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PHONETIC EVIDENCE FOR PHONOLOGICAL STRUCTURE IN SYLLABIFICATION[*]

Heather Goad Kathleen Brannen
McGill University

1. Preliminaries

It has been widely observed that codas are marked vis-à-vis onsets. In adult languages, coda markedness manifests itself in two ways: some languages do not tolerate codas at all (e.g. Cayuvava (Key 1961), Senufo (Clements and Keyser 1983)), while virtually all languages that do permit codas place restrictions on what this position can license. Coda markedness has consequences for the syllabification of consonants at the right edge of words as well. While one view is that final consonants are always syllabified as codas, there are many languages for which this analysis is not motivated. In the 1980s, final consonants were commonly designated as extraprosodic in these types of languages (Steriade 1982; Borowsky 1986; Itô 1986). More recently, it has been observed that there is a striking parallel between right-edge extraprosodic consonants and onsets in many languages; accordingly, extraprosodic consonants have been interpreted as onsets of empty-headed syllables by a number of scholars (see e.g. Giegerich 1985; Kaye 1990; McCarthy and Prince 1990; Charette 1991; Piggott 1991, 1999; Rice 1992; Harris 1994).

The marked status of codas is observed in child language as well. Early grammars show a strong preference for CV syllables, independent of the constraints of the target language (see e.g. Jakobson 1941/68; Ingram 1978; Fikkert 1994). When word-final consonants ultimately emerge, the predominant view is that they are syllabified as codas (e.g. Fikkert 1994; Demuth and Fee 1995; Stemberger 1996). In this paper, we argue against this view. We propose that right-edge consonants are first syllabified as onsets – specifically, as onset-nuclear sequences – regardless of their status in the language being acquired. The principal evidence in support of this view comes from the phonetic properties that characterize early obstruent-final CVC forms: for the final consonant, the presence of aspiration (final release[1]), length, and homorganic nasal release; and for the medial vowel, the presence of length and post-vocalic pause. The data on which we base our analysis come from five English-speaking children between the ages of 18 and 26 months, shortly after the point when CVC forms emerge.

We begin in §2 by laying out our assumptions about language acquisition and about the representations that we assume for segment structure and syllable structure. We turn in §3 to demonstrate how our views on syllable structure yield a three-way typology for the

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[1] Throughout this paper, we use the term ‘aspirated’ to refer to stops which are *post*-aspirated (cf. Steriade 1997). In this way, aspiration is technically final release (see Laver 1994:355).

syllabification of post-vocalic consonants across languages. This section concludes with a discussion of phonetic correlates of right-edge onsets in adult languages. In §4, we turn to the child data. We demonstrate that early CVC forms are characterized by release and timing properties consistent with their being syllabified as onsets. We suggest that a ban on codas is partly responsible for the shapes of these outputs: syllabifying right-edge consonants as onsets enables children to avoid building the marked representation required for a coda without compromising the segmental content of the adult target. In §5, we detail the representations that we posit for right-edge onsets. We propose that, in child language, these consonants are syllabified as onset–nuclear sequences, rather than as onsets of empty-headed syllables. In §§5.3-5.4, we draw a distinction between children who represent voicing contrasts through the Laryngeal node, as in the target English grammar, and those who initially represent this contrast through the Sonorant Voice (SV) node. We discuss how the release properties of final consonants differ as a consequence of the way that voicing is represented in the two types of grammars. Finally, in §6, we return to the syllabification of right-edge onsets in adult languages, in light of the representations that we have proposed for child language.

2. Assumptions

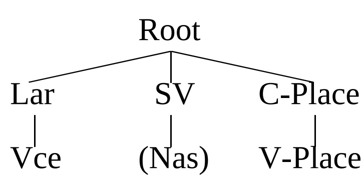
2.1 *Acquisition*

In the following lines, we outline our assumptions about acquisition. First, we adopt the view that children's early grammars are structurally unmarked (e.g. Jakobson 1941/68; Stampe 1969; Gnanadesikan 1995). Second, we accept that children learn through exposure to positive evidence only (e.g. Chomsky 1981; Pinker 1984). In the present context, since we will argue that children initially syllabify final consonants as onsets, we must ensure that this reflects the unmarked case (see Borowsky 1986:197-199; Piggott 1991; Goad and Brannen 2000; cf. Itô 1986:102). In earlier work (Goad and Brannen 2000), we provided two types of arguments in favour of this position. One, following Piggott (1991), we argued that the potential for the availability of positive evidence necessitates that children begin with the analysis that final consonants are syllabified as onsets; in some languages, if learners were to start with the assumption that final consonants are instead codas, positive evidence for onset status would not be available. Two, from the point of view of processing, we demonstrated that final onsets are the optimal way to signal the right word edge, thereby yielding word-final onsets over word-final codas as unmarked. Codas are good cues to the right edge of syllables, since they depend on following onsets to license material that they cannot themselves license; however, for this same reason, they are poor cues to the right edge of words.

