabic consonants can occur word-internally as well.[2] Nevertheless, the point is well taken: a structure like $_{\omega}$[*g .nɔ́ː.mɛː.*] is typologically more common, and therefore presumably less marked, than one like $_{\omega}$[*.ment.* **r** *.ka.*]. I propose the constraint C-AT-MARGIN to capture this observation.

(6) C-AT-MARGIN
An extrasyllabic consonant is at the margin of the prosodic category to which it is linked.

The significance of C-AT-MARGIN will become clear in section 9.4, where Munster Irish will be shown to permit extrasyllabic consonants both pword-initially and foot-initially.

Left-edge consonant extrasyllabicity seems to occur in Attic Greek (Steriade 1982), where some permissible word-initial clusters are heterosyllabic internally (e.g., *sm, kt, ps, gn, bl, gm*), while others are tautosyllabic internally (e.g., *kr, kʰl, pn, br*). The tautosyllabic clusters are those with a steep sonority rise, namely voiceless stop + sonorant and voiced stop + *r*. All other rising-sonority or level-sonority clusters (e.g., fricative + sonorant, stop + obstruent, voiced stop + nasal, voiced stop + *l*), even though they are permitted as onsets word-initially, are heterosyllabic word-internally. Evidence from the scansion of Greek poetry reveals syllabification, as CVC syllables are heavy while CV syllables are light.

When a word-initial cluster is not permitted at the σ level, for example, *gn* in *gnɔ́ːmɛː*, the first consonant *g* skips the σ level and attaches directly to the pword level, giving the structure $_{\omega}$[*g .nɔ́ː.mɛː.*]. Word-internally, for example,

in *hagnós* 'holy', the *g* is syllabified into the coda of the preceding syllable: $_{\omega}$[*.hag.nós.*].

As Steriade points out, independent evidence for the extrasyllabicity[3] of the *g* in *gnɔ́:mɛ:* comes from the rules of Greek poetic scansion: the *g* in this word (and indeed any initial consonant when the word-initial cluster is heterosyllabic) is resyllabified as the coda of a preceding vowel-final word. Thus, for example, the phrase *parà gnɔ́:mɛ:n* 'contrary to expectation' is syllabified *.pa.ràg.nɔ́:.mɛ:n.* (Steriade 1982: 193).

Furthermore, in Attic Greek, consonant-initial verbs form their perfect stem differently depending on whether the initial consonant is syllabified. When the verb root begins with a tautosyllabic cluster (voiceless stop + sonorant or voiced stop + *r*) or a single consonant, the perfect stem is formed by adding a reduplicating syllable of the form C_1e, where C_1 indicates the initial consonant of the stem. (Other changes not relevant to the discussion at hand may be made to the root as well.) Examples of reduplicating perfects are shown in (7).

(7) Reduplicating perfects in Attic Greek

	Root	Perfect stem	Gloss
a.	ly:	le-ly:	'to untie'
b.	tla:	te-tla:	'to endure'
c.	grap^h	ge-grap^h	'to write'

If the verb root begins with a heterosyllabic cluster, the initial consonant of the stem cannot be copied onto the template C_1e-, and the prefix surfaces as *e-* alone, as shown in (8).[4]

(8) Nonreduplicating perfects in Attic Greek (Steriade 1982: 197)

	Root	Perfect stem	Gloss
a.	sper	e-spar	'to sow'
b.	psau	e-psau	'to touch'
c.	kten	e-kton	'to kill'
d.	gnɔ:	e-gnɔ:	'to know'

I do not have space to go into an OT analysis of Attic Greek reduplication here, but the generalization seems to be that the root-initial consonant must also be syllable-initial to be copied into the reduplicant. The root-initial consonants in (8) are barred from syllable-initial position by the OWF constraints and can therefore not be reduplicated.[5]

Just as we saw in section 9.2 that the distribution of onset clusters in Icelandic can be accounted for by the ranking $*_{\sigma}$[*kn* >> NoCoda >> $*_{\sigma}$[*tr*, so for Greek we can propose that certain OWF constraints are ranked above Exh$_{\omega}$ and NoCoda, and others below them:

