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Markedness in Right-edge Syllabification: Parallels across Populations

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1. Introduction

In recent years, a large literature has been amassed which demonstrates that end-state grammars require two options for the syllabification of singleton word-final consonants. On the one hand are languages like Japanese where final consonants demand a coda analysis (Itô 1986). On the other are languages like Diola-Fogny where consonants in this position warrant an onset analysis (Piggott 1999). However, the proposal that right-edge consonants may be analysed as onsets has encountered some resistance, especially with the recent trend away from abstract representations in favour of phonetically-motivated explanations of phonological patterning. In view of this, the general goal of this article is to provide support for right-edge onsets from across populations: from developing grammars, both first (L1) and second (L2) language learner systems, and from Specific Language Impairment (SLI).

The more specific goal is to demonstrate that, among languages that opt for final onsets, a division must be drawn between those languages where such consonants are syllabified as onsets of empty-headed syllables (OEHS) and those where they are syllabified through onset-nuclear (ON) sharing (following Goad and Brannen in press). The latter representation will be employed in languages where final consonants display fortition (overt release): the final nucleus serves to host the release of the consonant.

ON sharing will be argued to be unmarked. I will demonstrate that learners display a preference for this syllabification option, in the case of L1 and SLI, regardless of the status of such consonants in the target language, and in the case of L2, independent of the status of final consonants in both the L1 and target grammars. The position that right-edge consonants are optimally analysed through ON sharing will also be supported through a processing argument; this will serve to illustrate how ON syllabification provides an advantage to end-state grammars, beyond being an emergent property from acquisition.

The article is organized as follows. In section 2, I detail my assumptions about syllable structure and review the criteria that determine whether a language merits a coda or onset analysis for right-edge consonants. Among languages that organize final consonants as onsets, the further division into OEHS and ON sharing will be motivated here as well (section 2.2.3). In section 3, I demonstrate that final onsets are optimal for parsing in end-state grammars, as they better demarcate the right word-edge than do codas. I will further argue that, among the two types of onsets, ON sharing is ideal: through the release, it is better able to host the range of contrasts that right-edge onset consonants display. After discussing the role of markedness in developing grammars in section 4, I turn in sections 5-7 to provide empirical support from across populations for the position that ON sharing is unmarked. Section 5 demonstrates that ON syllabification is favoured in L1, independent of the release properties that final consonants display in the target languages under focus – English, Québec French and German. In section 6, I argue that English speakers with SLI resort to ON sharing to syllabify plural *s* which, because of other constraints on the shapes of their grammars, cannot be syllabified in the same fashion as in the unimpaired adult grammar. Finally, in section 7, L2 learners are shown to use the strategy of ON sharing to syllabify final stops encountered in the languages being acquired, independently of how both the native and target languages handle such consonants. After briefly discussing the patterns observed among Polish, Italian, Japanese and Mandarin learners of English as well as Mandarin learners of French, particular emphasis will be placed on a study of Korean learners of English which was designed to explicitly investigate this issue.

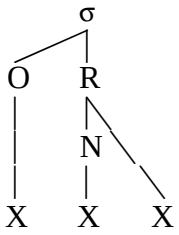
2. Theoretical Assumptions

In section 2.1, I discuss my assumptions about syllable constituency and introduce the options that languages employ for the syllabification of word-final consonants. I then turn, in section 2.2, to three types of evidence – segmental profile, rhyme length, and release properties – which will serve to divide languages into two broad classes, coda languages versus onset languages. The latter will be further divided into those languages that permit onsets of empty-headed syllables and those that prefer onset-nuclear syllabification of final consonants.

2.1. Syllable structure

I adopt a number of assumptions about syllable structure from Government Phonology (GP; see esp. Kaye, Lowenstamm, and Vergnaud 1990). First, I consider the syllable to be structured as in (1).[1] As can be seen, I do not recognize the coda as a formal constituent; coda consonants are instead organized as post-nuclear segments. I will, however, continue to use the term "coda" for convenience.

(1) *Constituency:*



Second, I accept the GP principles in (2). I consider all sub-syllabic constituents to be universally left-headed (2a). Heads are indicated by a vertical line linking these positions (X) to the syllable constituents that dominate them. An important difference between heads and non-heads is that the former can license more melodic contrasts than the latter. In the present context, this difference will become relevant when we turn to the options that languages employ for the syllabification of word-final consonants: singleton onsets are heads and, thus, they license more featural contrasts than codas which – as indicated by the oblique line in (1) – are dependents of the rhyme.

(2) a. *Headedness:*
Syllable constituents – onset, rhyme, nucleus – are universally left-headed

b. *Strict Locality*:
The head of a syllable constituent must be adjacent to every other member of the constituent

Strict Locality (2b) becomes important when we turn to the well-formedness of rhymes across languages. In many languages, complexity at the level of the rhyme (VC) or nucleus (VV) is tolerated. However, the vast majority do not allow a syllable to contain more than two rhymal positions. That is, the structures in (3) are typically ill-formed. In both cases, the head of the syllable, the leftmost X under N, is not adjacent to the final member of the rhyme.

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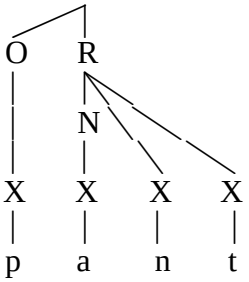
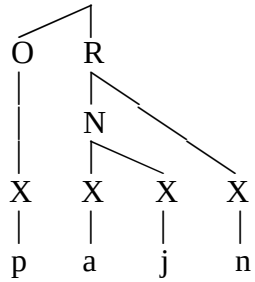
[1] In contrast to GP, I consider σ to be a formal constituent of syllable theory. In all other respects, (1) is consistent with GP.

(3) *Violations of Strict Locality:*

a. *



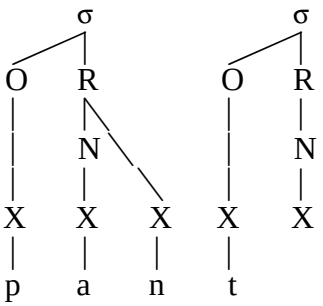
b. *



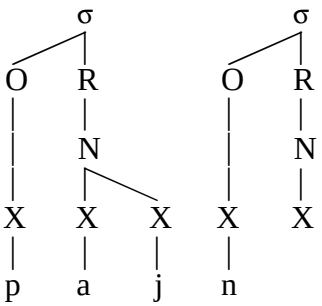
While most languages do not permit syllable-final VCC and VVC (henceforth VXC) in word-medial position, strings of this shape may be allowed at the right edge. In such cases, the final consonant is analysed as an OEHS in GP, as displayed in (4). I adopt the position that final consonants in strings of this shape are syllabified as onsets; however, OEHS is not the only option, as will be discussed below in the context of VC strings.

(4) *Word-final VXC in GP:*

a.



b.

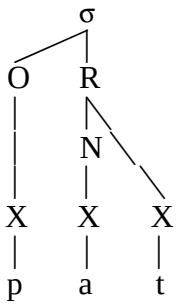


While Strict Locality compels an onset analysis for word-final consonants in VXC strings, this is not the case for VC strings. A priori, then, we might expect some languages to exhibit a coda analysis for word-final VC and others to display an onset analysis.[2] This position is advanced by Piggott (1999). In Goad and Brannen (in press), the proposal is extended as follows. Languages may analyse final consonants as codas (5a) (in VC strings only) or as onsets, but among the latter, a further division is required: some languages syllabify final onsets as OEHS (5b), while others syllabify such consonants as ON sequences (5c). I adopt this position. Indeed, I will focus mostly on providing evidence for (5c) and argue that ON sharing represents the unmarked case for final consonant syllabification.

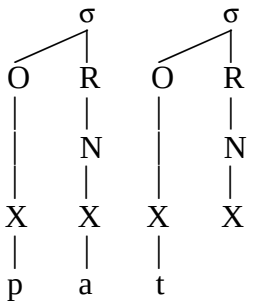
[2] This is not the position advocated in GP: final consonants are always syllabified as onsets of empty-headed syllables; word-final codas are not well-formed, as codas must be licensed by following onsets in this framework (Kaye 1990).

(5) *Word-final VC:*

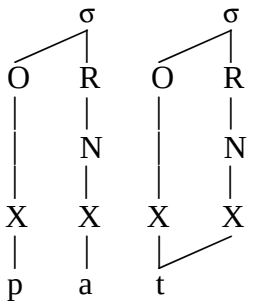
a. *Coda:*



b. *Onset: OEHS:*



c. *Onset: ON sharing:*



2.2. Three options for word-final consonants

Before turning to data from the populations under focus in this article, I will discuss the kinds of evidence that motivate the need for the three syllabification options in (5) (see also Goad and Brannen in press). The first two types of evidence, rhyme length and segmental profile, will support the coda–onset distinction, (5a) versus (5b-c). The third type, release properties, will speak to the difference between types of right-edge onsets, (5b) versus (5c).

2.2.1. Rhyme length

In some languages, the constraints that hold on the length of word-final strings are identical to those observed for word-medial rhymes. For example, in Japanese (Itô 1986) and Selayarese (Mithun and Basri 1986) in (6a), both word-final strings and word-internal rhymes are limited to VC. This suggests that right-edge VC is syllabified in the same fashion as word-internal VC; since the word-internal consonant can only be a coda (leaving aside a handful of languages with word-medial OEHS), the final consonant in VC# must be a coda as well.