2.2 *Segment structure*

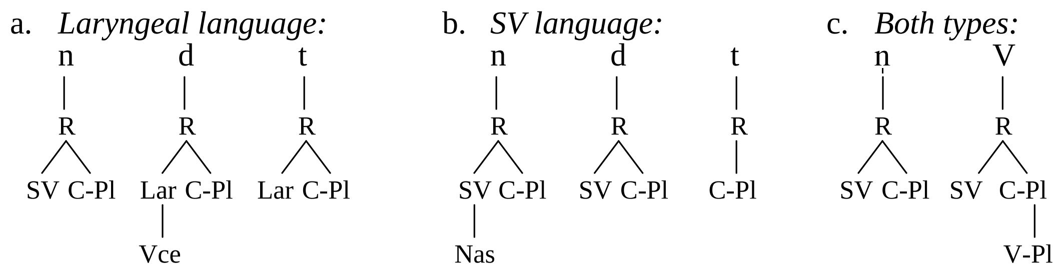
Turning to our assumptions about segment structure, we adopt the position that all phonological features are monovalent. We assume further that features are hierarchically organized as in (1) (only relevant structure is provided).

(1)



The primitives that we have selected are essential for the analysis. First, we assume that place is organized differently in consonants and vowels (Clements and Hume 1995): consonants bear a C-Place node only while vowels contain an additional dependent V-Place. Second, we assume that there is an SV node which organizes sonorant features (SV abbreviates Sonorant Voice or Spontaneous Voice; see Rice and Avery 1989; Piggott 1992). The only dependent of SV that will feature in our analysis is Nasal. It is in parentheses in (1) as we assume that in many languages this feature is not projected (Rice 1992). Indeed, in so-called Laryngeal languages, bare SV in non-nuclear position will be interpreted as nasality (Rice 1993; Avery 1996). This can be seen from the first structure in (2a). ([n], [d], and [t] abbreviate the class of nasals, voiced obstruents, and voiceless obstruents respectively.)

(2)



In contrast to the system in (2a), there are many languages for which there is no evidence that the Laryngeal node has been projected. These languages fall into two types. There are those for which voicing is entirely predictable and is often positionally determined (e.g. most Australian languages (Blake and Dixon 1979:19)). We are interested in the second type: languages where voicing is formally captured through the presence or absence of the SV node, as in (2b) (see Rice 1993; Avery 1996). In the latter type of language, a bare SV node in non-nuclear position will be interpreted as a ‘sonorant obstruent’, e.g. [d] in (2b) (Piggott 1992; Rice 1993). Accordingly, Nasal must be projected for the class of nasals, in contrast to the system in (2a). SV languages are characterized by, for instance, the presence of allophonic variation among voiced obstruents and pre-/post-nasalized stops, nasals, and/or approximants; processes such as voicing assimilation that treat voiced obstruents and sonorants as a class; and the absence of final devoicing (Avery 1996). Turning finally to (2c), we suggest that in both Laryngeal and SV languages, a bare SV node accompanied by a C-Place node in nuclear position is interpreted as a syllabic nasal. If C-Place contains a dependent V-Place node, however, the interpretation is as a vowel. In §5, the variable interpretation of SV will feature prominently in our analysis of the release patterns that characterize early CVC forms.