(9) OWF constraints ranked with respect to NoCoda and Exh_{ω} in Greek

a.	$*_{\sigma}$[Fricative^Sonorant >> Exh_{ω} >> NoCoda	des.mós 'fitting'
b.	$*_{\sigma}$[Obst^Obst >> Exh_{ω} >> NoCoda	ok.tó: 'eight'
c.	$*_{\sigma}$[VcdStop^Nas/Lat >> Exh_{ω} >> NoCoda	hag.nós 'holy'
d.	Exh_{ω} >> NoCoda >> $*_{\sigma}$[VclsStop^Son	a.pé.pni:.gon 'strangled'
e.	Exh_{ω} >> NoCoda >> $*_{\sigma}$[VcdStop^Rhotic	a.grós 'field'

It is crucial that Exh_{ω} is ranked above NoCoda in Greek to avoid extrasyllabic consonants in word-internal position. The tableaux in (10)–(13) show how the constraints interact. The constraints against onset clusters with shallow sonority rises are top ranked, excluding the candidates **ha.gnós* in (10) and **.gnɔ́:.mɛ:* in (12). Next is Exh_{ω}, which excludes the candidates that have extrasyllabic consonants. NoCoda comes into play with word-internal clusters that have steep rises, such as in (11): *a.grós* is picked over **ag.rós*. The constraints against steep-rising onset clusters are ranked low.

(10)

/hagnós/	$*_{\sigma}$[VcdSt^N/L	Exh_{ω}	NoCoda	$*_{\sigma}$[VcdSt^R
☞ .hag.nós.			**	
.ha.gnós.	*!		*	
.ha. *g* .nós.		*!	*	

(11)

/agrós/	$*_{\sigma}$[VcdSt^N/L	Exh_{ω}	NoCoda	$*_{\sigma}$[VcdSt^R
.ag.rós.			**!	
☞ .a.grós.			*	*
.a. *g* .rós.		*!	*	

(12)

/gnɔ́:mɛ:/	$*_{\sigma}$[VcdSt^N/L	Exh_{ω}	NoCoda	$*_{\sigma}$[VcdSt^R
.gnɔ́:.mɛ:.	*!			
☞ *g* .nɔ́:.mɛ:.		*		

(13)

/gráp^{h}ɔ:/	$*_{\sigma}$[VcdSt^N/L	Exh_{ω}	NoCoda	$*_{\sigma}$[VcdSt^R
☞ .grá.p^{h}ɔ:.				*
g .rá.p^{h}ɔ:.		*!		

In this section, we have seen that one possible solution to the problem of illicit clusters is extrasyllabicity. The Attic Greek facts can be accounted for by an analysis that says the hierarchy of OWF constraints is divided by Exh_{σ} and NoCoda; when heterosyllabic clusters occur in word-initial position, the first consonant is extrasyllabic, as evidenced by syllabification across word boundaries as well as by the behavior of perfect stems. In the next section we shall see evidence from Munster Irish that not only the pword and syllable levels but the foot level as well have OWF constraints.

9.4. Syllabification and Epenthesis in Munster Irish

So far, we have seen languages in which not all word-initial clusters may be word-internal onset clusters. In the Munster (or Southern) dialect of Irish Gaelic we find a three-way contrast: the set of tolerated onsets is different at the beginning of a word, an internal stressed syllable (i.e., the left edge of a foot), and an internal unstressed syllable. In this section I argue that there are foot-level OWF constraints too; as would be expected, the foot level is more tolerant of clusters than the syllable level but less tolerant than the pword level. Munster Irish uses different constraints from Icelandic and Greek to break up the set of OWF constraints and to determine onset well-formedness. In those languages, shallow-rising clusters are heterosyllabic word-internally, just as falling clusters (universally) are. In Munster Irish, however, no rising clusters are permitted across syllable breaks at all, indicating the influence of the Syllable Contact Law (Hooper 1976, Murray and Vennemann 1983, Vennemann 1988, Clements 1990, Rice 1992, among others). The role of the Syllable Contact Law within OT has been examined by Bat-El (1996), Bush (1997), and Davis et al. (1997); I follow the latter authors in defining the constraint SyllCont as "avoid rising sonority over a syllable boundary."

Word-initially, Munster Irish permits a variety of rising-sonority clusters: stop + liquid, *m* + coronal sonorant, fricative + liquid, and obstruent + nasal.[6] The examples in (14) come from Sjoestedt 1931, Ó Briain and Ó Cuív 1947, and Breatnach 1961.