(6) a. *Coda languages:*

	Wd-internal rhyme	Wd-final rhyme
Japanese	VC	VC
Selayarese	VC	VC

b. *Onset languages:*

	Wd-internal rhyme	Wd-final "rhyme"
French	VC	VCC
Diola-Fogny	VX	VXC

In other languages, for example French (Charette 1991; Dell 1995) and Diola-Fogny (Sapir 1965) in (6b), an additional position is permitted at the right word-edge. While word-internal rhymes are restricted to VC (and to VX more generally in Diola-Fogny), at the right edge, VCC (or VXC) is allowed. If final consonants were syllabified as codas in the latter case, the presence of this extra position would be surprising; however, the pattern is entirely as expected if the final consonant in such strings is syllabified as an onset.[3]

[3] French also permits branching onsets at the right word-edge, for example, *lettre* [lɛ.trØ] 'letter'. I will not consider such cases further, and any mention of right-edge CC refers exclusively to coda–onset strings.

2.2.2. Segmental profile

Turning to segmental profile, the observations parallel what has just been seen for rhyme length. Piggott (1999) has remarked that in coda languages, such as Japanese and Selayarese in (7a), the constraints on segmental profile that hold for word-final consonants reflect those that hold for word-medial codas: both may be unable to license place contrasts or may be limited to a subset of sonorants, for example. In such languages, right-edge consonants have a coda profile.

(7) a. *Coda languages:*

	Wd-internal coda	Wd-final consonant
Japanese	Place-sharing nasal; Half of geminate	Placeless nasal
Selayarese	Place-sharing nasal; Glottal stop; Half of geminate	Placeless nasal; Glottal stop

b. *Onset languages:*

	Wd-internal coda	Wd-final consonant
French	Liquid Obstruent (under some conditions)	Any possible onset
Diola-Fogny	Place-sharing nasal; Place-sharing liquid	Any possible onset

In other languages, French and Diola-Fogny in (7b), there are few if any restrictions on the segmental content of word-final consonants. These consonants are thus similar to onsets of overtly-realized nuclei, in contrast to what is permitted in word-medial coda position in the same language. In these languages, final consonants have an onset profile.

2.2.3. Release properties

Thus far, the focus has been on the ways that right-edge codas and onsets can be distinguished from each other on distributional grounds. Here, I consider what the release properties of final onsets reveal about their syllabification. Goad and Brannen (in press) observe that languages with word-final onsets fall into two classes in this respect. On the one hand, there are languages where final consonants are overtly released, analogous to onsets that are followed by phonetically-filled nuclei. On the other hand are languages where final consonants do not display this property; they may, for example, be optionally unreleased.[4]

Yapese and Continental French are two languages with final onsets that fall into the former category; see (8a). In Yapese, plain voiceless stops are “aspirated” in this position (Jensen 1977:27).[5] In Continental French, all final consonants are typically overtly released (Tranel 1987:132-133). Henceforth, I will refer to aspiration – and overt release more generally – as

[4] The observation that final consonants are optionally unreleased in some languages does not necessarily lead to a coda analysis for these segments. A coda versus onset analysis must be arrived at by taking into consideration distributional factors as well, as discussed in sections 2.2.1 and 2.2.2. While codas are subject to weakening, and unreleasing is a type of weakening process, onsets are also susceptible to such processes, particularly when they are in unstressed syllables (see Harris 1997).

[5] See Laver (1994:355-356) on the common (mis)labelling of final release as aspiration.

"fortition". Yapese and Continental French can be contrasted with Diola-Fogny and English which exhibit no fortition; see (8b). In Diola-Fogny, word-final voiceless stops are optionally unreleased (Sapir 1965:5). In English, all stops in this position are optionally unreleased.[6]

(8) a. *Fortition:*

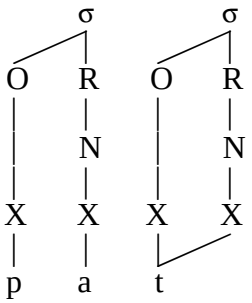
	Syllabification of final C	Release properties of final C
Yapese	Onset (Piggott 1999)	Voiceless stops aspirated (Jensen 1977)
Continental French	Onset (6b,7b)	All consonants overtly released (Tranel 1987)

b. *No fortition:*

	Syllabification of final C	Release properties of final C
Diola-Fogny	Onset (6b,7b)	Voiceless stops optionally unreleased (Sapir 1965)
English	Onset (excluding CVC words; see §7.3.3)	Stops optionally unreleased

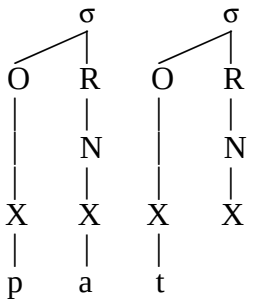
Goad and Brannen (in press) propose that the presence or absence of overt release reflects a difference in the syllabification of the final onset consonant. In languages that display fortition, final consonants are syllabified through ON sharing as in (9a). The overt release indicates that the melodic content of the consonant has "spread" into the empty nucleus: $(C+V)_{\sigma}(C+\emptyset)_{\sigma} \rightarrow (C+V)_{\sigma}(C+Release)_{\sigma}$ (cf. Hoard 1978). In languages which do not display fortition, final consonants are syllabified as OEHS as in (9b).

(9) a. *ON sharing: Fortition:*



Yapese- and Continental French-type languages

b. *OEHS: No fortition:*



Diola-Fogny- and English-type languages

In sections 5-7, I will demonstrate that a variety of populations display a preference for right-edge onsets over codas, and for ON sharing in particular: L1 learners, independent of the language being acquired; English speakers with SLI, regardless of the ambient language constraints; and L2

6 For English, the present focus is on CVXC and ˈCVCVC words where final consonants are syllabified as onsets. In CVC words, these consonants must be codas, to satisfy the requirements of word minimality. This difference in syllabification will be motivated in section 7.3.3.

learners, independent of the L1 and target-language properties. This suggests that final onsets are less marked than final codas (Piggott 1999) and that, among onsets, ON is less marked than OEHS (Goad and Brannen in press). More generally, it suggests that markedness guides the shape of developing grammars across populations, providing support for the optimality-theoretic (OT) premise that markedness constraints are not eliminated from the grammar when they are not active in a given language (Prince and Smolensky 1993). If the OT approach to expressing markedness is along the right lines, we would expect final onsets to provide some advantage to end-state grammars as well, that is, beyond being an emergent property from acquisition. Support for this will be provided in the following section.

3. Right-edge Onsets as Optimal for Parsing in End-state Grammars

In section 2.1, I briefly mentioned that singleton onsets are heads and, as a result, they can license a range of melodic contrasts not possible in coda. Indeed, codas are often restricted to a subset of sonorants and they typically cannot license place or laryngeal contrasts. These observations have frequently been argued to have their source in the phonetics. Concerning coda laryngeal, for example, maintaining a voicing contrast is articulatorily demanding in the absence of a following vowel due to low sub-glottal pressure (e.g., Westbury and Keating 1986); from a perceptual point of view, the lack of a following vowel results in fewer cues to the voicing contrast being available in this context (e.g., Steriade 1999).

The articulatory and perceptual constraints are particularly acute in word-internal position where a following onset will mask the distinct qualities that a preceding coda may attempt to preserve. Word-finally, however, there is no following vowel. There is also a competing interest in this position: languages require the edges of words to be clearly demarcated. I will demonstrate that this requirement is responsible for the preference for final consonants to be syllabified as onsets, not as codas.

Accurate comprehension requires that the speech stream be parsed by listeners into "bite-sized" chunks, the prosodic word (PWd) perhaps constituting the most important of these. Within this context, it is not surprising that the application – or non-application – of many phonological processes serves to signal the edges of words (see Kaye 1989:49-53). Stress, for example, is a good cue to word edge as the main stress foot is as close as possible to the left or right edge. Vowel harmony, as typically bounded by the edges of words, demarcates both the left and right edges of this constituent. The absence of cross-word assimilation is similarly revealing in this respect: string-adjacent assimilation processes often do not cross PWd boundaries. Goad and Brannen (2000) propose that final onsets also provide a good cue to the right word-edge, in ways that neither coda- nor vowel-final words do. I will elaborate on this below and further argue that, among onsets, the cue potential of final onsets is maximized by syllabifying these consonants through ON sharing, rather than as OEHS.

I begin with word-final onsets. Because codas, in contrast to onsets, are restricted in what they can license, in a language with word-internal codas and word-final onsets, the codas will be a subset of the consonants that are licit as right-edge onsets. That is, in words of the shape ...CV$\underline{C}]_{\#}$, the post-vocalic (onset) consonant, which is underscored, will exhibit a greater range of options than that permitted by the post-vocalic (word-internal coda) consonant in ...CV$\underline{C}]_{\sigma}$. As a result, the final consonant in ...CV$\underline{C}]_{\#}$ will clearly mark the right edge of the word. The type of edge involved in ...CV$\underline{C}]_{\#}$ will only be ambiguous when a word ends in a consonant which belongs to the set of permissable codas. In short, final onsets are a good way to cue the right edge of the word.