2.3 *Syllable structure*

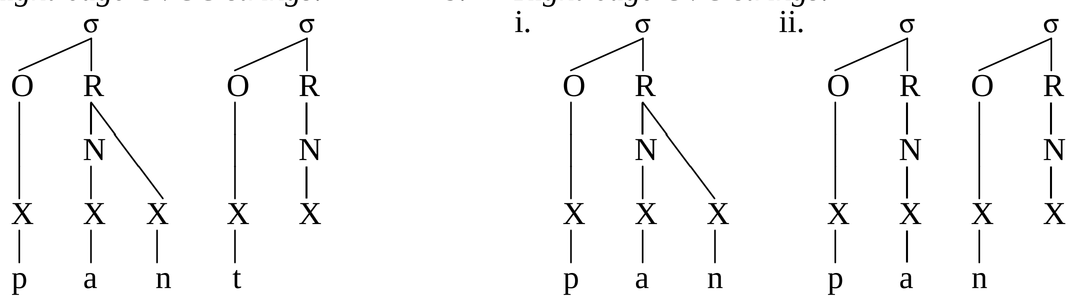
In this final subsection, we detail our assumptions about syllable structure. We adopt Onset–Rhyme theory with the proviso that the only sub-rhymal constituent is the nucleus. Following Government Phonology, there is no formal coda constituent (see esp. Kaye 1990; Kaye, Lowenstamm and Vergnaud 1990:201-202); coda consonants are organized as post-nuclear segments, as can be seen for [n] in (3a) (see also Blevins 1995:216).[2] The principal reason for this concerns rhyme binarity. In Government Phonology, it is proposed that all sub-syllabic constituents are universally maximally binary (e.g. Kaye, Lowenstamm and Vergnaud

2 For convenience, we will continue to use the term ‘coda’.

1990:199).[3] We accept a weaker version of this proposal, that constituent binarity reflects the unmarked state of affairs. If the coda were a formal constituent of the syllable, there would be no principled reason to rule out binary branching codas and, thus, ternary or even quaternary branching rhymes in the usual instance; both would be consistent with the view that sub-syllabic constituents are maximally binary.

While ternary branching rhymes are attested in languages such as Finnish, the majority of languages do not tolerate CVXC syllables word-internally. However, in several languages of the latter type, strings of this shape are tolerated at the right edge, precisely because the final consonant can be syllabified as the onset of an empty-headed syllable, as illustrated in (3a). As expected, final CC clusters in such languages have a coda–onset profile (see e.g. Rice 1992; Harris 1994, 1997; Piggott 1999; and §3.1 on Diola-Fogny).

(3) a. *Right-edge CVCC strings:* b. *Right-edge CVC strings:*



In languages which respect constituent binarity, this constraint will force the final consonant out of the rhyme in a CVXC# string. However, this is clearly not the case with CVC# strings. Following Piggott (1991, 1999), we contend that languages have two options for the syllabification of the final segment in strings of this shape: rhyme-internal consonant (coda) as in (3b.i), and onset of empty-headed syllable, (3b.ii). (A version of (3b.ii) where final consonants are syllabified as onset–nuclear sequences will be discussed in §§5-6.) We thus follow the spirit of Itô (1986) where it is proposed that languages have two choices for the syllabification of final consonants (cf. Government Phonology where final consonants are syllabified as onsets of empty-headed syllables in all languages).

Broadly speaking, there are three kinds of evidence which support two options for the syllabification of final consonants at the right edge. The first two, segmental profile and rhyme shape, appear in the literature; the third, release properties, will be explored in this paper, mostly within the context of child language.

(i) Segmental profile: In languages where final consonants are syllabified as codas, these segments have a coda profile in the sense that the restrictions observed mirror those that hold of word-internal codas. Languages which fall into this category include Selayarese and, under most analyses, Japanese (e.g. Itô 1986; cf. Yoshida 1990). In languages where final consonants are syllabified as onsets, on the other hand, these segments have an onset profile in the sense that there are (virtually) no restrictions on what can be present in this position as compared to what can appear in word-internal coda position in the same language. Diola-Fogny and French fall into this class of languages.

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[3] Since both rhymes and nuclei can branch, it may seem that Government Phonology freely permits ternary branching VVC rhymes. In this framework, rhymes of this shape are ruled out by ‘strict locality’, which requires the head, the initial V in this string, to be adjacent to every other member of the rhyme.

(ii) Rhyme shape: In languages where final consonants are syllabified as onsets and branching rhymes are permitted, strings of the shape CVXC are tolerated in final position as in, for example, Diola-Fogny (CVVC and CVCC) and Yapese (CVVC). This is in direct contrast to languages where right-edge consonants are syllabified as codas; in such languages, final strings are limited to CVC (and CVV, if licit), as in Selayarese. In some of these languages, claims about rhyme shape can be supported through alternations: closed syllable shortening, vowel epenthesis, consonant deletion, etc.