(14) Word-initial onset clusters in Munster Irish
  a. Stop + liquid
    'glan 'clean'; 'kra: 'anguish'; kʲrʲə'xa:n 'small potato'
  b. **m** + cor. sonorant
    'mʲrʲi:; 'strength' (ecl.); 'mni: 'woman' (dat.)
  c. Fricative + liquid
    'sra:dʲ 'street'; 'xra: 'anguish' (len.); 'hrʲiəl 'voyage' (len.)
  d. Obstruent + nasal
    'gnʲi:v 'deed'; knə'pa:n 'flower bud'

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pond to the left edges

(15) Only stop + liqui
  a. ə$_f$['bra:n]
  b. ʲa$_f$['dra:]nəx
  c. po$_f$['kʲʲe:mʲ]

When other rising-
cluster is broken up w
Contact Law prevents
ary, and they are too s
The dilemma is solved

(16) Other clusters po
  a. amʲə$_f$['ʲi:xt]
  b. avə$_f$['ra:n]

Word-internal unstr
not correspond to eitl
Any underlying rising-
epenthetic schwa, as sh
tions prohibit V.CCV s
VC.CV syllabification.

(17) Epenthesis into p
  a. $_f$['agə]lə *
  b. $_f$['okə]rəs *
  c. $_f$['lasə]rəx *
  d. $_f$['axə]rən *
  e. $_f$['ahə]rəʃ *
  f. $_f$['agʲə]nʲə *
  g. $_f$['ʃau]mərə *

Munster thus provid
can dictate onset well
NoCompOns and Syll

As we see in (15), word-internal stressed syllables permit only stop + liquid clusters (i.e., those with the steepest sonority rise) as onsets. As shown in Green 1997, noninitial stressed syllables in Munster are always heavy syllables and always correspond to trochaic feet made up of a single heavy syllable ('H). Trochees of two light syllables ('L L) are found only word-initially. Therefore, the left edges of all noninitial stressed syllables correspond to the left edges of feet (marked $_f[$ in (15)).

(15) Only stop + liquid clusters permitted at $_f[$
a. ə$_f$['bra:n] 'April'
b. l^{ʲ}a$_f$['dra:]nəx 'tedious'
c. po$_f$['k^{ʲ}l^{ʲ}e:m^{ʲ}] 'frolic'

When other rising-sonority clusters occur before stressed syllables, the cluster is broken up with an epenthetic schwa, as shown in (16). The Syllable Contact Law prevents these clusters from being divided by a syllable boundary, and they are too shallow to be onset clusters at the left edge of a foot. The dilemma is solved with epenthesis.

(16) Other clusters potentially at $_f[$ repaired by epenthesis
a. am^{ʲ}ə$_f$['l^{ʲ}i:xt] *a$_f$['m^{ʲ}l^{ʲ}i:xt], *am^{ʲ}$_f$['l^{ʲ}i:xt] 'wretchedness'
b. avə$_f$['ra:n] *a$_f$['vra:n], *av$_f$['ra:n] 'song'

Word-internal unstressed syllables, that is, syllables whose left edge does not correspond to either a foot or a pword, do not permit clusters at all. Any underlying rising-sonority clusters in this position are broken up with an epenthetic schwa, as shown in (17). Again, onset well-formedness considerations prohibit V.CCV syllabification, and the Syllable Contact Law prohibits VC.CV syllabification.[7]

(17) Epenthesis into prohibited clusters in Munster

a.	$_f$['agə]lə	*$_f$['a.glə], *$_f$['ag.lə]	'fear'
b.	$_f$['okə]rəs	*$_f$['o.krəs], *$_f$['ok.rəs]	'hunger'
c.	$_f$['lasə]rəx	*$_f$['la.srəx], *$_f$['las.rəx]	'flames'
d.	$_f$['axə]rən	*$_f$['a.xrən], *$_f$['ax.rən]	'entanglement'
e.	$_f$['ahə]rəʃ	*$_f$['a.hrəʃ], *$_f$['ah.rəʃ]	'imitation'
f.	$_f$['ag^{ʲ}ə]n^{ʲ}ə	*$_f$['a.g^{ʲ}n^{ʲ}ə], *$_f$['ag^{ʲ}.n^{ʲ}ə]	'mind'
g.	$_f$['ʃau]mərə	*$_f$['ʃau]mrə, *$_f$['ʃaum]rə	'room'

Munster thus provides evidence that not only the syllable but also the foot can dictate onset well-formedness. At the syllable level, the constraints NoCompOns and SyllCont outrank Dep-IO. Under my view, NoCompOns

is not actually a single constraint, but a convenient cover term for the entire range of constraints against onset clusters. In Munster, these constraints are not distinguishable at the syllable level and so may conveniently be grouped together under this single heading.