Turning to codas, these constituents signal the right edge of the syllable well, but for the same reason, they are a bad cue to the right edge of the word. As mentioned above, codas are weak licensers. In contrast to word-final position, however, word-internally, the range of features that codas can bear is greater than they can license as these features can be shared with and thus licensed by a following onset (see, e.g., Japanese and Selayarese in (7a)). Consequently, the segments allowed as word-final codas will typically be a subset of those found in word-medial coda

position in the same language. When listeners hear the final consonant in ...CV<u>C</u>]$_{\#}$, they will thus not know whether this coda ends the word or whether it merely ends a word-medial syllable. It is only when the following word in the string is considered that listeners can appropriately identify the edge of the preceding word.

In the interest of completeness, I turn finally to vowel-final contexts and address whether vowels are good cues to the right edge of the syllable (...<u>V</u>.CV), as are codas, or good cues to the right edge of the word (...<u>V</u>#CV), as are onsets. Since the segment which most often follows a vowel is a consonant, and VC assimilation rarely crosses constituent boundaries, whether the consonant is in the same word as the preceding vowel (...<u>V</u>.CV) or in the next word (...<u>V</u>#CV) will not be detectable to the listener, in the absence of other cues. For this reason, vowels are an equally good – or bad – signal to the right edge of the syllable as they are to the right edge of the word.

The summary in (10) recapitulates the cue value of codas, onsets and vowels as concerns the right edge of words and syllables: codas are good cues to the right edge of syllables and, thus, bad cues to the right edge of words; onsets display the opposite pattern; and vowels are neutral, signalling neither the right edge of syllables nor the right edge of words better than the other. In short, we are left with onsets as the only way to clearly indicate the right word-edge.

(10) *Summary of cue value:*

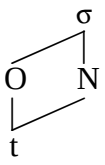
	Right edge of word	Right edge of syllable
Coda		✓
Onset	✓	
Vowel		

Thus far, the investigation has primarily been concerned with whether onsets or codas are better signals to the right edge of words. The cue potential of word-final consonants syllabified as OEHS or through ON sharing has yet to be compared. In this context, I will return to the phonetic issues addressed at the beginning of this section. As mentioned earlier, laryngeal (as well as place) contrasts are often neutralized in coda, as preserving a range of contrasts in the absence of a following vowel is both articulatorily and perceptually difficult. By itself, the absence of a following vowel would thus appear to lead to final codas as optimal, that is, to constituents where neutralization of contrast is observed. Immediately above, however, a parsing argument was provided which favours word-final onsets: maintaining a range of contrasts in this position effectively signals the right word-edge. In the following lines, I propose that the best way to resolve this tension between maintenance/loss of contrast and optimal parsing is to syllabify final consonants as ON strings.

Recall from section 2.2.3 that in languages where final onsets display fortition, the release indicates that the featural content of the consonant occupies what would have otherwise been an empty nucleus. Importantly, this serves to enhance the contrasts present on the onset consonant in the absence of a following vowel, as the nucleus hosts the release of the consonant. The assessment in (11i) reveals that, from this point of view, ON syllabification (11a) is optimal as compared with OEHS (11b) as, in the latter, the following nucleus remains empty. Following from this difference in representation, ON syllabification is also optimal as concerns syllable structure markedness (11ii): filling the nucleus with melodic content effectively yields a CV syllable, the least marked

syllable shape.[7]

(11) *Assessment of right-edge onsets:*

Syllabification:	Assessment: i. Segmental: Ability to maintain contrast for C	Assessment: ii. Prosodic: Syllable shape
a. ON 	✓	✓
b. OEHS 		

In sum, I have argued that final onsets are optimal for parsing; given the range of contrasts that they exhibit, they better demarcate the right word-edge than codas. Among types of onsets, ON sharing is ideal when compared to OEHS as, in the absence of a following vowel, the former representation, through the release, is better able to host the contrasts that right-edge onsets display. In terms of markedness, we can conclude that ON sharing represents the least marked way to syllabify word-final consonants from both syllable shape and parsing points of view. In the following section, I will examine the consequences of markedness for development.

4. The Role of Markedness

A recurrent theme in acquisition research has been that markedness guides the shape of developing grammars (see, e.g., Jakobson 1968 and Gnanadesikan in press on L1, and Eckman 1977 and Broselow, Chen and Wang 1998 on L2). If ON syllabification truly reflects the unmarked case for final consonants, we would expect that when learners first attempt to parse CVC strings (or CVC strings with illicit final consonants) as such, they would initially parse these strings as $(C+V)_{\sigma}(C+Release)_{\sigma}$, that is, with the right-edge consonant syllabified through ON sharing. In sections 5-7, I will argue that this is indeed the case. L1 learners initially favour ON sharing, regardless of the way such consonants are syllabified in the language being acquired (section 5). English speakers with SLI employ ON sharing to syllabify plural *s* which, because of other constraints on the shapes of their grammars, cannot be syllabified in the same way as in the unimpaired adult grammar (section 6). And finally, L2 learners use this strategy to deal with illicit final consonants encountered in the target language, independently of how both the native and target languages handle such strings (section 7).

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[7] Importantly, ON syllabification does come at a cost, with respect to both OEHS syllabification and consonant + vowel melodies which are syllabified as ordinary CV syllables. The sharing of melodic content across two positions observed in ON syllabification (11a) is more costly than the one-to-one association observed in OEHS syllabification (11b). Related to this, in ON syllabification, the nucleus is filled with consonantal material ([t] in (11a)), not with vocalic material as in typical CV syllables.

In the case of L1, the general unmarkedness that is observed in early grammars is typically captured in OT through the initial ranking of Markedness >> Faith (e.g., Demuth 1995; Smolensky 1996; Gnanadesikan in press). Concerning input CVC strings at stage 1 in acquisition, the result should thus be either epenthesis (CVC → CVCV) or deletion (CVC → CV). A preference for open syllables is in fact well-documented at this stage, independent of the syllable shapes permitted in the target language (e.g., Jakobson 1968; Ingram 1978; Fikkert 1994).

When CVC strings emerge in L1 outputs at stage 2, the standard position in the literature is that the final consonant is syllabified as a coda (e.g., Fikkert 1994; Demuth and Fee 1995; Stemberger 1996). Viewed in terms of ranking, segmental faithfulness now dominates the syllable well-formedness constraint against codas, NoCoda. If, however, the final consonant in early CVC outputs is syllabified through ON sharing, then the shift from stage 1 to stage 2 is less dramatic, when considered in terms of the relative ranking of syllable-structure markedness and faithfulness. Indeed, stage 2 represents the best compromise between these two competing forces: in ON sharing, the resulting word-final syllable is structurally unmarked – onset+nucleus where both constituents are filled with featural material – and yet the melodic content at the right edge of the input stem, the final consonant, has not been compromised as in the alternatives of epenthesis and deletion. Thus, syllable-structure markedness is still playing an important role in the shapes of children's grammars at stage 2, beyond the initial ranking of markedness over faith observed at stage 1.

In L2 acquisition, the preference for ON syllabification represents a case of Emergence of the Unmarked (McCarthy and Prince 1994; Broselow, Chen and Wang 1998 in L2; see further section 7.1). When the native grammar does not allow the configuration required for right-edge consonants in the target – whether the target requires coda or OEHS – ON will emerge as optimal. The case of word-final stops among intermediate Korean learners of English is particularly interesting in this respect (section 7.3), as the native grammar does permit coda stops (as voiceless unreleased). The evidence from ambient English, however, points toward an OEHS analysis of final consonants. As will be seen, learners select ON as the optimal compromise analysis.

In short, markedness shapes development across populations. As mentioned earlier, this supports the position taken in OT, that markedness constraints are not deleted from the grammar when they are not active in a particular language.

5. First Language Acquisition

Sections 5-7 will focus on providing empirical evidence in favour of ON syllabification for right-edge consonants in development. I begin with first language acquisition. As mentioned, when final consonants appear in L1 outputs, they are standardly considered to be codas. Goad and Brannen (in press) provide a number of arguments in favour of an onset over coda analysis for such consonants and, in particular, for ON over OEHS syllabification. In section 5.1, I summarize the empirical arguments they provide for ON sharing, as these are directly paralleled in the data from SLI and L2 which will be examined in sections 6 and 7 respectively. Their data are drawn solely from English; the investigation will be extended to Québec French and German in section 5.2.

