Bibliographic Details

The Blackwell Companion to Phonology

Edited by: Marc van Oostendorp, Colin J. Ewen, Elizabeth Hume and Keren Rice

eISBN: 9781405184236

Print publication date: 2011

36. Final Consonants

Marie-Hélène Côté

Sections

1 Introduction

Final consonants, in the stem, the word, or the phrase, often display properties that set them apart from consonants in other positions. Basic principles of syllabification predict that final consonants are codas (see also CHAPTER 33: SYLLABLE-INTERNAL STRUCTURE) and, as such, are expected to pattern like non-final codas. Final consonants thus pose an analytical challenge when this expectation is not fulfilled.

Languages in which final consonants simply mirror internal codas are referred to as "symmetrical." In Manam, only nasals appear in both positions, and stress is regularly attracted to closed syllables, internal and final (1a); default stress is penultimate in the absence of closed syllables (1b). So final consonants in Manam display the same segmental profile and stress-attracting power as internal codas (**Buckley 1998**; **Piggott 1999**).

(1)	a.	['embegi]	'sacred flute'
		[ˀu'laŋ]	'desire'
		[ura'pundi]	'I waited for them'
	b.	[wa'bubu]	'night'

Spanish and Selayarese offer other illustrations of the correspondence between internal codas and final consonants. As shown by **Harris's (1983**: 14–15) list of word-medial and final rimes in Spanish, the set of permissible codas is the same in both positions and includes any consonantal category, possibly followed by [s]. Final syllables closed by consonants also attract stress, which is consistent with their contributing weight to the final syllable, as coda consonants regularly do cross-linguistically (CHAPTER 57: QUANTITY-SENSITIVITY). In Selayarese (**Mithun and Basri 1986**), medial codas are restricted to homorganic nasals, the first parts of geminates, and [ˀ]; final consonants are limited to [ˀ] and [ŋ]. Assuming that [ˀ] and [ŋ] lack place specification (e.g. **Paradis and Prunet 1993**; **Lombardi 2002**), all codas can be characterized by the absence of independent place features (CHAPTER 7: FEATURE SPECIFICATION AND UNDERSPECIFICATION; CHAPTER 22: CONSONANTAL PLACE OF ARTICULATION): they are placeless or acquire the place of the following onset.

In many other languages, final consonants pattern differently from internal codas. First, the right edge of constituents regularly hosts more consonants than internal codas may accommodate. Second, final consonants may be ignored in the application of metrical processes, while internal codas cannot be. These two tendencies, formulated in (2), define final consonant exceptionality.

(2) a. *Segmental immunity*

Final consonants escape segmental constraints that apply to internal codas.

b. *Metrical invisibility*

Final consonants are ignored in the application of metrical processes.

Both patterns occur in Cairene Arabic. While only one consonant is allowed in phrase-internal codas, two may appear phrase-finally (**Wiltshire 2003**); the additional final consonant is said to escape the coda conditions applicable elsewhere in the phrase. In addition, word stress is attracted to non-final CVC syllables and final CVCC/CVVC, as opposed to CV and final CVC, as if the final consonant were invisible to the stress assignment algorithm (**Hayes 1995**).

Final consonant exceptionality has attracted considerable attention in the development of modern phonological theory. Segmental immunity (2a), clearly the most widely discussed aspect of final exceptionality, is treated in §2–§4, starting in §2 with a review of various representative patterns (generalizations). Analyses of the special behavior of final consonants have almost exclusively relied on special accommodations to syllable structure in final position; different representational devices are examined and compared in §3 (representations). Representations, however, provide only part of the story: they offer a formal frame for the expression of the specificity of final consonants, but no explanation for it. §4 (motivations) is concerned with the formal, grammatical, or functional factors that have been called upon to account for the freedom of occurrence of right edge consonants. Metrical invisibility (2b) and its relationship to segmental immunity are addressed in §5.

Final consonants are also implicated in other processes, which are not reviewed in this chapter, since they fall under different topics. First, if final consonants appear with greater freedom, they are also regularly subject to deletion processes (**CHAPTER 68**: DELETION). Final clusters variably simplify in many languages. The factors that govern simplification, however, appear to be relevant to final and non-final clusters alike (e.g. **Côté 2004**), and I have chosen not to address this topic. Single final consonants also delete, giving rise to various types of C/Ø alternations. Examples include French liaison (see **CHAPTER 112**: FRENCH LIAISON), linking [r] in non-rhotic dialects of English (**Hay and Sudbury 2005**; among many others), and Maori verbal forms (**Blevins 1994**). Interestingly, such cases may involve a re-analysis of historically word-final consonants as epenthetic consonants (**Vennemann 1972**). Finally, final consonants are subject to resyllabification with a following initial segment. Both C/Ø alternations and resyllabification fall under the scope of external sandhi phenomena.

2 Segmental immunity: Generalizations

The immunity of final consonants emerges in static segmental distributions in the lexicon (§2.1) and in the asymmetrical application of segmental processes (§2.2). More consonants are licensed in final than in internal coda position, allowing additional segmental slots (size effects) or a wider range of place, manner, or laryngeal contrasts (feature effects).

2.1 In the lexicon

Eastern Ojibwa (**Piggott 1991, 1999**) and Tojolabal (**Supple and Douglass 1949**; **Lombardi 1995**) exemplify increased licensing possibilities in final position in manner and laryngeal features. In Ojibwa, while nasals and fricatives are permissible codas in all positions in the word (3a), stops are only allowed word-finally (3b). In Tojolabal, the contrast between plain/aspirated and laryngeal stops and affricates is neutralized in word-internal codas, where only plain segments appear (4a), but remains active in onsets and word-finally (4b).

(3) a. [baŋgisin] 'it falls'
[mo:ʃkine:] 'it is full'
[wi:ja:s] 'meat'
b. [nindib] 'my head'
[ninik] 'my arm'

(4) a. [hutp'in-] 'to push'
[ˀatnija] 'you bathed'
b. [potot'] 'class of plant'
[k'ak] 'flea'

French illustrates the presence of additional consonantal slots word-finally. While it admits a large variety of final clusters of up to four consonants (5), all morpheme-internal clusters may be analyzed with codas limited to one consonant (**Dell 1995**). Final clusters include sequences of rising sonority, in violation of the Sonority Sequencing Principle (e.g. **Clements 1990**; **CHAPTER 49**: SONORITY). This can be taken as a further indication that final consonants are not regular codas: they exceed the possibilities offered by the syllable template applicable elsewhere in the word not only in terms of the number of segments, but also in their relative autonomy with respect to general syllabic principles.

(5) [adɔpt] 'adopt'
[sɛrkl] 'circle'
[ɑ̃bidɛkstr] 'ambidextrous'

English offers different kinds of final exceptionality effects. As in French, more consonants are found finally than in internal codas: up to three in monomorphemic words (e.g. *next*) and four with the addition of word-level suffixes (e.g. *thousandths*) *vs.* only one internally (exceptionally two, as in *empty*; see **Borowsky 1986**). Unlike French, however, English does not tolerate word-final sequences of an obstruent followed by a non-sonorant. In addition, English displays asymmetries in vowel + consonant combinations. Word-finally, long vowels are followed by any consonant (6a); morpheme-internally, long vowels in closed syllables appear in restricted contexts: before fricative + stop (6b) or a sonorant homorganic with the following onset (6c), often with additional combinatorial constraints. Coronal obstruents enjoy a special status in final position (**CHAPTER 12**: CORONALS). For example, long vowels are not followed by clusters except coronal ones (6d), [d] is the only voiced stop allowed after nasal consonants (6e), and vowel reduction is more likely to apply before coronals than non-coronals (6f) (e.g. **Borowsky 1986**; **Burzio 2007**).

(6) a. *soap, reach*
b. *pastry, auspices, after*[1]
c. *council, chamber, example*
d. *wild, paint*
e. *blind, bond* (*vs. bomb, long*)
f. Unreduced final vowel: *Adirondack, insect, chipmunk*
Reduced final vowel: *Connecticut, Everest, elephant*

2.2 In segmental processes

The asymmetrical application of segmental processes may also give rise to final exceptionality effects. For example, word-internal complex codas may be simplified by consonant deletion or vowel epenthesis, while final clusters are left intact; final vowel deletion may create configurations that are not tolerated in medial syllables. Various feature-changing processes may also result in additional contrasts being tolerated in final consonants.

Although the majority of cases of final immunity appear to involve the word, exceptionality effects have also been reported at the stem and phrase levels. Interestingly, both morphosyntactic (stem) and prosodic (phrase) constituents appear to be targeted. However, the morphosyntactic or prosodic status of the word is usually unclear, being either left unspecified or assumed without argumentation for its status. Note that certain processes described at the word level may actually involve the phrase, since words are often considered in isolation. (See **CHAPTER 51**: THE PHONOLOGICAL WORD.)

Numerous patterns can be identified, depending on the specific configuration that is asymmetrically tolerated in final position, the process (deletion, epenthesis, or other) subject to asymmetrical application, and the level (stem, word, phrase) at which it applies. Some combinations are illustrated below (see **Côté 2000** for additional cases).

Kamaiurá allows codas only word-finally (**Everett and Seki 1985**). This language has a reduplication process that copies to the right the last two syllables of the base. When the base ends in a consonant, this consonant is lost word-medially, and surfaces only in the reduplicant (7).