As shown in the tableau in (18), C-AT-MARGIN, NOCOMPONS, and SYLL-CONT are all ranked high. The optimal candidate, ω[Ft[a.gə.]lə], violates only low-ranked DEP-IO.

(18)

/aglə/	C-AT-M	NOCOMPONS	SYLLCONT	DEP-IO
ω[Ft[.a. g .lə.]]	*!			
ω[Ft[.a.glə.]]		*!		
ω[Ft[.ag.lə.]]			*!	
☞ ω[Ft[a.gə.]lə]				*

At the foot level, the OWF constraints are split into two groups: those ranked above DEP-IO, and those ranked below it. The tableau in (19) illustrates the high rank of *Ft[m^Sonorant for the form ω[.i.mʲəFt[nʲiː.]] 'anxiety': the constraint *Ft[Fricative^Sonorant is also ranked high, compelling epenthesis in /avraːn/ 'song' with output ω[.a.və.Ft[raːn.]], though for lack of space I do not illustrate this in a tableau.

(19)

/imʲnʲiː/	*Ft[m^Son	C-AT-M	NOCOMPONS	SYLL CONT	DEP-IO
ω[.i Ft[mʲ .nʲiː.]]	*!				
ω[.i Ft[.mʲnʲiː.]]	*!		*		
ω[.i. mʲ Ft[.nʲiː.]]		*!			
ω[.imʲFt[.nʲiː.]]				*!	
☞ ω[.i.mʲəFt[.nʲiː.]]					*

The constraint against stop + liquid clusters at the foot level, however, is ranked below DEP-IO, as shown by the tableau in (20). In this case, the optimal candidate has the first consonant of the cluster linked to the foot node, indicating that EXH$_{Ft}$ (prohibiting the linking of extrasyllabic consonants directly to the foot) is low ranked.

(20)

/əbraːn/	
☞ .əFt[b .raːn.]	
.əFt[.braːn.]	
.ə. b Ft[.raːn.]	
.əbFt[.raːn.]	
.əbəFt[.raːn.]	

At the pword leve
(grouped together und
clusters to stand in wor
that the *gl* cluster is no
the *g* is linked to the f
tempting to assume th
tableau in (21), where
above the constraint ag

(21)

/glan/	
a. ω[Ft[.glan.]]	
b. ☞ ω[Ft[g .lan.]]	
c. ω[g Ft[.lan.]]	
d. ω[.gəFt[.lan.]]	

If, however, the canc
EXH$_{\omega}$, or the two are ur
is made by the constrai
however, I will continue
within the foot, as in (21
The first consonant ir
there is no word-initial
(22)–(23).

(22)

/kʲrʲəxaːn/
ω[.kʲrʲəFt[.xaːn.]
☞ ω[kʲ .rʲəFt[.xaːn.
ω[.kʲəˌrʲəFt[.xaːn

(20)

/əbra:n/	C-AT-M	NoCompOns	SyllCont	Dep-IO	Exh$_{f}$	*$_{f}$[St^Liq
☞ .ə.$_{f}$[*b* .ra:n.]					*	*
.ə.$_{f}$[.bra:n.]		*!				*
.ə. *b* $_{f}$[.ra:n.]	*!					
.əb.$_{f}$[.ra:n.]			*!			
.ə.bə.$_{f}$[.ra:n.]				*!		