5.1. Fortition at stage 2 in L1 English

At stage 2, when CVC forms begin to appear in L1 acquisition, the final consonant in CVC_{obstr} outputs displays fortition effects atypical of codas: the obstruent may be aspirated (orally released),

nasally released, or lengthened. Consider the data in (12) from four learners of English.[8]

(12) *L1 English:*

a. Hildegard (Leopold 1970):

Voiceless Stops:		
[wɛk(ə) ʔapʰ]	‘wake up’	(1;11)
[mitʰ]	‘meat’	(1;10)
[botʰ]	‘boat’	(1;10)
[datʰ]	‘forgot’	(1;11)
[bokʰ]	‘broke’	(1;9-1;10)
[bakəbʊkʰ]	‘pocket-book’	(2;1)

b. Jacob (Menn 1978):

Voiceless Stops:			Fricatives:		
[apʰ]	‘up’	(20:13)	[ʃusː]	‘juice’	(20:5)
[sɨtʰ]	‘sit’	(20:18)	[baɨsː]	‘bus’	(19:29-20:22)
[hætʰ]	‘hat’	(19:29-20:22)	[ʂiːʂç]	‘cheese’	(19:29)
[bakh]	‘box’	(19:29-20:22)	[wɑsç]	‘watch’	(19:20)
[dʌkʰ]	‘duck’	(19:29-20:22)	[dɑtixː]	‘cottage cheese’	(19:27)
[ɔkʰ]	‘walk’	(20:13)			

c. Lasan (Fey and Gandour 1982):

Voiceless Stops:			Voiced Stops:		
[dapʰ]	‘drop’	(21-25 mos)	[dabm̩]	‘stub’	(21-25 mos)
[jopʰ]	‘soap’	(21-25 mos)	[laitʰabm̩]	‘lightbulb’	(21-25 mos)
[vitʰ]	‘feet’	(21-25 mos)	[vidn̩]	‘feed’	(21-25 mos)
[watʰ]	‘what’	(21-25 mos)	[bædn̩]	‘bad’	(21-25 mos)
[dɔkʰ]	‘talk’	(21-25 mos)	[wɔgŋ̩]	‘frog’	(21-25 mos)
[gʊkʰ]	‘cook’	(21-25 mos)	[bɪgŋ̩]	‘big’	(21-25 mos)

d. Mollie (Holmes 1927):

Voiceless Stops:			Voiced Stops:		
[æˈtː]	‘hat’	(18 mos)	[bɪdˈ]	‘bib’	(23 mos)
[bɛˈtː]	‘bed’	(18 mos)	[bæˈdː]	‘bad’	(18 mos)
[wætˈ]	‘hat’	(22 mos)	[gʊˈdː]	‘good’	(18 mos)
[bʊˈkː]	‘book’	(18 mos)	Fricatives:		
[keˈkː]	‘cake’	(18 mos)	[wʌvː]	‘love’	(21 mos)
[mɾˈkː]	‘milk’	(19 mos)	[tɪsˈ]	‘kiss’	(23 mos)
			[pɪʃˈ]	‘fish’	(22 mos)

[8] Throughout this article, children’s ages are reported as in the original sources with two exceptions, Mollie (12d) and Annalena (18a), where dates provided by the authors have been converted into ages. All data are also transcribed as in the original sources with two exceptions: Leopold’s (1970) symbol for final aspiration (apostrophe) has been changed to superscript [h] in (12a) and (18b); Elsen’s (1991) symbol for ambisyllabicity (overdot) has been changed to underdot in (18a).

If final consonants were syllabified as codas in early grammars, outputs such as those in (12) would be highly unusual when compared with coda-final forms in adult grammars. In the latter, weakening – not fortition – is common in coda and arguably represents the unmarked state of affairs for segments syllabified in this fashion. In short, consonants which exhibit fortition effects as in (12) are syllabified as onsets, specifically, through ON sharing.

The ON analysis is supported by the descriptions provided by several of the authors cited in (12). In Leopold's (1970:108) discussion of 'meat' at 1;10, he remarks that the final [t] was "strongly aspirated with the exaggeration typical of the first final consonants". Fey and Gandour (1982:74) point out that all of Lasan's right-edge voiceless stops had a "distinctive oral release" while his voiced stops in this position "were consistently produced...with a distinctive nasal release".[9] Holmes transcribes Mollie's voiceless stops as long, not as aspirated, unlike the other authors in (12). However, on the subject of Mollie's [k]-final forms, he (1927:221) states that "the explosion of *k* was... prolonged (almost equal to a *schwa*)", revealing that the release, rather than the closure, was lengthened. From this description, it can be concluded that Holmes's transcription of final length is equivalent to the other authors' transcription of final release/aspiration and should thus be formally represented in the same fashion. Indeed, Goad and Brannen argue that all of the release types in (12) are represented in the same way, through ON sharing as in (9a).

Beyond the transcription differences just discussed, the various types of release observed in (12) arise due to differences in voicing of the final consonant (Lasan's [dapʰ] 'drop' versus [dabm̩] 'stub'); to the way that voicing is formally represented in a given child's grammar ([d] in Lasan's [bædn̩] 'bad' versus Mollie's [bæˈdː] 'bad'; see below); or to the continuancy value of the final consonant (Jacob's [sɨtʰ] 'sit' versus [baɨsː] 'bus'). Equating the aspirated stop and lengthened fricative forms in Jacob's productions is supported by Leopold's (1970:108) observation that in Hildegard's outputs, "the aspiration [in 'meat' at 1;10] sometimes even took the form of a homorganic fricative, [ç]".

The data in (12) which require further discussion are those from Lasan: why 'bad', for example, is realized as [bædn̩], in contrast to Mollie's [bædː]. Goad and Brannen (in press) argue that Lasan's pattern of nasally-released stops is not anomalous. It is what is expected for children who represent voicing contrasts with the feature SV (sonorant voice), rather than Laryngeal as in Mollie's grammar. In an SV language, a bare SV node on a contoid is interpreted as a "sonorant obstruent" in non-nuclear position (not as a nasal as it is in Laryngeal languages) (Rice 1993; Avery 1996). In nuclear position, Goad and Brannen propose that bare SV is interpreted either as a nasal or as a vowel. It is interpreted as a nasal when it is specified for C-Place alone (that is, with no dependent V-Place). In the examples under discussion, the syllabic nasal always shares place with the preceding stop revealing that it bears C-Place alone. In short, the interpretation of a sonorant obstruent syllabified through ON sharing is as a nasally-released stop. The representations in (13) for Lasan's and Mollie's outputs for 'bad' reflect the difference in interpretation of the final nuclear release, depending on whether the child treats English as an SV language or as a Laryngeal language.

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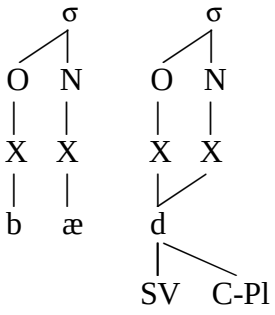
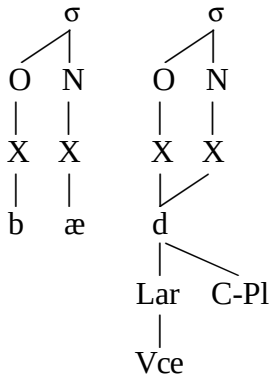
9 Laver (1994:362) reports that there are adult languages which exhibit oral and nasal release of underlying oral stops, similar to Lasan's grammar. He provides the following examples from Wolof (from Coustenoble 1929, via Catford 1977:215): [lapʰ] 'be thin' versus [lapm̩] 'to drown'; [gɔkʰ] 'white chalk' versus [gɔkŋ̩] 'horse's bridle rope'.

(13) a. *SV language:* Lasan's [bædn̩] 'bad':



b. *Lar language:* Mollie's [bæˈdː] 'bad':



To sum up, I have shown that final consonants in the outputs of L1 English learners are formally represented as onsets, not as codas, and more specifically, as ON strings. Support for ON syllabification has come from the observation that final consonants in these early forms are accompanied by release. The release was shown to be phonetically realized in a number of ways, through aspiration (oral release), length, or nasal release.

Thus far, the data have been drawn entirely from English. Since it was argued in section 4 that ON sharing represents the unmarked state of affairs, we would expect to observe final release in the outputs of children learning a range of languages. This will be shown to hold for Québec French and German below.

5.2. Final release in L1 Québec French and German

In this section, I turn to a cross-language investigation of final release – specifically, aspiration on stops – in early L1 outputs. The new languages from which data will be drawn are Québec French and German. The release properties of final consonants in the target languages will be discussed in this context as well, as this will enable us to determine that children's preference for final release cannot be accounted for through properties of the input to which they are exposed. This will lend support to the proposal that ON reflects the unmarked option for word-final consonant syllabification.

I begin by returning to English where we observed in section 5.1 that fortition on final stops manifests itself through aspiration, length and, in some grammars (namely Lasan's), through nasal release; see (14a).

(14) *English:*

a. L1 data:	b. Target language:
Final stops: Fortition Voiceless: Aspirated or lengthened Voiced: Nasally released or lengthened	Final stops: No fortition Voiceless and voiced: Optionally unreleased

Importantly, (14b) reveals that fortition is not a property of the adult grammar, as was discussed earlier in section 2.2.3. Final stops – regardless of whether they are syllabified as onsets (OEHS) or as codas (see note 6 and section 7.3.3) – are optionally unreleased. In short, there is nothing in the input to which children are exposed which would lead them to syllabify final consonants through ON sharing.

In Québec French, a similar situation regarding release holds of the target grammar. As can be seen from (15b), in contrast to Continental French where right-edge consonants display fortition (see (8a)), final stops are optionally unreleased in Québec French.

(15) *Québec French:*

a. L1 data:	b. Target language:
Final stops: Fortition	Final stops: No fortition
Voiceless: Aspirated	Voiceless and voiced: Optionally unreleased

Nevertheless, fortition is observed in the L1 data for voiceless targets, as stated in (15a). Examples are provided in (16) from Clara and Théo respectively (Rose 2000).