(7) /o-mo-kon-mo-kon/ [omokomokon] 'he swallowed it frequently'
/je-umirik-mirik/ [jeumirimirik] 'I tie up repeatedly'

Kayardild (**Evans 1995**) displays a similar effect involving vowel deletion at the phrase level. Word-final [a] deletes phrase-finally but is kept before another word. This is illustrated in (8) with the two words [cirkuɻ-uŋ-ka] 'from the north' and [t̪a:-t̪a] 'he returned' pronounced in either order: only the second, phrase-final word loses its final [a]. See **Piggott (1991)** for other cases of apocope.

(8) [cirkuɻuŋka t̪a:-t̪] [t̪a:-t̪a cirkuɻuŋk]

Cairene Arabic allows CVCC syllables phrase-finally (9a), but enforces a CVC template phrase-internally. Vowel epenthesis prevents complex codas when clusters of more than two consonants are created through suffixation (9b) and word concatenation (9c) (e.g. **Broselow 1980**; **Wiltshire 2003**).

(9)	a.	/katab-t/	[katabt]	'you wrote'
		/bint/	[bint]	'girl'
	b.	/katab-t-l-u/	[katabtilu]	'I/you wrote to him'
	c.	/katabt gawaab/	[katabtigawaab]	'you (MASC) wrote a letter'
		/bint nabiiha/	[bintinabiiha]	'an intelligent girl'

Ondarroa Basque exemplifies a more complex case, in which exceptionality effects apply simultaneously at the word and phrase levels. Three different processes conspire to prevent the appearance of stops and affricates in coda position: vowel epenthesis, stop deletion, and affricate simplification. The choice of the repair strategy depends on a complex interplay of lexical and syntactic factors; see **Côté (2000)** for details. Root-final stops and affricates are excluded before consonant-initial suffixes inside words (10a), are optionally retained before consonant-initial words inside phrases (10b), and remain intact phrase-finally (10c).

(10)	a.	/kiʃket-tsat/	[kiʃketatsat]	'lock-PROLATIVE'
		/lapits-ʧo/	[lapitsaʧo]	'pencil+DIM'
			[lapisʧo]	
	b.	/iɾu kiʃket bota dot/	[iɾukiʃket(a)botaɾot]	'I have thrown three locks'
		/semat mutil/	[sema(t)mutil]	'how many boys'
		/eskats bat/	[eskatsbat]	'a/one kitchen'
			[eskasbat]	
			[eskatsabat]	
	c.	/lau silbot/	[lausilbot]	'four prominent bellies'
		/bost okots/	[bostokots]	'five chins'

Balantak displays different feature restrictions, involving manner and place of articulation at the stem level (**Broselow 2003**). Codas are limited to homorganic nasals inside morphemes (11a) and at the prefix-root juncture, where impossible codas are avoided by place assimilation (11b), deletion (11c), or epenthesis (11d). In contrast, all consonants other than voiced stops and glides may appear root-finally (12a), and root-final nasals fail to assimilate in place to the following consonant (12b), pointing to the privileged status of the root-final position.

(11)	a.	gampal		'underlayer'
		uŋgak		'hornbill bird'
	b.	/niŋ-borek/	[nimborek]	'lied'
		/miŋ-sapit/	[minsapit]	'hidden'
	c.	/saŋ-loloon/	[saloloon]	'one thousand'
		/moʔ-tokol/	[motokol]	'to lie down'
	d.	/mVŋ-roŋor/	[moŋoroŋor]	'to hear'

(12)	a.	/siok-ta/	[siokta]	'our (INCL) chicken'
		/bantil-kon/	[bantilkon]	'inform (BENEFACTIVE)'
	b.	/laigan-ku/	[laiganku]	'my house'
		/wuruŋ-ta/	[wuruŋta]	'our (INCL) language'

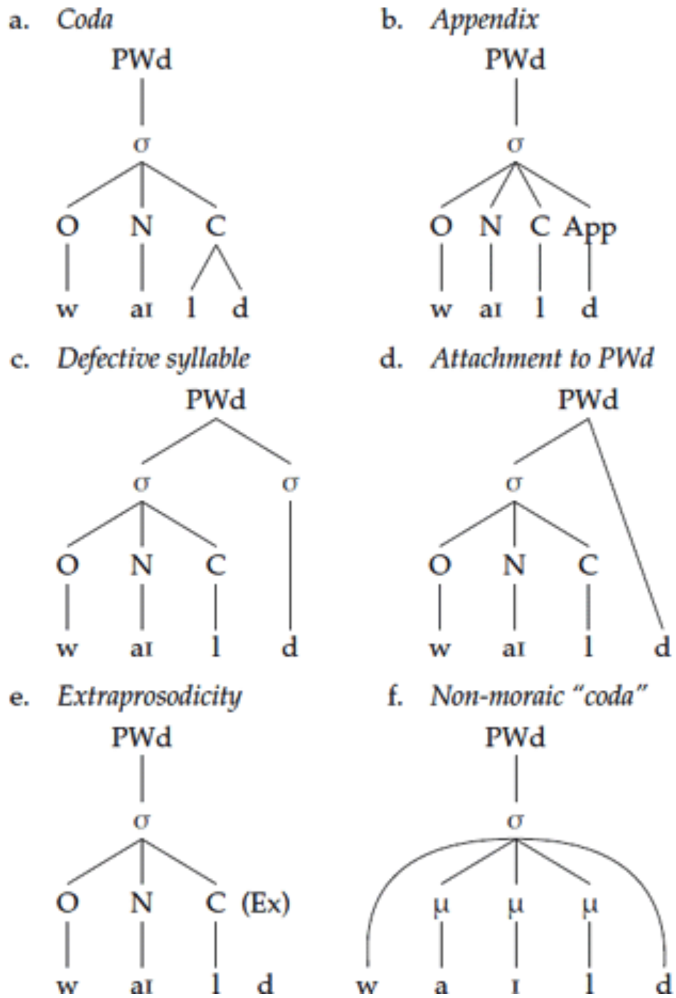
Patterns so far have been described in terms of more consonants being *allowed* at the right edge. Another language type has been put forward, which *requires* constituents to end in a consonant. This possibility is instantiated in Yapese, the case most commonly discussed (Piggott 1991, 1999; Broselow 2003; Wiltshire 2003). This language has no internal codas, but a generalized final short vowel deletion process, which results in words ending in a consonant on the surface. (Final long vowels shorten but do not delete.) The status of Yapese as a distinct type is questionable. As in Kayardild (8), vowel deletion applies finally but not internally (at the word level rather than the phrase), leading to the same generalization as other cases of final consonant immunity: consonants are more easily tolerated in final position. The Yapese pattern may be interpreted as favoring vowel deletion to the extent that it results in phonotactically acceptable forms, rather than actively requiring words to end in a consonant. Menominee is another language in which words end in a consonant, lexically or as a result of final vowel deletion (Bloomfield 1962).[2]

3 Segmental immunity: Representations

If final consonants escape the conditions applying to codas in other positions, their identity as codas is called into question or must be qualified. At least four directions have been explored to account for the internal–final asymmetry. (i) One consists in admitting position-specific syllable well-formedness conditions, for example by defining different coda constraints for final and non-final syllables. This approach is often taken at a descriptive level but it has not been favored in analytical work. (ii) Uniform syllabic conditions may be maintained across positions but violated at edges under pressure from independent constraints. Recent Optimality Theory (OT) analyses have often relied on this type of reasoning; see §4 for a discussion of some relevant factors. (iii) Another line of research has explored the idea that syllabic structure is irrelevant in all or some of the final immunity effects, which arise through sequential generalizations. It has been argued, for instance, that final clusters in English and other languages are accounted for with a constraint limiting sequences of consonants to only one place of articulation (with coronals unspecified for place in English) (Iverson 1990; Yip 1991; Lamontagne 1993; see also Burzio 2007). Such a sequential generalization allows a unified account of consonant clusters in all positions in the word. Côté (2000) takes a more radically non-syllabic approach to consonant phonotactics in general, and final edge effects in particular, which are defined in terms of segment sequencing and adjacency to constituent boundaries (see §4.4). (iv) However, the most widespread approach in the last 40 years has consisted in elaborating specific syllabic representations that distinguish final consonants from internal codas. The main proposals are presented and compared below: appendices, defective syllables, attachment to higher prosodic constituents, extraprosodicity, and non-moraic consonants.

These structural possibilities are illustrated in (13b)–(13f) for the English word *wild*. Each configuration allows final consonants to escape the conditions that apply to internal codas. The straightforward complex coda approach, which does not involve a specific final representation, is given for comparison in (13a). Notice that these devices are not mutually exclusive and have occasionally been combined. For example, Borowsky (1986) uses both extraprosodic and appendix consonants, Iverson (1990) appendices and empty-headed syllables.[3]

(13)



Appendix (13b): It has been argued that final consonants belong to a separate constituent that hosts consonants that do not fit into the coda. This constituent has been variably called "appendix"[4] (e.g. **Halle and Vergnaud 1980**; **Mohanan 1982**; **Charette 1984**; **Borowsky 1986**; **Goldsmith 1990**; **Iverson 1990**; **Wiltshire 1994**; **Booij 1995**; **Kraehenmann 2001**), "affix" (**Fujimura and Lovins 1982**), and "termination" (**Fudge 1969**). By stipulation, the appendix is available only in word-final position. This constituent is usually attached to the syllable node, as in (13b); it is alternatively part of the word structure, as a sister to the syllable. Two types of affixes may be distinguished, for non-suffixal and suffixal consonants (**Goldsmith 1990**; **Duanmu 2008**).