At the pword level, all the constraints against rising-sonority clusters (grouped together under the heading *$_{\omega}$[TR) are ranked low, allowing these clusters to stand in word-initial position. In a form like *glan* 'clean', we know that the *gl* cluster is not permitted at $_{\sigma}$[, but it cannot be determined whether the *g* is linked to the foot or the pword. Since *gl* is a licit cluster at $_{f}$[, it is tempting to assume that it is in fact located there. This is illustrated in the tableau in (21), where Exh$_{\omega}$ is ranked above Exh$_{f}$, which in turn is ranked above the constraint against stop + liquid clusters at the foot level.[8]

(21)

/glan/	NoCompOns	Dep-IO	Exh$_{\omega}$	Exh$_{f}$	*$_{f}$[Stop^Liq	*$_{\omega}$[TR
a. $_{\omega}$[$_{f}$[.glan.]]	*!				*	*
b. ☞ $_{\omega}$[$_{f}$[*g* .lan.]]				*	*	*
c. $_{\omega}$[*g* $_{f}$[.lan.]]			*!			*
d. $_{\omega}$[.gə$_{f}$[.lan.]]		*!				

If, however, the candidate in (21c) is correct, then either Exh$_{f}$ outranks Exh$_{\omega}$, or the two are unranked with respect to each other, and the decision is made by the constraint against stop + liquid clusters at $_{f}$[. That being said, however, I will continue to assume that stop + liquid clusters at $_{\omega}$[$_{f}$[are parsed within the foot, as in (21b).

The first consonant in a word-initial cluster is linked to the pword node if there is no word-initial foot or if the cluster is prohibited at $_{f}$[, as shown in (22)–(23).

(22)

/kʲrʲəxa:n/	NoCompOns	Dep-IO	Exh$_{\omega}$	*$_{\omega}$[TR
$_{\omega}$[.kʲrʲə$_{f}$[.xa:n.]]	*!			*
☞ $_{\omega}$[*kʲ* .rʲə$_{f}$[.xa:n.]]			*	*
$_{\omega}$[.kʲə.rʲə$_{f}$[.xa:n.]]		*!		

(23)

/xra:/	*$_{f}$[Fr^Son	NoCompOns	Dep-IO	Exh$_{\omega}$	Exh$_{f}$	*$_{\omega}$[TR
$_{\omega}$[$_{f}$[.xra:.]]	*!	*				*
$_{\omega}$[$_{f}$[*x* .ra:.]]	*!				*	*
☞ $_{\omega}$[*x* $_{f}$[.ra:.]]				*		*
$_{\omega}$[.xə$_{f}$[.ra:.]]			*!			

Unfortunately there is, to the best of my knowledge, no independent evidence for the extrasyllabicity of consonants in onset clusters in Irish, other than the small break between the consonants alluded to in note 8. Irish has no reduplication, for example, that could shed light on syllable structure the way we saw in Attic Greek in section 9.3. Nevertheless, the analysis proposed here is preferable to one in which all word-initial clusters are possible syllable onsets, in which case the facts of epenthesis must remain a mystery.

In this section we have seen how OWF constraints apply not only at the syllable level but at higher levels as well. The ranking of Dep-IO with respect to the various constraints against clusters at syllable- and foot-initial positions in Munster Irish derives the observed pattern of epenthesis into illicit clusters. In Green 2000 I argue that the proclitic copula *s* in phrases like *s fa:r fum* 'I prefer' (literally 'is better with-me') is attached not to the syllable, foot, or pword node of the host, but rather directly to the phonological phrase (ϕ): $_{\phi}$[*s* $_{\omega}$[*fa:r*]], as evidenced by the fact that *sf-* clusters do not occur at pword-initial position. I do not have room to go into this topic further here, but the evidence suggests that the phonological phrase also can determine what onsets are well formed at its left edge, since *sf-* is permitted at $_{\phi}$[but not at $_{\omega}$[.

9.5. Summary

In this paper we have seen in general that more marked consonant clusters may be banned from syllable onset position while still tolerated at the left edges of higher prosodic categories like the foot or pword. Thus, in Icelandic and Attic Greek, both steeper and shallower clusters are permitted at $_{\omega}$[, but only steeper clusters are permitted at $_{\sigma}$[not coinciding with $_{\omega}$[. In Munster Irish, both steeper and shallower clusters are permitted at $_{\omega}$[, but only steeper clusters are permitted at $_{f}$[not coinciding with $_{\omega}$[; no clusters at all are permitted at $_{\sigma}$[not coinciding with $_{f}$[or $_{\omega}$[. These facts can be accounted for by postulating a universally and intrinsically ranked set of constraints against onset clusters; the position of other constraints like faithfulness constraints, NoCoda, and SylCont with respect to these OWF constraints determines which onset clusters are tolerated where in a given language. I have argued

that there are separa
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Wiltshire, this volume