(16) *L1 Québec French:*

a. Clara (Rose 2000):

Target:	Output:		
[kaˈʁɔt]	[kæˈʁɔtʰ]	‘carrot’	(2;05.10)
[twɑˈlɛt]	[twæˈlɛtʰ]	‘toilet’	(2;05.25)
[pat]	[pætʰ]	‘paw’	(2;06.05)
[paˈtɑ̃t]	[baˈtɑ̃tʰ]	‘thing’	(2;06.05)
[kat]	[kætʰ]	‘four’	(2;07.19)
[aˈsjɛt]	[æˈsjɛːtʰ]	‘plate’	(2;07.19)

b. Théo (Rose 2000):

Target:	Output:		
[pɔʁt]	[pɔtʰ]	‘door’	(2;04.28)
[biˈbɪt]	[pəˈpɪtʰ]	‘bug’	(2;05.11)
[fʊʁˈʃɛt]	[əˈʃɛtʰ]	‘fork’	(2;05.29)
[salɔˈpɛt]	[aˈbɛtʰ]	‘overalls’	(2;05.29)
[pɪk]	[pɪcʰ]	‘(it) pricks’	(2;05.11)
[bɪˈsɪk]	[b̥ɪˈsɪkʰ]	‘bicycle’	(2;06.12)

The data in (16) are particularly interesting when the status of word-final consonants in Québec French is examined more concretely. While right-edge consonants in Québec French pattern as onsets, in particular as OEHS, there are two properties of this dialect, in contrast to Continental French, which could incorrectly lead the child toward a coda analysis. One, as mentioned in (15b), there is optional unreleasing at the right edge, a property often observed to hold of codas cross-linguistically. Two, in surface closed syllables, high vowels are laxed (e.g., [pɪk] ‘(it) pricks’ versus [pike] ‘to prick’; cf. [pik] in Continental French). Given that, across languages, lax vowels are typically shorter than their tense counterparts, this could incorrectly suggest to the child a process of closed-syllable shortening.

In spite of these properties of ambient Québec French, Rose (2000) provides a number of arguments, two of which are summarized below, which suggest that both Clara and Théo have arrived at an onset analysis for final consonants. One, all word-final consonants are acquired at once: there are no place, sonority or voicing restrictions at the right-edge, inconsistent with a coda analysis for these consonants (see section 2.2.2). Two, word-final consonants emerge before word-internal codas; if the final consonants were analysed as codas at this stage, these child grammars would be rogue grammars: there appear to be no adult languages which lack word-internal codas and where final consonants pattern as codas (Goad and Brannen in press).

These arguments lead to the conclusion that the final consonant in CVC words in early Québec French must be an onset. The aspiration observed in (16) is consistent with this view and, in

particular, with an ON analysis of these consonants.[10] Thus, in spite of the potentially misleading right-edge effects observed in adult Québec French outputs, children nonetheless posit an ON analysis. This is exactly what is predicted based on markedness, as discussed in section 4.

We turn finally to German. While the target language does not exhibit fortition, early L1 data do; see (17).

(17) *German:*

a. L1 data:	b. Target language:
Final stops: Fortition Voiceless: Aspirated	Final stops: Typically released, but no fortition is observed

Representative examples are provided in the second column of (18a) from Elsen's (1991) diary study of her daughter Annalena. The targets in (18a) are transcribed without aspiration, yet (17b) mentions that final consonants are typically released in German. On the basis of (17b), have the adult forms been mistranscribed? That is, do the final consonants in the child outputs in the second column of (18a) accurately reflect target German? The answer to both of these questions is no. As can be seen by comparing the second and third columns in (18a), Elsen transcribes final aspiration for Annalena until approximately 18 months of age, after which she transcribes right-edge stops as plain. From this point in time, Annalena's outputs do not exhibit fortition and no longer warrant an ON analysis.

(18) *L1 German:*

a. Annalena (Elsen 1991):

Target:	Aspirated output:		Non-aspirated output:		
[ʔap]	[ʔapʰ]	(1;6.00)	[ʔap]	(1;07.29)	'from'
[fɪl̩ɪp]	[fɪl̩ɪ-pʰ]	(1;06.17)	[fɪl̩ɪ→ᵊp]	(1;08.03)	(name)
[blat]	[batʰ]	(1;04.27)	[bat]	(1;05.09)	'newspaper'
[gūt]	[gɯtʰ]	(1;05.19)	[gūt]	(1;05.26)	'good'
[dʁɛk]	[dɛkʰ]	(1;05.08)	[dʁɛk]	(1;09.15)	'dirt'
[vɛk]	[bɛkʰ]	(1;04.21)	[vɛk]	(1;06.12)	'away, off'

b. Hildegard (Leopold 1970):

Target:	Output:		
[mɪt]	[mɪtʰ]	(1;8-1;10)	'with'
[kapʊt]	[bʊtʰ]	(1;10)	'broken'
[bɛt]	[bɛtʰ]	(1;11)	'bed'
[buːx]	[bukʰ]	(1;10)	'book'
[baʊx]	[bɑʊkʰ]	(1;10)	'belly'
[lɔx]	[lokʰ]	(1;10)	'hole'

Additional German data are provided in (18b) from Hildegard. Hildegard is bilingual German–English and she exhibits aspiration in both languages (see (12a) for English examples). One could therefore conclude that she has a single phonology for both German and English (Leopold 1978). However, on the basis of her early prosodic development, Paradis (1995) has argued that Hildegard's two languages are differentiated by this stage in development. With some

[10] Rose (2000), however, concludes that final consonants in early Québec French are onsets of empty-headed syllables. He does not consider the option of ON sharing.

caution, then, the data in (18b) can be taken as providing independent evidence, beyond those in (12a), for fortition in early L1 outputs.

5.3. Summary for L1

To summarize the examination of first language acquisition, we have observed fortition for right-edge obstruents in the outputs of children learning English (12), Québec French (16) and German (18). I have argued that this reflects an ON analysis of such consonants. While the standard account for word-final consonants is that they are instead syllabified as codas, if these consonants were syllabified in this fashion in early L1, the data would be anomalous when compared with adult languages where weakening, not fortition, is commonly observed in coda. Further, we have seen that fortition is present in L1 outputs, independent of the release properties in the adult languages to which learners are exposed.

In section 4, I argued that this reflects the impact of markedness on the shapes of early grammars, specifically, that there are three advantages of ON sharing over the alternative syllabification options for CVC. First, in ON syllabification, the right-edge onset is followed by a nucleus which is melodically filled, CVC $\rightarrow$ $(CV)_{\sigma}(C+Release)_{\sigma}$, in contrast to OEHS syllabification where the nucleus, by definition, remains empty, CVC $\rightarrow$ $(CV)_{\sigma}(C\emptyset)_{\sigma}$. Second, given that at the previous stage in development, only CV syllables are permitted, ON sharing, in contrast to coda syllabification, requires no change in the syllable shapes permitted by the grammar. Finally, syllabifying right-edge consonants through ON sharing represents the best compromise between satisfying syllable well-formedness on the one hand and faithfulness constraints on the other: ON sharing allows learners to avoid the prosodically-marked structures required for other CVC parses (i.e., coda and OEHS), while still being faithful to the input string, unlike the alternatives of deletion (CVC $\rightarrow$ CV) and epenthesis (CVC $\rightarrow$ CVCV).

If ON sharing indeed represents the least marked option for final consonant syllabification, we should expect to observe it in other populations as well. This will be shown to be the case, in the impaired grammars of individuals with SLI, section 6, and in the interlanguage (IL) grammars of second language learners, section 7.

6. Specific Language Impairment

In the following lines, I will argue that ON sharing is employed by the SLI grammar to syllabify plural *s* in English. Because of other constraints on the shapes of SLI outputs, *s* cannot be prosodified in the same fashion as in the unimpaired grammar.

Although SLI is typically defined through exclusionary criteria – it occurs in the absence of hearing loss, motor deficits, gross neurological impairment, et cetera – a common theme that re-emerges in research on this population is problems in the area of inflectional morphology (see Clahsen 1992 for a recent summary). In earlier work (Goad 1998), I argue that plural marking is implicated in the impairment. Specifically, (some) individuals with SLI lack the morphological feature [±plural]. Plurals must therefore be built through other means: they involve the concatenation of stems, and in this way, resemble compounds, both morphologically and prosodically. The segmentally anomalous patterns that are observed in SLI plurals can be accounted for through this compound-like structure. The pattern that is relevant to the present discussion is that in (19): the plural marker is lengthened, similar to what was observed in the L1 English outputs for fricatives in (12).[11]

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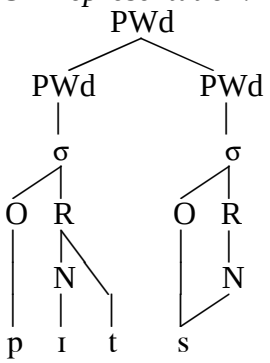
11 The examples in (19) are drawn from a corpus of data collected from five English-speaking adults with SLI. The target dialect is Cockney; the unimpaired outputs in the first column in (19) are transcribed accordingly.

(19) *Lengthening of plural marker in SLI:*

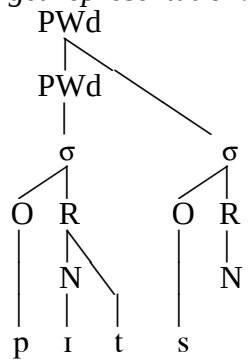
Unimpaired target	Impaired output	Gloss
[pɪts]	[pɪtsː]	'pits'
[skuːps]	[skuːpsː]	'scoops'
[dɒgz]	[dɒgsˈ]	'dogs'
[kɑːdz]	[kɔdsˈ]	'cards'
[sʌnz]	[sʌnsː]	'suns'
[kʌʊmz]	[kəʊmsˈ]	'combs'
[wɪʊz]	[wɪʊsˈ]	'wheels'
[bʌʊz]	[bæusˈ]	'bows'

If SLI plurals are structurally compounds, the plural marker must form its own prosodic word, as shown in (20a). This is in contrast to the target representation in (20b) where plural is an affixal clitic adjoined to the PWd (cf. Selkirk 1997).