Defective syllables (13c): Final consonants are by default taken to be part of the syllable headed by the closest preceding vowel. This assumption is regularly challenged by claims that these consonants in fact belong to a separate syllable, one without a pronounced nucleus (e.g. **McCarthy 1979**; **Selkirk 1981**; **Iverson 1990**; **Burzio 1994**; **Dell 1995**; **Bye and de Lacy 2000**; **Cho and King 2003**). Representational and terminological details abound here. These special syllables have been termed "degenerate," "empty-headed," "minor," "defective," "semi-syllables," and "catalectic." They may or may not contain a nucleus position; the consonants may be onsets, rimes, or segments attached directly to the syllable node. Different types of degenerate syllables may even be distinguished, for example moraic *vs.* non-moraic (**Nair 1999**), or syllables whose nucleus position is empty *vs.* those whose nucleus is occupied by segmental material shared by the onset (**Goad 2002**; **Goad and Brannen 2003**). Final consonants have been considered to be universally onsets, notably in the model of Government Phonology (**Kaye 1990**; **Harris and Gussmann 2002**). Others advocate a mixed coda *vs.* onset approach to final consonants, depending on their segmental profile and behavior, and determined on a language-specific basis or even varying within the same language (**Piggott 1991, 1999**; **Goad 2002**; **Rice 2003**).

Attachment to higher prosodic constituents (13d): Final consonants may attach directly to prosodic constituents higher than the syllable, usually the prosodic word (PWd), but also phrasal constituents (e.g. **Rubach and Booij 1990**; **Rialland 1994**; **Rubach 1997**; **Wiltshire 1998, 2003**; **Auger 2000**; **Spaelti 2002**). As a variation on this theme, **Piggott (1999)** considers that final consonants are codas or onsets of empty-headed syllables *licensed* by, rather than attached to, the prosodic word. Attachment to higher prosodic constituents implies that the relevant domains for final consonant exceptionality are prosodic in nature. This proposal does not directly account for additional contrasts or slots at the end of morphosyntactic constituents, such as the stem (**Broselow 2003**).

Extraprosodicity (13e): The most prevalent approach to final consonant exceptionality involves the concept of extraprosodicity (or extrametricality; see CHAPTER 43: EXTRAMETRICALITY AND NON-FINALITY). Originally designed to exclude final syllables from stress assignment algorithms (**Liberman and Prince 1977**), extra-prosodicity has been extended to final consonants by Hayes (1980 (citing a presentation by K. P. Mohanan 1982)) for stress and Steriade (1982) for syllabification. Designating final consonants extraprosodic makes them invisible for the purposes of syllabification, stress assignment, and other processes. The consonants are later adjoined to prosodic structure, in conformity with the principle of Prosodic Licensing (Itô 1986), at a stage in the derivation when syllabic constraints are no longer applicable and metrical structure has already been built. Extraprosodicity is subject to the Peripherality Condition, which restricts it to edges of constituents.

Here again, the theme of extraprosodicity allows for numerous variations, regarding its universality and the level at which it operates. Final consonants are claimed to be universally extraprosodic at the lexical level (Borowsky 1986; Itô 1986). At the word level, extraprosodicity is parametrized (Itô 1986) or universal (Piggott 1991). Itô argues that it is turned off post-lexically, but cases of final consonant exceptionality at the phrasal level motivate its possible extension to post-lexical phonology (Rice 1990).

Non-moraic "coda" consonants (13f): In languages with moraic codas, additional final consonants may be represented as non-moraic (Lamontagne 1993; Sherer 1994; Hall 2002; Kiparsky 2003).

The merits and disadvantages of each of these approaches depend in large part on theory-internal considerations. Each must give up on at least one established principle or generalization of phonological theory. The idea of enriching syllable structure with an appendix constituent has encountered some resistance, since it involves position-specific syllable architecture. Little evidence has been adduced to motivate the appendix as a constituent, which would be expected to act as a trigger or target of some phonological processes; the only case known to me is Mohanan's (1982) suggestion that [r] depalatalizes in the appendix position in Malayalam. Attachment to higher prosodic constituents violates the principle of exhaustive syllabification, as well as strict layering of prosodic constituents. Extraprosodicity requires multiple levels of syllabification, in itself a contentious issue, and may be interpreted as a weakening of the principles of prosodic phonology (Piggott 1999). On the other hand, it avoids syllabic constituents that are otherwise unnecessary (Steriade 1982). Degenerate syllables imply a higher level of abstractness; empty syllabic positions are either viewed as going against the "uncontroversial assumption that syllables must have nuclei" (Rubach 1997: 570– 571) or, more positively, as a natural consequence of the phonological architecture in which the segmental and suprasegmental structures are independent of each other (Harris and Gussmann 2002).

Beyond conceptual considerations, at least three issues must be addressed by all approaches relying on specific representations for final consonants. One issue concerns the featural or combinatorial restrictions that additional consonants allowed at the right edge may themselves be subject to, and how these should be expressed. Final obstruent + sonorant sequences occur in French, but not in English. Germanic languages are also well known for allowing word-final strings of voiceless coronal obstruents. The representations in (13b)–(13f) do not make explicit predictions as to the range of consonants they may host, with the exception of the onset approach, according to which final consonants are expected to display onset-like properties. Final consonants or clusters in many languages do have an onset or coda-onset profile (e.g. French; Dell 1995). But many other patterns appear more challenging for the onset approach, as final consonants are regularly much more limited than onsets. In particular, the claim that final consonants are universally onsets is not readily compatible with languages in which final consonants share the same segmental profile as internal codas (but see Harris and Gussmann 2002 for discussion).

A related problem concerns the coda-like behavior of final consonants, even when they do not have a coda segmental profile. In Québec French, for example, high vowels have a lax variant that surfaces variably before internal codas and categorically before final consonants (14). This process has naturally been characterized as applying in closed syllables. If final consonants are not codas, can they be said to "close" the preceding syllable? Or should the laxing context "in closed syllables" be reformulated without reference to the closed syllables?

(14)	[bɪŋ.go]	'bingo'
	[pʊtr] ~ [pʊt]	'beam'
	[kʏb]	'cube'

Finally, why and how are such special representations restricted to final or edge positions – if indeed they are? Appendices, attachment to higher prosodic constituents, degenerate syllables, and extraprosodicity have been excluded inside constituents by stipulation. But in fact, some of these devices have been extended to non-peripheral positions as well (e.g. Rubach and Booij 1990; Rubach 1997). Relevant factors in answering this question are explored in the next section.

4 Segmental immunity: Motivations

Beyond representations, what factors possibly underlie segmental immunity? In particular, why do the exceptional structures described above occur at the right edge of constituents, or what motivates violations of coda conditions in final position? Five factors are discussed here: alignment, positional faithfulness, licensing parameters, perceptual factors, and morphology.

Some of these proposals specifically address final immunity effects, others are integrated into a larger typological perspective and cannot be properly evaluated without considering the full range of phonotactic possibilities in internal and final syllables. As a step toward this objective, let us look at the idealized patterns in (15), which specify the number of consonantal slots available in internal codas *vs.* final position.

(15)		*Internal codas*	*Final position*			*Examples*
	a.	Ø	C	i.	optional	Kamaiurá (7)
				ii.	obligatory	Yapese (§2.2)
	b.	C	CC			Cairene Arabic (9)
	c.	Ø	Ø			see Blevins (1995: 219), e.g. Fijian
	d.	C	C			Manam (1)
	e.	C	Ø			Warlpiri (Nash 1980)
	f.	CC	C			(unclear)

Three categories of languages can be identified: languages that allow more consonants finally (15a) and (15b), symmetrical languages (15c) and (15d), and languages that allow more consonants internally (15e) and (15f). Languages with final immunity effects and symmetrical languages have already been discussed, and require few additional comments. Within type (15a), a further division can be made based on whether final consonants are merely allowed (Kamaiurá) or required (Yapese). As mentioned in §2.2, the status of Yapese as a distinct case of final exceptionality requiring a separate analysis remains unclear. Apart from the Yapese case, all consonantal slots in (15) are optional. Symmetrical languages include those with simple codas or open syllables across the board; languages where complex codas are allowed internally and finally are not included in (15).

Types (15e) and (15f), the opposite of (15a) and (15b), illustrate "internal immunity" effects. The pattern in (15e) is not uncommon; it applies to languages that allow internal codas but require words to end in a vowel, including Hixkaryana (**Derbyshire 1979**) and a number of Australian languages (e.g. Warlpiri; **Nash 1980**). Type (15f), the mirror image of Cairene Arabic, where complex codas are tolerated only in internal syllables, is more controversial, and its existence not well established. More complex internal codas may relate to factors that are independent from the internal–final distinction: they may be allowed in stressed or initial syllables, at morpheme boundaries, or as a result of coda–onset linking that is not available in final position. Languages in which internal codas in any position might be productively allowed to be more complex than at the right edge need to be further investigated. In any case, pattern (15f) does not appear to be as prominent as the opposite type (15b).

4.1 Alignment

Analyses of final consonant immunity have explored a range of alignment constraints, requiring coincidence between the edges of two prosodic or morphological constituents.