NOTES

1. Vowels are lengthen
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2. See Cho and King, t
Polish.
3. Under Steriade's ana
technically extrasylla
to tautosyllabic clust
My analysis does no
extrasyllabic while t
between my analysis
4. Actually, there are se
points out, some roo
be crooked', *be-blap*^{l}
blasp^{h}*ɛ:me* 'to speak
glyp^{h} 'to carve'. Furt
fall', *ke-kt̪ɛ:* beside *e*
5. Kaye (1992) argues t
sion, all heterosyllab
coda of an onsetless
the root *strep*^{h} were
as the reduplicating s
analysis, however, th
See also Morelli (thi
6. Also permitted are *s*
7. It must be the Syllab
that prohibits VC.C'
allowed to cross sy
'county', etc. (Sjoest
8. Ó Briain and Ó Cuív
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that there are separate OWF constraints against onset clusters at the left edges of syllables, feet, pwords, and possibly phonological phrases; see Wiltshire, this volume, for similar arguments regarding right edges.

NOTES

1. Vowels are lengthened in stressed monosyllables before a single word-final consonant, which is apparently nonmoraic or extrametrical.
2. See Cho and King, this volume, for another analysis of extrasyllabic consonants in Polish.
3. Under Steriade's analysis, the first consonant in heterosyllabic clusters like *gn* is not technically extrasyllabic but rather is external to the Onset node. This is in contrast to tautosyllabic clusters like *kr*, in which both consonants are under the Onset node. My analysis does not assume an Onset node: rather, I maintain that the *g* of *gn* is extrasyllabic while both consonants in *kr* are under the σ node. The difference between my analysis and Steriade's is thus largely terminological.
4. Actually, there are several exceptions to this generalization. As Steriade (1982: 206f.) points out, some roots in *bl* and *gl* do take reduplication: *be-blais* beside *e-blais* 'to be crooked', *be-blap*^{h} beside *e-blap*^{h} 'to hinder', *be-blast* beside *e-blast* 'to sprout', *be-blasp*^{h}*ɛ:me* 'to speak irreverently', *be-blɛ:p*^{h} or *be-blop*^{h} 'to look', *ge-glyp*^{h} beside *e-glyp*^{h} 'to carve'. Further exceptions are found in *me-mnɛ:* 'to remember', *pe-pɪɔ:* 'to fall', *ke-kɪɛ:* beside *e-kɪɛ:* 'to possess', *he-stɛ:* (< /se-stɛ:/) 'to stand'.
5. Kaye (1992) argues that the first consonant in *sC* clusters (and presumably by extension, all heterosyllabic clusters) in Greek is not extrasyllabic but rather forms the coda of an onsetless and nucleusless syllable. He claims that if, for example, the *s* in the root *strep*^{h} were extrasyllabic, the reduplicated perfect stem would be **te-strop*^{h} as the reduplicating syllable picks the first onset consonant to copy. Under Steriade's analysis, however, this is not a problem: **te-strop*^{h} would involve illicit line crossing. See also Morelli (this volume) for a discussion of *s* + stop clusters.
6. Also permitted are *s* + stop clusters, which I will not discuss for lack of space.
7. It must be the Syllable Contact Law, rather than a ban on closed syllables generally, that prohibits VC.CV syllabification here, since falling-sonority clusters are freely allowed to cross syllable boundaries in Irish: cf. *kʲirʲ.kʲə* 'hen' (gen.), *kaun.de:* 'county', etc. (Sjoestedt 1931, 112–114).
8. Ó Briain and Ó Cuív (1947: 106) report a very slight vowel coming between a word-initial voiced stop and a following sonorant, thus *bᵊla:h* 'flower'. These authors did not feel this sound was significant enough to include in transcriptions, whereas the epenthetic vowel in a word like *agələ* was always transcribed. I believe this slight vowel sound is not a true epenthetic vowel and does not form a syllable; rather, it is the phonetic correlate to the break between the voiced stop, attached to the foot or pword, and the sonorant, attached to the syllable.

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