(20) a. *SLI representation:*



b. *Target representation:*



Given the representation in (20a), [s] is the only segment contained within the second PWd. To be well-formed, however, every PWd must contain at least one syllable with a phonetically-realized head. I propose that length on plural *s* indicates that this requirement has been satisfied through ON sharing. The alternative, vowel epenthesis (e.g., [pɪtsə]), would be less faithful to the target form. Thus, parallel to what has already been seen for L1, ON sharing emerges as the optimal way to satisfy constraints on prosodic structure as well as faithfulness in the SLI grammar.

What about plural *s* in the unimpaired grammar? In the target representation in (20b), ON sharing is not required because, through the adjunction structure, the constraint that every PWd contain a phonetically-realized head has been satisfied by the first syllable [pɪt]. Plural *s* can therefore be syllabified as an OEHS, a structure which is independently required for English (see section 7.3.3).

7. Second Language Acquisition

I turn finally to investigate right-edge consonant syllabification among second language learners. After discussing in section 7.1 how markedness can play a role in shaping interlanguage grammars, in section 7.2, I review some previous L2 studies where evidence for ON sharing is observed. I will then turn, in section 7.3, to a more detailed study which was specifically designed to investigate this issue among Korean learners of English.

7.1. Emergence of the Unmarked

Although in L1 acquisition, the widespread unmarkedness encountered in early outputs can be formally expressed through an initial fixed ranking of constraints, in L2 acquisition, the starting point is clearly different, as speakers have already arrived at a grammar where constraints have been reranked, according to the patterns exhibited in their native language. However, when Universal Grammar permits more than one parse for segments in particular positions, as is the case for the final consonant in ...VC#, and when learners are acquiring a second language whose inventory of segments in this position represents a superset of their native language, then markedness should continue to guide the shape of the IL grammar. Specifically, for learners whose L1 does not permit right-edge consonants (or right-edge consonants of a particular type), we would expect the illicit final consonant in ...VC# to first be analysed through ON sharing in the IL grammar, rather than as an OEHS or coda. Indeed, a preference for ON should initially be observed, independent of the constraints of the language being acquired. As mentioned in section 4, this scenario represents a case of Emergence of the Unmarked, evidence for which will be provided below.

7.2. Previous studies: ON syllabification in L2

In this section, I review some previous studies where fortition of word-final consonants has been observed. The emphasis will be on final aspirated stops, in the outputs of Polish, Italian, Japanese and Mandarin learners of English, as well as Mandarin learners of French. With one exception (Steele 2002a,b on Mandarin learners of French), these studies do not provide an analysis for final release; they merely mention it in the context of discussing trends observed in the data. For our purposes, the main point which emerges from these investigations is as follows: using a range of methodologies, final aspiration is often reported for beginner and intermediate L2 learners, regardless of the constraints of the L1, and for the most part (see below), independent of the constraints of the language being acquired.

I begin by reviewing Hodne (1985), a study which looked at Polish learners of English. Hodne observes aspiration in learners' outputs which cannot be traced back to the L1: in native Polish, final voiceless stops are released, but they do not display fortition.[12] Hodne focussed on two learners of English, one upper beginner and the other lower intermediate. The methodology involved elicited production: the learners provided responses to questions based on pictures and described the subject matter of a videotape. Hodne reports that she often observed final aspiration in the learners' outputs (no numbers are provided), for example [blækʰ bɔɹd] 'blackboard' for target [blækˀ bɔɹd].

Prator and Robinett (1972) comment on the presence of aspiration in the outputs of Italian learners of English. In Italian, word-final obstruents are illicit and so, as in Polish, transfer is not a possible explanation for this behaviour. Prator and Robinett is a pronunciation manual for American English and, thus, it does not report on any experiments. Nevertheless, the authors provide the following observation: "Many students from abroad...try to pronounce final consonants...with a great deal of force. This may sound like aspiration: an Italian may pronounce *I don't think so* as /ay downtʰ θɪŋkʰ sow/. The little puffs of air after /t/ and /k/ sound like extra syllables" (p. 89). Their final comment on extra syllables is exactly what is expected under an ON analysis of these sounds.

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12 I have arrived at this conclusion on the basis of e-mail discussions with Wladyslaw Cichocki and Ewa Czaykowska-Higgins and from Cichocki's (p.c.) translation from Jassem's (1992) handbook of English pronunciation where it is said that final [p, t, k] are released in both Polish and English but that the release in English is stronger (pp. 146, 157, 161). Given that English stops, when released, do not show fortition, the conclusion that Polish stops do not as well seems warranted.

In Ross's (1994) study of Japanese learners of English, approximately 150 low and higher proficiency learners were recorded in a spontaneous speech situation. Ross points out that higher proficiency learners, in an attempt to sound more English-like, commonly apocopated vowel-final English words and Japanese words embedded in English utterances (no numbers are provided). Final stops in these contexts were then aspirated, for example, [fantʰ] for '(Jane) Fonda'. Like Italian, Japanese does not permit obstruent-final words, so aspiration cannot be due to transfer from the L1 grammar.

In Heyer's (1986) study of Mandarin Learners of English, 40 learners (with three years of English study) were tested reading a story. Prior to the study, the author had observed aspiration of final voiceless stops and lengthening of fricatives at the right edge among Mandarin learners. During the study, she found 45.6% "hyperaspiration" among the errors for voiceless stop targets. In Mandarin, final obstruents are illicit; again, transfer is not a possible source for aspiration.

In a second study on Mandarin learners of English, Goad, White, and Steele (to appear) examined the influence of L1 prosodic constraints on the representation of inflection in L2. Twelve intermediate learners of English were asked to describe a series of pictures. The picture-description task was initially designed to elicit 3rd singular agreement and tense (White 2002); it is thus unlikely that participants paid undue attention to the realization of final [p, t, k] (except perhaps in [t]-inflected past tense forms). When the data were phonetically transcribed for the Goad, White, and Steele study, however, phrase-final aspiration was present an average of 62% of the time, with four participants aspirating 78% of the time or more often.[13]

We turn finally to Steele's (2002a,b) study of five Mandarin beginner learners of Continental French. This study was designed to investigate the acquisition of right-edge clusters. Subjects were required to label pictures (disguised as a memory task), the names for which ended in clusters of the shape LC and CL (e.g., [fulk] 'coot', [lɛtʁ] 'letter'). Steele found that the liquids were typically deleted from the clusters and, importantly, that learners (heavily) aspirated the remaining stops 94% of the time. Steele (2002a) proposes that these consonants are syllabified through ON sharing, following Goad and Brannen's (in press) analysis for aspiration in L1 acquisition (but see Steele 2002b where they are instead analysed as OEHS). While, as discussed above, a transfer analysis of final aspiration is not available for Mandarin, recall from (8a) that the target language, Continental French, does exhibit final release. By itself, then, this study cannot be used to support the proposal that ON syllabification emerges due to its unmarked status; learners could well have arrived at this analysis on the basis of the ambient input to which they had been exposed. Nevertheless, taken together with the other studies discussed here, this study is consistent with ON as being the least marked analysis for final consonants, and thus the first that learners entertain.

The summary in (21) displays the essential information from the six studies reviewed above for which final aspiration was found. As discussed, all of the works observe aspiration in L2 outputs, independent of the constraints of the L1 and those of the language being acquired (with the exception of (21f)).

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13 Phrase-final, rather than word-final, context was examined to ensure that cross-word effects such as resyllabification and assimilation could not apply. Regular past tense [t] was excluded from the counts, given that regular inflection is prosodified differently from [p, t, k] in uninflected and irregularly-inflected forms (Goad, White and Steele to appear).

(21) *Summary of final aspiration:*

	Author(s)	L1	L2	Methodology
a.	Hodne (1985)	Polish (Final [p, t, k] released but no fortition)	English (No fortition)	Elicited production
b.	Prator and Robinett (1972)	Italian (No final obstruents)	English (No fortition)	N/A
c.	Ross (1994)	Japanese (No final obstruents)	English (No fortition)	Spontaneous speech
d.	Heyer (1986)	Mandarin (No final obstruents)	English (No fortition)	Story reading
e.	Goad, White and Steele (to appear)	Mandarin (No final obstruents)	English (No fortition)	Picture description
f.	Steele (2002a,b)	Mandarin (No final obstruents)	Continental French (Fortition)	Picture naming/ Memory task

Importantly, these studies have exploited a diverse range of methodologies, bolstering the view that final aspiration reflects a property of the grammar – ON sharing – rather than being a task effect. The latter could have arisen in particularly formal testing situations if L2 learners were to pay undue attention to their productions in the interest of ensuring intelligibility. Further support against aspiration as a task effect comes from the fact that the same fortition patterns are attested in L1, as was seen earlier in section 5. Since children are not sensitive to the needs of their interlocutors in the way that adults are, this should further dispel the concern that task effects could have been responsible for the patterns observed.

7.3. Korean learners of English

In the remaining sections of this article, I provide an analysis for some of the results from a study on Korean learners of English (see Goad and Kang in press for details). I will discuss this study in some depth as it was specifically designed to address the question of the formal status of final consonants in IL grammars. Native Korean permits stops at the right edge, as codas; and as will be seen, the evidence from ambient English points toward an OEHS analysis for final consonants in this language. Nevertheless, intermediate learners' English outputs display a preference for ON sharing.