First, constraints may force marked structures to appear at an edge. Contour tones, for instance, are limited to peripheral positions in many languages (**CHAPTER 45**: THE REPRESENTATION OF TONE). Similar restrictions have been proposed for non-canonical syllables used to accommodate additional final consonants: semi-syllables (**Cho and King 2003**) and trimoraic syllables (**Hall 2002**). For example, ALIGN(μμμ]$_{\sigma}$–R, PWd–R) aligns the right edge of a trimoraic syllable with the right edge of a phonological word (**Hall 2002**). Alternatively, marked structures may be prevented to appear in internal positions. Thus, **Bye and de Lacy (2000)** and **Clements (1997)** exclude non-peripheral moraless syllables and extra-syllabic consonants, respectively, with constraints enforcing mora and syllable adjacency.[5]

Alignment constraints have also contributed to account for final consonant immunity in an indirect fashion. In her analysis of Kamaiurá (7), which allows no internal codas but one final consonant, **Wiltshire (1998, 2003)** keeps NOCODA unviolated and attaches the final consonant directly to the prosodic word. This disrupts alignment between the right edge of the word and that of a syllable, in violation of ALIGN–R(PWd, σ). Ranking this constraint below NOCODA and NODELETION yields the desired candidate, with medial deletion and final extrasyllabicity, as shown in (16). Cairene Arabic, which allows extra consonants only phrase-finally (9), is analyzed in the same way, with NOCOMPLEXCODA and ALIGN–R(Phrase, PWd) in place of NOCODA and ALIGN–R(PWd, σ); **Clements's (1997)** analysis of Berber uses a similar constraint ALIGN–L(Phrase, σ).[6]

(16)

o-mo-kon-mo-kon	NOCODA	NODELETION	ALIGN-R(PWd,σ)
a. .o.mo.kon.mo.kon.	*!*		
b. .o.mo.ko.mo.ko.		**!	
☞ c. .o.mo.ko.mo.ko.n		*	*

Not considered here, however, are candidates with internal consonants linked to the PWd. Internal extrasyllabicity violates none of the constraints in (16), so the candidate [.o.mo.ko.n.mo.ko.n], with each [n] attached to the PWd, should win over that in (16c), since it incurs no violation of NODELETION. With the addition of another alignment constraint banning internal extrasyllabic segments (**Clements 1997**), candidate (16c) could emerge as optimal, but so could [.o.mo.ko.n.mo.ko], with an internal extrasyllabic [n] and deletion of the final [n] (under the ranking NoCoda >> NoDeletion and the constraint against internal extrasyllabicity at the bottom). This could be argued to correspond to type (15e), the mirror image of (15a); likewise, types (15f) and (15b) are generated with equal likelihood. In this approach, then, final consonants are no more likely to surface than non-final ones, and final and internal immunity effects are treated symmetrically.

Yet another use of alignment is found in **McCarthy's (1993)** constraint FinalC, corresponding to Align-R(PWd, C), which requires words to end in a consonant. This constraint has served to account for the Yapese pattern (15a.ii) (**Broselow 2003**; **Wiltshire 2003**), but it cannot generate type (15b), in which consonant clusters are allowed finally but eliminated in internal codas, since FinalC does not distinguish between one or two final consonants. **Lombardi (2002)** and **Wiltshire (2003)** extend FinalC to the phrasal level; Wiltshire also uses Align-R(PWd, V), the vocalic equivalent of FinalC, to derive languages of type (15e).

4.2 Positional faithfulness

Another approach invokes constraints protecting the right edge of constituents, ensuring that final segments or syllables make it to the surface. Syllable well-formedness is obeyed inside constituents, but violated finally under pressure from right-edge faithfulness (**chapter 63**: markedness and faithfulness constraints). Such faithfulness constraints have taken different formulations, with slightly different effects and predictions; two are offered in (17).

(17) a. Anchor-R(GWd)

A segment at the right edge of the grammatical word in the output has a correspondent at the right edge of the grammatical word in the input (**Broselow 2003**).[7]

b. Faith-R

The rightmost syllable constituent in the word is faithful to its underlying form (**Krämer 2003**).

Ranked above the constraints banning codas and consonant deletion, any of these constraints straightforwardly derives the Kamaiurá deletion pattern (7). As shown in (18), the surface form [.o.mo.ko.mo.kon.] emerges as optimal: the final consonant is protected from deletion by the undominated Anchor/Faith-R constraint, while the internal [n] is eliminated by NoCoda outranking NoDeletion.

(18)

o-mo-kon-mo-kon	Anchor-R(GWd) Faith-R	NoCoda	NoDeletion
a. .o.mo.kon.mo.kon.		**!	
b. .o.mo.ko.mo.ko.	*!		**
☞ c. .o.mo.ko.mo.ko.n		*	*

This approach follows a line of analysis that has been developed for other positions: syllable onsets (*vs.* codas), roots (*vs.* affixes), stressed syllables (*vs.* unstressed ones), initial syllables (*vs.* non-initial ones), and long vowels (*vs.* short ones). These positions are protected by specific faithfulness constraints that reflect their privileged psycholinguistic or phonetic status (**Beckman 1998**). A similar treatment for final segments or syllables (*vs.* non-final ones) is conceivable, although it has not been functionally motivated in the way other privileged positions have. From a more formal perspective, right-oriented constraints, as in (17) and the alignment constraints in §4.1, go against recent claims that constraints may only refer to the left edge, not the right one. This has been argued for Anchor by **Nelson (2003)** and for all constraints by **Bye and de Lacy (2000)**, who re-analyze right-edge effects, including final consonant exceptionality, without reference to the right edge.

Beyond such conceptual questions, right-edge faithfulness constraints fail to account for cases where vowel deletion applies finally but not medially, as in Kayardild (8), since ANCHOR excludes final deletion. The constraint FINALC, requiring every word to end in a consonant, has been invoked to counter the effect of ANCHOR and generate the Yapese pattern. As a result, cases of final consonant immunity end up being motivated by distinct constraints, FINALC and ANCHOR, depending on whether they arise from final vowel deletion or processes applying internally. This analytical distinction seems questionable.

One difference between the ANCHOR (17a) and FAITH-R (17b) approaches is that the former only targets the last segment, while the latter considers the entire final syllable. The last segment formulation cannot derive cases where clusters are maintained finally but eliminated internally (15b), as in Cairene Arabic. Consider the hypothetical example /arspont/ and the three constraints in (19). The only possible winners are the faithful [arspont], if NODELETION outranks NOCOMPLEXCODA, and [arpot], under the opposite ranking. There is no ranking that yields the desired candidate [arpont].[8]

(19)

arspont	ANCHOR-R(GrWd)	NOCOMPLEXCODA	NODELETION
☞ a. .ars.pont.		**	
b. .ar.pon.	*		**
c. .ar.pont		*	*
☞ d. .ar.pot.			**

Since Krämer's FAITH-R considers the entire final syllable, it correctly derives the desired output [arpont]. However, by evaluating identity, and not only correspondence, between input and output, it also predicts that contrasts may be maintained only in final syllables, including in their onset. Could distinctive voicing, for instance, be found only in the onset of final syllables? **Beckman (1998)** describes patterns in which initial syllables accommodate more complex codas than non-initial ones. Languages with more complex onsets in final than in non-final syllables remain to be reported, however.[9]

4.3 Licensing parameters

Final consonant freedom of occurrence has been generated by licensing parameters that allow or even favor final consonants on a language-specific basis. **Kaye (1990)** proposes a Coda Licensing Principle, according to which all codas must be licensed by a following onset; **Harris and Gussmann (2002)** provide further arguments for this approach (see also **Scheer 2008**). It follows that word-final consonants cannot be codas; they are onsets to an empty-headed syllable. The occurrence of final consonants is independent from that of internal codas, and depends on whether languages allow final onsets to be licensed by an empty nucleus. A four-way typology emerges from the combination of two binary parameters: whether or not (internal) codas are permitted and final empty nuclei are licensed. This yields four categories of languages (20).

(20)
a. No codas, no final empty nuclei — Type (15c)
b. No codas, final empty nuclei — Type (15a)
c. Codas, no final empty nuclei — Type (15e)
d. Codas, final empty nuclei — Type (15b)

Crucially, this typology excludes the other symmetrical pattern (15d), in which internal codas and final consonants obey the same constraints. This appears too restrictive, as argued by **Piggott (1991)**. In response, **Piggott (1999)** proposes another parameter based on the notion of remote licensing. All segments must be licensed by a higher prosodic category, either directly by the syllable, or indirectly (remotely) by the PWd or a phrasal constituent. Piggott, unlike Kaye, allows final consonants to be either codas or onsets, depending on their segmental profile; final onsets, which escape coda restrictions, are always licensed remotely, final codas may be licensed by the syllable or a higher constituent, and vowels must be licensed directly by the syllable. Languages vary in whether remote licensing is excluded (all final segments are either vowels or codas), possible (final segments are vowels, codas, or onsets), or obligatory (final segments must be consonants). This last option, reminiscent of **McCarthy's (1993)** FINALC, derives Yapese generalized apocope. Unlike Coda Licensing, Piggott's parametric approach does not provide for languages of type (20c); it also predicts that final consonants that exceed the coda template display onset-like properties, which is not always the case, for example with final coronal obstruents in Germanic languages.