7.3.1. Methodology

The present discussion focusses on the two intermediate learners of English from Goad and Kang (in press). Both are native speakers of the Kyung-Sang (southeastern) dialect of Korean and are in their mid 20s and early 30s. Participants in the study were asked to read through a pseudo-randomly-ordered word list. There were 43 singleton stop-final stimuli, which are under present focus, and 96 other stimuli. The list was read through twice, for a total of 278 tokens.[14]

[14] Returning to the issue of task effects introduced in section 7.2, collecting data by means of a word list can misrepresent an individual's competence, as it is a formal setting with isolated stimuli, both of which can enhance the use of explicit production strategies. Nevertheless, the patterns observed in these data – in particular final release – are the same as those observed in the L1 and L2

The variables controlled for that are of current interest are: short versus long vowel; and voiced versus voiceless stop at the right edge. The significance of these variables will become clear when the shapes of Korean rhymes are examined in the following section.

7.3.2. Korean rhyme shape

Korean rhymes abide by the constraints in (22). Each will be elaborated on in turn.

(22) *Rhyme constraints for Korean:*
- a. Word-final consonants are codas, not onsets
- b. Coda stops permitted, but must be unreleased
- c. No long vowels allowed (among younger speakers)
- d. Sonorant codas are moraic; obstruent codas are not
- e. FOOTBINARITY is a violable constraint

Concerning (22a-b), post-vocalic consonants in Korean are limited to the inventory given in (23) (see, e.g., Kim-Renaud 1986:4). From the discussion in section 2.2.2 on segmental profile, we can conclude that the identity between the two columns in (23) leads to a coda analysis for word-final consonants in Korean, as in Japanese and Selayarese in (7a).

(23) *Korean codas:*

a. Word-internal position:

p˺	t˺	k˺
m	n	ŋ
	l	

b. Word-final position:

p˺	t˺	k˺
m	n	ŋ
	l	

Further support for a coda analysis comes from rhyme length (see earlier section 2.2.1): CVCC roots are reduced to CVC when no vowel-initial suffix is attached. That is, CVCC is not permitted to surface as such, in contrast to languages like French and Diola-Fogny in (6b).

In Section 7.3.3, we will see that English differs from Korean as concerns the analysis of word-final consonants. Under some conditions, final consonants in English are codas; but under other conditions, they are onsets. The Korean learner of English must contend with this.

Turning to (22c), a number of researchers have remarked that, in contrast to older generations of speakers, vowel length distinctions have been largely or altogether neutralized among younger speakers of the central (Seoul) dialect of Korean (e.g., Martin 1992; Magen and Blumstein 1993). Vowel length is no longer contrastive in the Kyung-Sang dialect either. However, the length distinctions that are observed among older speakers of the central dialect correspond to contrastive pitch in the Kyung-Sang dialect spoken by the participants in this study (Sohn 1999).

Korean learners of English must grapple with the fact that English contrasts long and short vowels. What is particularly challenging, though, is that the status of the final consonant in monosyllabic words – coda or OEHS – differs according to preceding vowel length, as will be argued for in Section 7.3.3.

Finally, regarding (22d-e), Korean is somewhat unusual in that sonorant codas are moraic, but obstruent codas are not (Broselow and Park 1995; see Zec 1995 on this pattern across languages). CVC_{obstr} words are nevertheless well-formed, indicating that FTBIN (22e) is not undominated in the language (compare [$so_{\mu}k$˺] ‘sequel, continuation’ with [$i_{\mu}l_{\mu}$] ‘one’). Further support for the low ranking of this constraint comes from the fact that CV words are also licit (e.g., [k’$æ_{\mu}$] ‘sesame’).

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studies cited earlier. We can thus be confident that the results have not been significantly biased by the methodology employed.

As will be seen in Section 7.3.3, FTBIN is inviolable in English. Indeed, this constraint plays an important role in determining the status of final consonants in CVC words in the language. This could pose a problem for Korean learners' treatment of English CVC, given the violability of FTBIN in their L1.

We turn now to look at English more concretely.

7.3.3. Status of final consonants in English

In section 2.2.3, where evidence was provided for coda, OEHS and ON analyses of final consonants, I mentioned that English requires an OEHS analysis for CVXC words and a coda analysis for CVC words. This difference will be motivated below.

I begin with CVXC words. With a handful of exceptions, English falls into the large class of languages that does not permit PWd-internal rhymes of the shape VXC, while tolerating strings of this shape at the right word-edge. If the final consonant were a coda in the latter context, there would be nothing to prevent VXC rhymes from appearing word-medially (see section 2.1). If the final consonant is an onset, on the other hand, this type of asymmetry is entirely as expected.

As to what kind of onset the final consonant in VXC# is – OEHS versus ON – we must consider the release properties of such consonants. Recall from (8b) that, in English, final stops are optionally unreleased. They do not show fortition, leading to an OEHS analysis over ON sharing.

Turning now to CVC words, word minimality requires final consonants to be codas in words of this shape in English. Since in this language all feet must be binary, the foot is a moraic trochee, and every PWd must contain at least one foot to be well-formed, the minimal word must be as follows: PWd ≥ $(\mu\mu)_{Ft}$. As (word-final) onsets are by definition not weight-bearing, final consonants in CVC words must be moraic codas: ✓$(CV_{\mu}C_{\mu})_{Ft}$, *$(CV_{\mu}C\emptyset)_{Ft}$.

Taken together, I have argued that the right-edge consonant in CVXC versus CVC words is subject to different analyses in English. Additional support for this comes from the observation that the inventories of final consonants permitted in the two types of words are not identical, suggesting that they are syllabified differently. With a handful of exceptions, [ŋ, b, ɡ, θ, ʃ, ð] are illicit at the right edge of CVXC (as well as ˈCVCVC), while any consonant (except [h]) can occur at the right edge of CVC (experimentally confirmed by Flegg 2001).

Although word-final onsets and codas should exhibit differences in segmental profile, the difference that is found in English is not as expected: across languages, it is right-edge onsets that usually display a wider range of options than right-edge codas (see earlier section 2.2.2). While there are clearly languages like English where right-edge onsets are more restricted than onsets of phonetically-realized syllables (e.g., Yapese, in contrast to French and Diola-Fogny in (7b)), what makes English particularly odd is that it permits virtually any consonant as a word-final coda. A further confounding factor for learners concerns the absence of fortition: final stops in English, regardless of whether they are syllabified as codas or as onsets, are optionally unreleased.

A summary of the status of final consonants in English by word shape is provided in (24).

(24) *Summary for English:*

	Analysis of final C:	Evidence:
a. Word-final CVX<u>C</u>	✓ Onset ✗ Coda	Rhyme shape
	✓ OEHS ✗ ON	Release properties: no fortition
b. CV<u>C</u> words	✗ Onset ✓ Coda	Minimal word = $(\mu\mu)_{Ft}$
c. CVX<u>C</u> ≠ CV<u>C</u>		Differences in inventory shape (but counter to what is expected)

Taken by themselves, the evidence available for the status of the final consonant in (24a-b) is not unexpected. In combination with (24c), however, English looks rather odd. Indeed, as will be discussed in section 7.3.4, the observations in (24a-c), taken together, should incorrectly lead Korean learners toward an OEHS analysis for English words of all shapes.

7.3.4. Hypotheses

In this section, I will lay out the hypotheses for final consonant syllabification for Korean learners of English. Although the subjects under focus in this article are intermediate learners, I begin with the predictions for beginner learners, based on transfer from the L1, because: (i) the transfer grammar will be the input to the grammar that intermediate learners construct on the basis of the evidence to which they are exposed; and (ii) transfer can continue to have an impact on development, beyond the earliest stages in acquisition. Given the observations in (22a-c) that hold for rhyme shape in Korean, the beginner grammar should display the following properties in outputs (production): (a) final consonants should be analysed as codas; (b) neutralization of laryngeal contrasts in stops to voiceless unreleased should be observed; and (c) vowel length distinctions should be eliminated in favour of short. Assuming accurate perception of laryngeal and vowel length contrasts by Korean subjects – that is, that inputs are target-like[15] – a single output is hypothesized:[16]

(25) *Beginner learners:*

Hypothesized inputs:			Hypothesized output:
'beat'	/pi:t^h/	⎫	σ
'bead'	/pi:t/	⎬	⟋ | ⟍
'bit'	/pit^h/	⎪	p i t
'bid'	/pit/	⎭	

In short, the beginner grammar should be a coda grammar, independent of the shapes of the input strings:

(26) *Hypothesis for beginner (transfer) grammar:*
Final consonant = coda

Turning to the intermediate grammar, learners at this stage should be able to extract more information from the ambient input and, thus, they should have moved beyond the transfer grammar in (26). Specifically, intermediate learners should have access to the information in (27). However,

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15 The possibility that reduction in vowel length and word-final laryngeal contrasts reflects a perceptual (input) problem, rather than being derived by the grammar as in (25), is addressed by Goad and Kang (in press). They provide two types of evidence in favour of accurate perception, summarized as follows: (i) In the treatment of English loan words, words with long versus short vowels are adapted differently in Korean, as are words with final voiced versus voiceless stops (e.g., Broselow and Park 1995); this would be unexpected if these differences could not be perceived by the Korean speakers who are importing the loans. (ii) Regarding Korean speakers' perception of vowel length in English, Flege, Bohn, and Jang (1997) demonstrate that, at least for high front vowels, Korean speakers can correctly identify English vowels based on duration (see also Ingram and Park 1997).