An OT account similar in spirit to that of Piggott has been proposed by **Spaelti (2002)**. According to his WEAKEDGE family of constraints, the right edge of a constituent should contain as little prosodic structure as possible. These constraints favor the attachment of final segments to constituents higher than the syllable in the prosodic hierarchy. Since only consonants may be so attached, WEAKEDGE establishes consonants as the preferred segment type in final position.

Piggott's and Spaelti's proposals rely on the idea that constituents *should* end in a consonant, echoing the constraint FINAL-C mentioned above, and specifically in a non-coda consonant. **Goad (2002)** argues that final non-codas are indeed advantageous from a processing viewpoint. Final consonants that are not possible internal codas signal the right edge of words more clearly than final vowels or codas do, since they cannot appear syllable-finally inside words. Likewise, codas signal the right edge of syllables better than vowels do. This parsing argument needs to be tested; for now, two questions arise. First, if it is a desirable thing for words to end in onsets, one should expect to find more cases of generalized word-final vowel deletion or epenthesis of a non-coda consonant. As noted above, many languages actually require that words, but not syllables, end in a vowel. Second, if codas are the best indicators of the right edge of syllables, why are they considered marked in syllable typology?

4.4 Perception and adjacency to prosodic boundaries

The syllabic basis of consonant phonotactics has been questioned in the last decade or so (**Steriade 1999a, 1999b**; **Blevins 2003**), in particular by proponents of the "licensing by cue" approach, according to which the likelihood that a feature or segment occurs in a given context is a function of its relative perceptibility in that context (**CHAPTER 98**: SPEECH PERCEPTION AND PHONOLOGY). **Côté (2000)** applies this idea to segmental immunity at the right edge, arguing that the additional licensing possibilities in peripheral positions are motivated by perceptual factors. More consonants are tolerated at edges, because their perceptibility is enhanced by a number of phonetic processes: lengthening, articulatory strengthening, and reduction of the amount of overlap with adjacent segments.

The formal architecture is based on two constraint families that require consonants to be followed by a vowel (21a) or adjacent to a vowel (21b), contexts where they benefit from optimal transitional cues. But consonants with stronger internal or contextual cues are less dependent on vocalic transitions and vowel adjacency. This includes final consonants, which are subject to the more specific constraints in (21c) and (21d), where *i* ranges over the set of prosodic boundaries at the word level and above, including Ø for word-internal consonants (which are not adjacent to any boundary).

(21)
a. $C \rightarrow V$ A consonant is followed by a vowel.
b. $C \leftrightarrow V$ A consonant is adjacent to a vowel.
c. $C]_i \rightarrow V$ A consonant followed by a prosodic boundary i is followed by a vowel.
d. $C]_i \leftrightarrow V$ A consonant followed by a prosodic boundary i is adjacent to a vowel.

It is assumed that the higher the prosodic boundary a consonant is adjacent to, the more easily it surfaces without the support of an adjacent vowel; consonants not adjacent to any prosodic boundary are the weakest. This is expressed in the rankings in (22), which follows the three-way distinction between phrase-final, word-final, and (word-)internal consonants established in §2.2. Syllable well-formedness and extraprosodicity are irrelevant concepts in this framework, but C → V and C ↔ V obviously bear similarity to, but are not equivalent to, NoCoda and NoComplexCoda/Onset, respectively.

(22)
a. $C]_{\varnothing} \rightarrow V >> C]_{PW} \rightarrow V >> C]_{Ph} \rightarrow V$
b. $C]_{\varnothing} \leftrightarrow V >> C]_{PW} \leftrightarrow V >> C]_{Ph} \leftrightarrow V$

This approach derives the Kamaiurá and Cairene Arabic patterns. In Kamaiurá, NoDeletion is ranked between $C]_{\varnothing} \rightarrow V$ and $C]_{PW} \rightarrow V$; word-internal consonants have to be followed by a vowel, but word-final ones survive (23). It also directly accounts for cumulative immunity effects, as in Basque (10), with the rankings in (22). Note that C in these constraints may be restricted to specific categories or features (e.g. stops or [coronal] consonants).

(23)

o-mo-kon-mo-kon	$C]_{\varnothing} \rightarrow V$	NoDeletion	$C]_{PW} \rightarrow V$
a. omokonmokon	*!		*
b. omokomoko		**!	
☞ c. omokomokon		*	*

Broselow (2003) interprets the existence of exceptionality effects involving the stem – a morphosyntactic constituent – as contradicting the prosodic basis of the perceptual account. Moreover, enhancement effects are strongest at the phrase level but tend to be weak or inconsistent word-finally (phrase-internally). This may appear at odds with final exceptionality effects being most often reported at the word level. One possibility is that word-final effects arise through a generalization of phrase-final effects, which stabilizes word forms across prosodic contexts (see **Hyman 1977** and **Gordon 2001** for similar ideas regarding stress). The Balantak case involving the stem investigated by Broselow is consistent with this idea, since stems in this language may surface unsuffixed, in word- and phrase-final position. It remains to be seen whether there are stem-level cases that are incompatible with a phrase-final generalization account. In any case, if a prosodic/perceptual explanation is justified at some level, it would need to be enriched with other grammatical factors to account for the generalization effects.

Burzio (2007) pursues a related but complementary perceptual approach to final consonant immunity effects in English. As noted above, additional word-final consonants in English are most often coronals, and unstressed vowels preceding coronal consonants tend to reduce, unlike vowels preceding non-coronals (6f). Burzio argues that coronals being unmarked ("pre-neutralized"), they need not be cued by a full vowel and may survive with the weaker cues provided by a reduced vowel. Non-coronals, especially obstruents, need the cues of a full vowel. In other words, the special status of coronals in English (and presumably other languages) stems from their weaker perceptual demands.

4.5 Morphology

Morphology is obviously involved in some of the segmental immunity effects in final position. Additional final consonants in English (and many other languages) correspond in large part to word-level morphemes (plural and 3rd person [s z], past [t d], ordinal [θ]), which are productively added to relevant lexical forms. Final consonants, then, are partly motivated by "the morphology," this idea being implemented in various ways, depending on one's view of phonology and its interaction with the morphosyntactic component (**CHAPTER 103**: PHONOLOGICAL SENSITIVITY TO MORPHOLOGICAL STRUCTURE).

Suffixes may be excluded from syllable well-formedness conditions (**Selkirk 1982**; **Harris and Gussmann 2002**) or added into morphological constituents separate from the syllable (**Goldsmith 1990**; **Duanmu 2008**). The role of morphology may also extend beyond consonantal suffixes, as argued by **Duanmu (2008)**. First, he includes in a final suffix constituent not only true suffixes but also affix-like consonants, which correspond in English to all occurrences of [t d s z θ] that exceed the syllable template. In *bond*, for instance, the final [d] is licensed by some analogical principle to the extent that it could potentially correspond to the past tense affix (of some verb *bon*). The *bomb-bond* contrast, with deletion and retention, respectively, of the final stop, relates here to the pseudo-suffixal status of [d], and not to its coronality, as others have argued. Second, any final consonant that is potentially followed by a vowel-initial suffix is supported by a paradigm uniformity or anti-allomorphy principle. For example, the [p] in *help* is protected by its prevocalic position in *helping* and *helper*; its stability in *help* ensures a uniform expression of the morpheme in all contexts. The exclusion from syllable constituency of all morphologically motivated consonants (plus cases of segmental fusion, not discussed here) allows Duanmu to maintain a simple and cross-linguistically invariant CVX syllable template.

4.6 Summary and discussion

The proposals in §4.1–§4.5 can be compared along two empirical dimensions: (i) do they adequately account for all types of final immunity?; (ii) are they compatible with other phonotactic patterns involving the internal-final relationship? Concerning the first question, alignment constraints, due to their variety, are capable of deriving the full range of immunity effects; parameters such as Coda Licensing and Remote Licensing also account for additional consonantal slots, but their onset status appears at odds with the limited range of final consonants often tolerated beyond syllabic possibilities. Positional faithfulness struggles with final consonant immunity obtained though final vowel deletion; Anchor-based analyses also fail to protect final clusters by targeting only the last segment. Prosodic approaches raise the issue of immunity effects at the end of morpho-syntactic constituents. Finally, it remains to be seen how reasonably morphology can embrace all cases of final consonant immunity.

Beyond final immunity effects, Coda and Remote Licensing are integrated into parametric systems that claim to account for the full typology of internal-final phonotactic patterns, but the former fails to provide for symmetric languages of type (15d), where final consonants display a typical coda profile, and the latter ignores languages that require words to end in a vowel (15e). Alignment constraints probably offer the most flexible framework and derive the full range of patterns in (15). In fact, the flexibility of alignment constraints is such that final immunity effects enjoy no special status: consonant sequences are as likely to be more complex internally as to be more complex finally. This position might be argued to lack restrictiveness or explanatory power or, conversely, better reflect the range of formally possible patterns, depending in part on the status of type (15f), with complex codas productively allowed only inside constituents. Approaches based on positional faithfulness, perception, or morphology make no specific claims with regard to phonotactic patterns other than final immunity, especially those involving more complex internal codas, which need to be derived by independent constraints or factors. The requirement that words end in vowels might be interpreted as a morphological constraint, but type (15f) would seem to be more challenging. Progress in the analysis of final (and internal) immunity effects rests on a deeper understanding of the patterns in (15), how they arise diachronically, and what factors they are sensitive to.

5 Metrical invisibility

As noted in (2b), final exceptionality also manifests itself prosodically, final CVC syllables patterning like CV ones in stress assignment and vowel length alternations. While regularly noted, the metrical invisibility of final consonants has not given rise to the same analytical diversity as phonotactic immunity. Whether or not metrical invisibility and phonotactic immunity are amenable to a unified approach is also unclear: despite some attempts at a common analysis, there is evidence that the segmental and metrical manifestations of final exceptionality should be kept separate. §5.1 presents the relevant generalizations underlying metrical invisibility and its relationship with segmental immunity; §5.2 addresses its functional motivation.

5.1 Generalizations

In quantity-sensitive stress systems, syllable weight is normally determined by the segmental make-up of the rime. In some cases weight assignment also depends on the position of the rime in the word. Of interest here is the pattern where CVC syllables count as light in final position but as heavy elsewhere. See **Hayes (1995**: 57), **Lunden (2006**: 1), and **Gordon *et al.* (2010**: 142) for lists of languages in which final CVC patterns as light.

Various dialects of Arabic illustrate this effect, among them Cairene (**Hayes 1995**: 67–71; see also **CHAPTER 124**: WORD STRESS IN ARABIC). Cairene has three syllable types: light CV, heavy CVC and CVː, and superheavy CVCC and CVːC, found only in final position. Stress falls on final superheavy syllables (24a), otherwise on heavy penults (24b), otherwise on the penult or antepenult, according to a complex algorithm not described here. This pattern reveals an equivalence between final CVCC/CVːC and penultimate CVC/CVː, which regularly attract stress, and between final CVC and penultimate CV, which do not. This is straightforwardly accounted for if word-final consonants are ignored in the computation of weight and stress.

(24)	a.	[ka'tabt]	'I wrote'
		[hadʒ'dʒaːt]	'pilgrimages'
	b.	[ka'tabta]	'you (MASC SG) wrote'
		[haː'ðaːni]	'these (MASC DUAL)'
		[mu'darris]	'teacher'

As shown in (9) and (24), final consonants are simultaneously invisible to syllabic restrictions and stress assignment, which makes Cairene Arabic a textbook example of final consonant exceptionality, regularly discussed since **Broselow (1976)** and **McCarthy (1979)**. Such data make it tempting to interpret segmental immunity and metrical invisibility as two effects of a single phenomenon. Yet the two must be distinguished. In Cairene, stress assignment applies at the word level, but the CVC syllable template is enforced at the phrasal level, after resyl-labification of word-final consonants with a following vowel, as in (25a). Crucially, stress remains on the second syllable in [ʃi'ribt] and the first in ['katab] (25b), even though on the surface the second syllable is assumed to be CVC in both cases.

(25)	a.	/ʃiribt ahwa/	[ʃi.'rib.'tah.wa]	'you drank coffee' (Selkirk 1981: 222)
	b.	/katab lilmalik/	['ka.tab.lil.'ma.lik]	'he wrote to the king' (Broselow 1976: 16)

Other evidence of the independence of segmental immunity and metrical invisibility can be found in the stress pattern of Hindi-Urdu (**Hayes 1980**; **Hussain 1997**). The relevant facts resemble those of Cairene Arabic, with stress falling on final superheavy syllables, otherwise on the rightmost heavy. Unlike Cairene, however, superheavy syllables are not restricted to the final position. Final consonants are metrically invisible, since CVC attracts stress only in non-final syllables. But segmental immunity is not involved, since complex codas occur in all positions.

Like stress, vowel length is sensitive to syllable shape, vowel shortening typically occurring in closed syllables and lengthening in open syllables. Again, final consonants appear to be ignored in some languages, with lengthening applying in final CVC syllables or shortening applying only in CVCC ones. Icelandic (**Gussmann 2002**) regularly stresses the initial syllable of the word. The stressed vowel lengthens in open syllables (26a) and in monosyllables closed by only one consonant (26b), but no lengthening is observed in non-final closed syllables (26c) and in monosyllables closed by two or more consonants (26d). This is a straightforward case of final consonant invisibility: final CVC patterns like non-final CV, and final CVCC like non-final CVC. Similar length alternations are observed in Swiss German (**Spaelti 2002**) and Menominee (**Milligan 2005**).

(26)	a.	['puː]	'estate'
		['staːra]	'stare'
	b.	['pruːn]	'edge'
		['θaːkʰ]	'roof'
	c.	['sɛnta]	'send'
		['flaska]	'bottle'
	d.	['tʰjalt]	'tent'
		['rixs]	'rich (GEN SG MASC)'

English shows both stress and length effects of final metrical invisibility. In verbs, final CVCC attracts stress (*u'surp, tor 'merit*), but CVC does not (*'edit, de'velop*). The stress-attracting power of internal CVC is, however, visible in nouns (*a'genda, a'malgam*) (**Hayes 1982**). With respect to length, long vowels in final CVːC syllables regularly correspond to short vowels in final CVCC or non-final CVC, after the addition of a consonantal or syllable-size suffix (*keep-kept, wide-width, five-fifth-*

fifty, wise-wisdom, intervene-intervention). This suggests that shortening applies in closed syllables (internal CVC and final CVCC) but spares final CVC, treated as open by virtue of final consonant invisibility.

The representations specific to final consonants discussed in §3 have also been used to derive their metrical invisibility, in particular extraprosodicity (13e) and non-moraic coda consonants (13f). The latter directly accounts for invisibility in the context of stress assignment, if stress depends on syllable weight and weight on moraic structure. Extraprosodicity for metrical purposes is generally kept distinct from phonotactically motivated extrametricality (e.g. **Hayes 1995**: 106), echoing the remarks above on the non-equivalence between metrically invisible and segmentally immune consonants. **Iverson (1990)** in fact argues that extraprosodicity should be restricted to stress and excluded from the segmental domain, with cases of segmental immunity and vowel length alternations re-analyzed as involving some of the other devices mentioned in §3: appendices, empty-headed syllables, and sequential cluster constraints (see also **Lamontagne 1993**).

5.2 Motivation

The lightness of final CVC syllables is motivated by the avoidance of final stress, embodied in OT by the constraint Non-Finality (**Prince and Smolensky 2004**), which excludes final stressed syllables or head feet (see **chapter 43**: extrametricality and non-finality). Non-Finality, in conjunction with other constraints, correctly derives stresslessness on final CVC and stress on final CVCC and CVVC in Arabic dialects (**Rosenthall and van der Hulst 1999**).

If Non-Finality generates the facts, the question remains why final stress should be avoided or why final CVC is treated as light. A number of proposals functionally related to the special status of final CVC have recently been put forward. **Ahn (2000)**, **Lunden (2006)**, **Hyde (2009)**, and **Gordon *et al.* (2010)** offer explanations that, although distinct, are all related to final lengthening.[10] Ahn suggests that the increased vowel duration resulting from final lengthening jeopardizes the contrast between short and long vowels by making final short vowels comparable in duration to non-final long vowels. Stressing the final vowel would weaken the length contrast even further. Lunden and Gordon *et al.* develop a duration-based account of syllable weight, according to which syllables count as heavy (and attract stress) if their rime is sufficiently longer than that of light syllables. The relative difference in duration between internal CVC and CV is sufficient for CVC to be categorized as heavy, but this may not be the case finally, where final lengthening reduces significantly the durational ratio of CVC to CV. **Gordon *et al.* (2010)** also reveal that the languages that asymmetrically treat final CVC as light lack vowel length contrasts in final syllables. It is proposed that phonetic final lengthening tends to be more pronounced when no length contrasts need to be maintained, making it more likely that CVC be interpreted as light.

Hyde (2009) focuses on certain properties of final lengthening rather than on duration itself. He notes that, unlike initial lengthening, final lengthening is typically associated with tempo deceleration and declining intensity. These characteristics make final position less compatible with stress, either because diminished intensity makes stress more difficult to perceive, or because the intensity that typically accompanies stress makes it more difficult to decelerate. See **Hyman (1977)** and **Gordon (2001)** for related ideas. Gordon invokes intonational factors, final stress being avoided because it would result in the high tone associated with stress and the low final boundary tone being realized on the same syllable. Note that these different factors – duration, final lengthening, length contrasts, tones, deceleration, and intensity – are potentially complementary rather than contradictory in explaining the distinction between final stressless CVC and stressed CVCC/CVVC.

6 Conclusions

Final consonants are implicated in a multiplicity of data and analytical approaches, involving a variety of representations, constraints, and parameters. Among the relevant empirical domains, consonant phonotactics has largely dominated the debates, and the stresslessness of final CVC has drawn some attention, while vowel length alternations have been relatively neglected. Analytically, no unified conception of final consonant exceptionality has really emerged, despite attempts based on extraprosodicity, which have been challenged by evidence for the independence of metrical invisibility and segmental immunity. In a changing theoretical landscape, discussions have tended to shift over time from issues of representation to motivations, ranging from abstract parameters (coda or remote licensing) and OT constraints (alignment, positional faithfulness) to the role of morphology and functional explanations (perceptual factors, final lengthening). These approaches are probably to some extent complementary.