16 Korean does not have contrastive voicing. Laryngeal contrasts are formally expressed through aspiration. Hence, English /b/ and /t, d/ in (25) are interpreted as Korean /p/ and /t^h, t/ respectively.

as mentioned in section 7.3.3, the input from English may in fact mislead Korean speakers to posit an OEHS analysis for right-edge consonants in words of all shapes.

Starting with observation 1 in (27), recall from (24b-c) that final consonants in English CVC words are codas but they do not have a coda profile; indeed, they are a superset of what is permitted in Korean (23). As a result, intermediate learners should hypothesize that the final consonant in English CVC is not a coda. Turning to observation 2, it was mentioned in (22e) that Korean does not have to satisfy FTBIN; consequently, the analysis where the final consonant in English CVC is a coda is not forced by the L1 grammar. Third, while in (24c) it was mentioned that the inventories of final consonants in English CVC and CVVC words are different, observation 3 points out that they are sufficiently close such that the differences between them will likely go unnoticed by Korean speakers. This should lead learners to hypothesize that the final consonant in both CVC and CVVC words is syllabified in the same way. Finally, observation 4 points out that the final consonant in both CVC and CVVC is optionally unreleased (there is no fortition). This should direct learners to an OEHS analysis for the final consonant in words of both shapes, rather than the consonant being syllabified through ON sharing.

(27) *(Misleading) evidence for the Korean learner of English:*

Observations:	Intermediate learner's hypotheses:
1. Final C in English CVC = coda but C does not have a coda profile	CV<u>C</u> ≠ coda
2. Korean words can violate FTBIN, so CV<u>C</u> = coda is not forced	Consistent with hypothesis that CV<u>C</u> ≠ coda
3. Final C in English CVC is similar to final C in CVVC	CV<u>C</u> = CVV<u>C</u>
4. Final C in English is optionally unreleased in both CVC and CVVC	CV<u>C</u> = CVV<u>C</u> = OEHS

Taken together, the evidence in (27) should lead Korean learners of English toward an OEHS analysis for final consonants, regardless of whether the preceding vowel is short or long:

(28) *Hypothesis for intermediate grammar:*
Final consonant = OEHS

In section 7.3.5, however, we will see that this is not what the data show. Intermediate learners do analyse all final consonants as onsets. However, as in the L2 studies discussed earlier, they opt for ON syllabification, not for OEHS, even though there is no evidence for ON either in the L1 or in the target language.

7.3.5. Results and interpretation

The results for final release, across the four types of stimuli, are provided in (29). The high percentage of release is inconsistent with a coda analysis, indicating that the intermediate learners have moved beyond the transfer grammar in (26). The CVC_{vclss} stimuli in (29a) are particularly important in this respect, as words of this shape fit the native Korean coda grammar. However, this only holds if the final consonant is unreleased (22b), in contrast to the 85% shown in (29a). This observation, in combination with the same release behaviour exhibited for strings of other shapes in

(29b-d), instead suggests that learners have arrived at an onset analysis for final consonants across the board. Given observation 1 in (27), an onset analysis is what is expected for learners at this stage in development, as it will enable the IL grammar to license the wide range of contrasts observed for English in final position in both CVC and CVVC words.

(29) *Release:*

	Stimuli:	Final C released:
a.	CVC_{vclss}	85%
b.	CVC_{vcd}	78%
c.	$CVVC_{vclss}$	91%
d.	$CVVC_{vcd}$	96%
	Average	88%

However, while learners have moved beyond the transferred coda grammar to an onset grammar, the high percentage of release in (29) is not consistent with OEHS syllabification, counter to the hypothesis in (28). It instead reflects an ON analysis. Where does the preference for ON sharing come from? Observation 4 in (27) reveals that there is no evidence for ON sharing in the ambient input. The information on Korean rhyme shape in (22a-b) also indicates that there is no evidence for this in the native language. In section 7.1, I suggested that the preference for ON syllabification in L2 represents a case of Emergence of the Unmarked. Specifically, on the basis of the observations in (27), intermediate learners conclude that English requires final onsets. However, while from the L1 Korean standpoint, the data suggest that English requires OEHS syllabification in words of all shapes, this structure is more costly than ON sharing. ON sharing thus represents the optimal compromise analysis.

7.4. Summary for L2

In sum, we have seen that final release occurs in L2, independent of the constraints of the L1 and target languages. ON syllabification, the formal representation of final release, emerges as the least marked option for L2 learners whose L1 permits no right-edge consonants or a limited inventory of consonants in this position. The role that markedness plays is particularly apparent among Korean learners of English, as in this case, the L1 grammar does have a means to syllabify final stops, namely, as unreleased codas. Nevertheless, in the presence of evidence for OEHS, intermediate learners opt for an ON grammar.

8. Conclusion

In this article, I have provided support for the view that languages require both coda and onset analyses for the syllabification of word-final consonants; and further, that the latter must be divided into languages where final consonants are OEHS and those where consonants in this position are syllabified through ON sharing. The coda–onset division was based on cross-language differences in rhyme length and the segmental profile of word-final consonants; the division into types of onsets was based on release properties, specifically, that consonants which are overtly released are syllabified through ON sharing. Among the three syllabification options, I have argued that ON sharing is the least marked. Various types of evidence were provided in support of this position.

First, I argued that ON syllabification is favoured among L1 learners, independent of the release properties that final consonants display in the target languages under focus, English, Québec French and German. Concerning markedness, I proposed that ON sharing represents the best compromise between satisfying syllable well-formedness on the one hand and faithfulness

constraints on the other: it enables learners to avoid the prosodically-marked structures required for other parses of CVC# (coda and OEHS) while still being faithful to the input string, unlike the alternatives of deletion and epenthesis.

Second, I argued that among English-speaking individuals with SLI, ON sharing is utilized by the grammar to syllabify plural *s*. Constraints on the morphological structure of SLI plurals – that *s* must form a PWd separate from the base to which it attaches, in contrast to the unimpaired grammar where it is an affixal clitic – require that the morpheme be syllabified in a manner different from the OEHS structure found in the unimpaired grammar. Parallel to what was seen for L1, ON sharing was shown to be the optimal way to satisfy constraints on the prosodic structure of SLI plurals as well as faithfulness.

Third, I demonstrated that ON sharing emerges as optimal in the interlanguage grammars of L2 learners. Specifically, for learners whose L1 does not permit right-edge consonants (of a particular type), I argued that illicit final consonants are first analysed through ON sharing, and that this strategy is observed, independently of how both the native and target languages handle such consonants. Support for this view was drawn from right-edge aspirated stops in the outputs of Polish, Italian, Japanese, Mandarin and especially Korean learners of English, as well as Mandarin learners of French.

Finally, I provided a parsing argument in favour of final onsets, and in favour of ON sharing in particular. I first argued that, given the range of contrasts that final onsets exhibit, they better demarcate the right word-edge than do codas. Second, among types of onsets, I proposed that ON sharing is ideal when compared to OEHS as, in the absence of a following vowel, the former representation, through the release, is better able to host the contrasts that right-edge onsets display. This argument served to illustrate how ON sharing provides an advantage to end-state grammars, beyond being an emergent property from acquisition.

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Markedness in Right-edge Syllabification: Parallels across Populations

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Abstract

The position that languages require both coda and onset options for the syllabification of word-final consonants is adopted. The latter option is further divided into languages where final consonants are - onsets of empty-headed syllables and those where consonants in this position are syllabified through onset-nuclear sharing. ON sharing is reserved for languages where final consonants display fortition (overt release): the nucleus hosts the release of the consonant. Empirical evidence from across populations demonstrates that ON sharing is unmarked. It is favoured among the outputs of first and second language learners and individuals with Specific Language Impairment. It is further argued that final onsets are optimal for parsing in end-state grammars, as they demarcate the right word-edge more effectively than codas. Among the two types of onsets, ON sharing is preferred: through the nuclear release, it is better able to host the range of contrasts that right-edge onsets display. The parsing argument serves to illustrate how ON sharing provides an advantage to end-state grammars, beyond being an emergent property from acquisition.

Résumé

La position selon laquelle les langues comportent deux options générales, coda ou attaque, pour syllaber les consonnes en position finale de mot est adoptée. Sous la deuxième option, deux subdivisions sont aussi nécessaires : les langues où les consonnes finales sont des attaques de syllabes à noyaux vides et des langues où les consonnes dans cette position sont syllabées avec un partager de tous leurs traits entre l'attaque et le noyau (partage A-N). Le partage A-N est réservé pour les langues où les consonnes finales manifestent un renforcement (relâchement consonantique fort) : le noyau contient la portion relâchée de la consonne. Des indices empiriques à partir de différentes populations de locuteurs sont fournis, lesquels supportent la position que le partage A-N est non marqué. Ce partage est favorisé chez les apprenants des langues premières et secondes, ainsi que chez les individus atteints de dysphasie. Il est de plus démontré que les attaques finales sont optimales dans la syllabation des consonnes finales dans les grammaires cibles, parce qu'elles démarquent la frontière finale des mots plus efficacement que les codas. Le partage A-N est privilégié dans les attaques finales, parce que le relâchement du noyau permet de supporter l'ensemble des contrastes présents en attaque finale. Cet argument supporte donc l'hypothèse que le partage A-N est avantageux pour les grammaires adultes, en plus d'être une propriété émergente du processus d'acquisition.