Focusing on phonotactic patterns, several issues remain to be clarified, concerning the typology of final immunity effects and their relationship to internal immunity effects, whereby more consonants are allowed in internal codas than in final position, and the prosodic or morphosyntactic nature of the constituents involved (phrases, words, stems). To what extent can patterns that require constituents to end in a consonant be analyzed along the same lines as those that merely allow additional consonants? What is the status of patterns displaying more complex codas inside constituents? Should internal and final immunity effects be accounted for in a unified and symmetrical fashion or do they involve distinct factors? One difficulty in answering such questions stems from the fact that positional asymmetries in the complexity of consonant sequences may relate to many factors other than the internal-final contrast, including stressed *vs.* unstressed syllables, initial *vs.* non-initial syllables, morpheme boundaries, and coda-onset linking.

ACKNOWLEDGMENTS

Thanks to two anonymous reviewers and the *Companion* editors for helpful comments. I also acknowledge the financial support of the Social Sciences and Humanities Research Council of Canada.

Notes

1 Long vowels before [ft] (6b) and [mp] (6c) are restricted to [a:], and only occur in some dialects, e.g. Southern British English.

2 If words may be required to end in a consonant, we should find cases of systematic final consonant epenthesis, instead of vowel deletion. Interestingly, I am aware of no such cases at the word level. However, many examples of *phrase*-final consonant epenthesis are reported (see some examples in **Trigo 1988**). This asymmetry between the word and the phrase needs to be investigated further, but it suggests that phrase-final epenthesis corresponds to an articulatory closure effect that is not relevant word-finally.

3 Another (partial) solution to the free occurrence of final consonants exploits the idea that certain combinations of consonants form complex phonemes and count as a single unit. It has been applied in particular to [s] + obstruent sequences in English (**Fudge 1969**; **Fujimura and Lovins 1982**; **Selkirk 1982**; **Wiese 1996** for German; see also **CHAPTER 38**: THE REPRESENTATION OF SC CLUSTERS). A word like *wild*, on this view, contains only one post-vocalic segment. **Duanmu (2008)** develops a richer theory of complex sounds, which allows him to maintain a simple CVX syllable template; see §4.5.

4 The term "appendix" has also been used to refer to non-moraic "coda" consonants (13f) (**Sherer 1994**; **Zec 2007**) or consonants attached directly to the syllable or prosodic word nodes (13d) (**Rosenthall and van der Hulst 1999**).

5 These adjacency constraints are defined in terms of alignment or contiguity. But contiguity here involves only output forms and no comparison with inputs, as in other formulations of CONTIGUITY, following **McCarthy and Prince (1995)**.

6 Cairene Arabic also excludes internal CVVC syllables, which cannot be accomplished with NOCOMPLEXCODA. Wiltshire's analysis does not address this issue.

7 The ANCHOR constraint has a predecessor in **McCarthy and Prince's (1993)** ALIGN-R(stem, σ), which, applied in the context of the early Parse-Fill approach to faithfulness in OT, has a faithfulness effect similar to that of ANCHOR in terms of protecting the final segment. This alignment approach is applied to the Cairene Arabic pattern by **Wiltshire (1994)** and extended to laryngeal contrasts by **Lombardi (1995)**. It must be distinguished from later alignment constraints, discussed in the preceding section, which have no faithfulness effects.

8 **Broselow (2003)** includes I-O CONTIGUITY, which bans medial deletion and epenthesis, in her constraint set. This does not allow [arpont] to emerge as optimal, and it has the unexpected consequence of generating type (15f), whose status remains unclear. I-O CONTIGUITY serves to derive languages that require words to end in vowels (15c), but this could also be accomplished with ALIGN-R(PWd, V).

9 FAITH-R also suffers from a problematic formulation. In the output [arspon], with deletion of the final [t], the last syllable [pon] is faithful to its corresponding string in the input. Without syllabification in the input, it is not clear how final deletion is penalized.

10 Final lengthening may also relate to length alternations that treat final CVC as open, as in Icelandic (26). I leave this issue open.

REFERENCES

Ahn, Mee-Jin. 2000. *Phonetic and functional bases of syllable weight for stress assignment*. Ph.D. dissertation, University of Illinois, Urbana.

Auger, Julie. 2000. Phonology, variation, and prosodic structure: Word-final epenthesis in Vimeu Picard. In Josep M. Fontana, Louise McNally, M. Teresa Turell & Enric Vallduví (eds.) *Proceedings of the 1st International Conference on Language Variation in Europe*, 14–24. Barcelona: Universitat Pompeu Fabra.

Beckman, Jill N. 1998. *Positional faithfulness*. Ph.D. dissertation, University of Massachusetts, Amherst.

Blevins, Juliette. 1994. A phonological and morphological reanalysis of the Maori passive. *Te Reo* (37) . 29–53.

Blevins, Juliette. 1995. The syllable in phonological theory. In John A. Goldsmith (ed.) *The handbook of phonological theory*, 206–244. Cambridge, MA & Oxford: Blackwell.

Blevins, Juliette. 2003. *The independent nature of phonotactic constraints: An alternative to syllable-based approaches*. In Féry & van de Vijver (2003). 375–403.

Bloomfield, Leonard. 1962. *The Menomini language*. New Haven: Yale University Press.

Booij, Geert. 1995. *The phonology of Dutch*. Oxford: Clarendon Press.

Borowsky, Toni. 1986. *Topics in the lexical phonology of English*. Ph.D. dissertation, University of Massachusetts, Amherst.

Broselow, Ellen. 1976. *The phonology of Egyptian Arabic*. Ph.D. dissertation, University of Massachusetts, Amherst.

Broselow, Ellen. 1980. Syllable structure in two Arabic dialects. *Studies in the Linguistic Sciences* (10) . 13–24.

Broselow, Ellen. 2003. Marginal phonology: Phonotactics on the edge. *The Linguistic Review* (20) . 159–193.

Buckley, Eugene. 1998. Alignment in Manam stress. *Linguistic Inquiry* (29) . 475–496.

Burzio, Luigi. 1994. *Principles of English stress*. Cambridge: Cambridge University Press.

Burzio, Luigi. 2007. Phonology and phonetics of English stress and vowel reduction. *Language Sciences* (29) . 154–176.

Bye, Patrik & Paul de Lacy. 2000. Edge asymmetries in phonology and morphology. *Papers from the Annual Meeting of the North East Linguistic Society* (30) . 121–135.

Charette, Monik. 1984. The appendix in parametric phonology. *Studies in African Linguistics*. Supplement (9) . 49–53.

Cho, Young-mee Yu & Tracy Holloway King. 2003. *Semisyllables and universal syllabification*. In Féry & van de Vijver (2003). 183–212.

Clements, G. N. 1990. The role of the sonority cycle in core syllabification. In John Kingston & Mary E. Beckman (eds.) *Papers in laboratory phonology I: Between the grammar and physics of speech*, 283–333. Cambridge: Cambridge University Press.

Clements, G. N. 1997. *Berber syllabification: Derivations or constraints*? In Roca (1997), 289–330.

Côté, Marie-Hélène. 2000. *Consonant cluster phonotactics: A perceptual approach*. Ph.D. dissertation, MIT.

Côté, Marie-Hélène. 2004. Syntagmatic distinctness in consonant deletion. *Phonology* (21) . 1–41.

Dell, François. 1995. Consonant clusters and phonological syllables in French. *Lingua* (95) . 5–26.

Derbyshire, Desmond C. 1979. *Hixkaryana*. Amsterdam: North-Holland.

Duanmu, San. 2008. *Syllable structure: The limits of variation*. Oxford: Oxford University Press.

Evans, Nicholas D. 1995. *A grammar of Kayardild*. Berlin: Mouton de Gruyter.

Everett, Daniel L. & Lucy Seki. 1985. Reduplication and CV skeleta in Kamaiurá. *Linguistic Inquiry* (16) . 326–330.

Féry, Caroline & Ruben van de Vijver (eds.) 2003. *The syllable in Optimality Theory*. Cambridge: Cambridge University Press.

Fudge, Erik C. 1969. Syllables. *Journal of Linguistics* (5) . 253–286.

Fujimura, Osamu & Julie B. Lovins. 1982. *Syllables as concatenative phonetic units*. Bloomington: Indiana University Linguistics Club.

Goad, Heather. 2002. Markedness in right-edge syllabification: Parallels across populations. *Canadian Journal of Linguistics* (47) . 151–186.

Goad, Heather & Kathleen Brannen. 2003. Phonetic evidence for phonological structure in syllabification. In Jeroen van de Weijer, Vincent J. van Heuven & Harry van der Hulst (eds.) *The phonological spectrum, vol. 2: Suprasegmental structure*, 3–30. Amsterdam & Philadelphia: John Benjamins.

Goldsmith, John A. 1990. *Autosegmental and metrical phonology*. Oxford & Cambridge, MA: Blackwell.

Gordon, Matthew. 2001. The tonal basis of weight criteria in final position. *Papers from the Annual Regional Meeting, Chicago Linguistic Society* (36) . 141–156.

Gordon, Matthew, Carmen Jany, Carlos Nash & Nobutaka Takara. 2010. Syllable structure and extrametricality: A typological and phonetic study. *Studies in Language* (34) . 131–166.

Gussmann, Edmund. 2002. *Phonology: Analysis and theory*. Cambridge: Cambridge University Press.

Hall, T. A. 2002. Against extrasyllabic consonants in German and English. *Phonology* (19) . 33–75.

Halle, Morris & Jean-Roger Vergnaud. 1980. Three-dimensional phonology. *Journal of Linguistic Research* (1) . 83–105.

Harris, James W. 1983. *Syllable structure and stress in Spanish: A nonlinear analysis*. Cambridge, MA: MIT Press.

Harris, John & Edmund Gussmann. 2002. Word-final onsets. *UCL Working Papers in Linguistics* (14) . 1–42.

Hay, Jennifer & Andrea Sudbury. 2005. How rhoticity became /r/-sandhi. *Language* (81) . 799–823.

Hayes, Bruce. 1980. *A metrical theory of stress rules*. Ph.D. dissertation, MIT. Published 1985, New York: Garland.

Hayes, Bruce. 1982. Extrametricality and English stress. *Linguistic Inquiry* (13) . 227–276.

Hayes, Bruce. 1995. *Metrical stress theory: Principles and case studies*. Chicago: University of Chicago Press.

Hussain, Sarmad. 1997. *Phonetic correlates of lexical stress in Urdu*. Ph.D. dissertation, Northwestern University.

Hyde, Brett. 2009. The rhythmic foundations of Initial Gridmark and Nonfinality. *Papers from the Annual Meeting of the North East Linguistic Society* (38) (1). 397–410.

Hyman, Larry M. 1977. On the nature of linguistic stress. In Larry M. Hyman (ed.) *Studies in stress and accent*, 37–82. Los Angeles: Department of Linguistics, University of Southern California.

Itô, Junko. 1986. *Syllable theory in prosodic phonology*. Ph.D. dissertation, University of Massachusetts, Amherst. Published 1988, New York: Garland.

Iverson, Gregory K. 1990. The stipulation of extraprosodicity in syllabic phonology. *Language Research* (26) . 515–552.

Kaye, Jonathan. 1990. "Coda" licensing. *Phonology* (7) . 301–330.

Kiparsky, Paul. 2003. *Syllables and moras in Arabic*. In Féry & van de Vijver (2003). 147–182.

Kraehenmann, Astrid. 2001. Swiss German stops: Geminates all over the word. *Phonology* (18) . 109–145.

Krämer, Martin. 2003. *What is wrong with the right side? Edge (a)symmetries in phonology and morphology*. Unpublished ms., University of Tromsø (ROA-576).

Lamontagne, Greg. 1993. *Syllabification and consonant cooccurrence conditions*. Ph.D. dissertation, University of Massachusetts, Amherst.

Liberman, Mark & Alan Prince. 1977. On stress and linguistic rhythm. *Linguistic Inquiry* (8) . 249–336.

Lombardi, Linda. 1995. Laryngeal neutralization and Alignment. *University of Massachusetts Occasional Papers in Linguistics* (18) . 225–247.

Lombardi, Linda. 2002. Coronal epenthesis and markedness. *Phonology* (19) . 219–251.

Lunden, Anya. 2006. *Weight, final lengthening and stress: A phonetic and phonological case study of Norwegian*. Ph.D. dissertation, University of California, Santa Cruz (ROA-833).

McCarthy, John J. 1979. On stress and syllabification. *Linguistic Inquiry* (10) . 443–465.

McCarthy, John J. 1993. A case of surface constraint violation. *Canadian Journal of Linguistics* (38) . 169–195.

McCarthy, John J. & Alan Prince. 1993. Generalized alignment. *Yearbook of Morphology 1993*. 79–153.

McCarthy, John J. & Alan Prince. 1995. Faithfulness and reduplicative identity. In Jill N. Beckman, Laura Walsh Dickey & Suzanne Urbanczyk (eds.) *Papers in Optimality Theory*, 249–384. Amherst: GLSA.

Milligan, Marianne. 2005. *Menominee prosodic structure*. Ph.D. dissertation, University of Wisconsin, Madison.

Mithun, Marianne & Hasan Basri. 1986. The phonology of Selayarese. *Oceanic Linguistics* (25) . 210–254.

Mohanan, K. P. 1982. *Lexical Phonology*. Ph.D. dissertation, MIT. Distributed by Indiana University Linguistics Club.

Nair, Rami. 1999. *Syllables and word-edges*. Ph.D. dissertation, Northwestern University.

Nash, David. 1980. *Topics in Warlpiri grammar*. Ph.D. dissertation MIT. Published 1986, New York: Garland.

Nelson, Nicole. 2003. *Asymmetric anchoring*. Ph.D. dissertation, Rutgers University.

Paradis, Carole & Jean-François Prunet. 1993. A note on velar nasals: The case of Uradhi. *Canadian Journal of Linguistics* (38) . 425–439.

Piggott, Glyne L. 1991. Apocope and the licensing of empty-headed syllables. *The Linguistic Review* (8) . 287–318.

Piggott, Glyne L. 1999. At the right edge of words. *The Linguistic Review* (16) . 143–185.

Prince, Alan & Paul Smolensky. 2004. *Optimality Theory: Constraint interaction in generative grammar*. Malden, MA & Oxford: Blackwell.

Rialland, Annie. 1994. The phonology and phonetics of extrasyllabicity in French. In Patricia, Keating (ed.) *Phonological structure and phonetic form*, 136–159. Cambridge: Cambridge University Press.

Rice, Keren. 1990. Predicting rule domains in the phrasal phonology. In Sharon Inkelas & Draga Zec (eds.) *The syntax-phonology connection*, 289–312. Chicago: University of Chicago Press.

Rice, Keren. 2003. On the syllabification of right-edge consonants: Evidence from Ahtna (Athapaskan). In Stefan, Ploch (ed.) *Living on the edge*, 427–448. Berlin & New York: Mouton de Gruyter.

Roca, Iggy (ed.) 1997. *Derivations and constraints in phonology*. Oxford: Clarendon Press.

Rosenthall, Sam & Harry van der Hulst. 1999. Weight-by-position by position. *Natural Language and Linguistic Theory* (17) . 499–540.

Rubach, Jerzy. 1997. *Extrasyllabic consonants in Polish: Derivational Optimality Theory*. In Roca (1997). 551–581.

Rubach, Jerzy & Geert Booij. 1990. Edge of constituent effects in Polish. *Natural Language and Linguistic Theory* (8) . 427–463.

Scheer, Tobias. 2008. Why the prosodic hierarchy is a diacritic and why the interface must be direct. In Jutta M. Hartman, Veronika Hegedüs & Henk van Riemsdijk (eds.) *Sounds of silence: Empty elements in syntax and phonology*, 145–192. Amsterdam: Elsevier.

Selkirk, Elisabeth. 1981. Epenthesis and degenerate syllables in Cairene Arabic. *MIT Working Papers in Linguistics* (3) . 209–232.

Selkirk, Elisabeth. 1982. The syllable. In Harry van der Hulst & Norval Smith (eds.) *The structure of phonological representations, part II*, 337–383. Dordrecht: Foris.

Sherer, Timothy. 1994. *Prosodic phonotactics*. Ph.D. dissertation, University of Massachusetts, Amherst.

Spaelti, Philip. 2002. *Weak edges and final geminates in Swiss German*. Unpublished ms., University of California, Santa Cruz (ROA-18).

Steriade, Donca. 1982. *Greek prosodies and the nature of syllabification*. Ph.D. dissertation, MIT.

Steriade, Donca. 1999a. Alternatives to syllable-based accounts of consonantal phonotactics. In Osamu Fujimura, Brian D. Joseph & Bohumil Palek (eds.) *Item order in language and speech*, 205–245. Prague: Karolinum Press.

Steriade, Donca. 1999b. Phonetics in phonology: The case of laryngeal neutralization. *UCLA Working Papers in Linguistics 2: Papers in Phonology* (3) . 25–146.

Supple, Julia & Celia M. Douglass. 1949. Tojolabal (Mayan): Phonemes and verb morphology. *International Journal of American Linguistics* (15) . 168–174.

Trigo, Loren. 1988. *On the phonological behavior and derivation of nasal glides*. Ph.D. dissertation, MIT.

Vennemann, Theo. 1972. Rule inversion. *Lingua* (29) . 209–242.

Wiese, Richard. 1996. *The phonology of German*. Oxford: Clarendon Press.

Wiltshire, Caroline. 1994. Alignment in Cairene Arabic. *Proceedings of the West Coast Conference on Formal Linguistics* (13) . 138–153.

Wiltshire, Caroline. 1998. Extending ALIGN constraints to new domains. *Linguistics* (36) . 423–467.

Wiltshire, Caroline. 2003. *Beyond codas: Word and phrase-final alignment*. In Féry & van de Vijver (2003). 254–268.

Yip, Moira. 1991. Coronals, consonant clusters, and the coda condition. In Carole Paradis & Jean-François Prunet (eds.) *The special status of coronals: Internal and external evidence*, 61–78. San Diego: Academic Press.

Zec, Draga. 2007. The syllable. In Paul de Lacy (ed.) *The Cambridge handbook of phonology*, 161–194. Cambridge: Cambridge University Press.

Cite this article

Côté, Marie-Hélène. "Final Consonants." *The Blackwell Companion to Phonology*. van Oostendorp, Marc, Colin J. Ewen, Elizabeth Hume and Keren Rice (eds). Blackwell Publishing, 2011. Blackwell Reference Online. 12 January 2012 <http://www.companiontophonology.com/subscriber/tocnode?id=g9781405184236_chunk_g978140518423638>