(iii) Release properties: Right-edge consonants which are syllabified as onsets may be, but are not required to be, characterized by release properties similar to those displayed by onsets that are followed by phonetically realized vowels. Yapese is a representative example. In this language, final plain stops are ‘aspirated’ (Jensen 1977:27).[4] We will see in §4 that CVC forms in early child language resemble Yapese in this respect. By contrast, final codas do not display such release properties; indeed, they are often subject to neutralization constraints which prohibit the appearance of such properties.

3. Right-edge consonants in adult languages

3.1 *Typology for the syllabification of post-nuclear consonants*

In this section, we will briefly demonstrate how the assumptions outlined above serve to limit the options available for the syllabification of post-nuclear consonants. A three-way typology will result. As mentioned in §2.3, the factors which are typically used to determine the status of right edge consonants are segmental profile and preceding rhyme shape. We will look at three languages from this perspective: Selayarese, where word-final consonants are syllabified as codas, and Diola-Fogny and Yapese, where final consonants are syllabified as onsets. Diola-Fogny differs from Yapese in that, like Selayarese, Diola-Fogny permits word-internal codas. Our discussion of these three languages draws heavily on Piggott (1999).

We begin with Selayarese where word-internal codas are restricted to geminates, homorganic nasals, and [ʔ]; see (4a) (transcriptions simplified from Mithun and Basri). Word-finally, consonants have a coda profile: only [ŋ] and [ʔ] are found, (4b). Further evidence for this comes from Mithun and Basri’s observation that words which end in consonants other than [ŋ] and [ʔ] are subject to final epenthesis (e.g. /katal/ → [katala] ‘itch’, /tulis/ → [tulisi] ‘write’).

(4) *Selayarese (Austronesian)* (Mithun and Basri 1986):

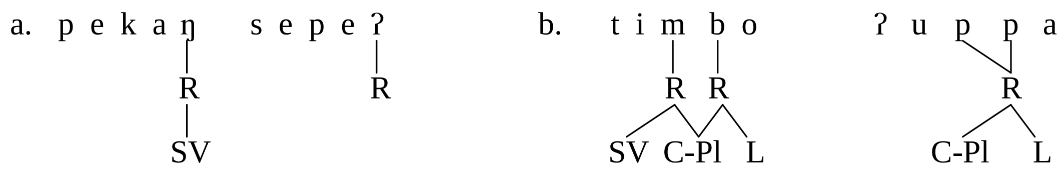
a.	ʔuppa	‘find’	ʔandeŋka	‘throw’	laʔba	‘lack of salt’
	allonni	‘this day’	timbo	‘grow’	seʔla	‘salt’
b.	pekaŋ	‘hook’	sepeʔ	‘narrow passage’		
	potoŋ	‘style’	sassaʔ	‘lizard’		

If [ŋ] and [ʔ] are placeless – [ŋ] because the least marked nasal is interpreted as velar in many languages (Trigo 1988; Rice 1996), and [ʔ] because it lacks supralaryngeal constriction – we arrive at the representations in (5a) where the Selayarese coda can only license nasality, a bare SV node in our approach (see Piggott 1999; cf. Goldsmith 1990). Word-internal codas also abide

[4] Importantly, by focussing on *similar* release properties across types of onsets, we do not mean that the aspiration found on an onset in a CV string and that the release observed on the onset of an empty-headed syllable are formally represented in the same fashion. This will become clear in §§5-6.

by this restriction, but as they can share features, which they cannot themselves license, with a following onset, a wider range of options is observed in this context, (5b).

(5)



On the face of it, Diola-Fogny is similar to Selayarese: word-internal codas are limited to nasal geminates or to homorganic nasals and liquids, (6a). The second column in (6a) reveals that consonant deletion due to morpheme concatenation yields forms which are consistent with this. In contrast to Selayarese, though, any consonant from the Diola inventory can occur in final position (Sapir 1965:6). Representative examples are provided in (6b).

(6) *Diola-Fogny (West Atlantic)* (Sapir 1965):

a.

niŋaŋŋan	‘I cried’	takʊn - mbɪ	→	takʊmbɪ	‘must not...’
jɛnsʊ	‘undershirt’	lɛt - kʊ - jaw	→	lɛkʊjaw	‘they won’t go’
saltɛ	‘be dirty’	na - laŋ - laŋ	→	nalalaŋ	‘he returned’

b.

fumoːməf	‘the trunk’	ufeːgir	‘three’	famb	‘annoy’
wopuːs	‘green caterpillar’	irok	‘I am fat’	jawac	‘to swim’

According to Itô (1986), word-final consonants in Diola-Fogny are not codas, but are instead licensed by extraprosodicity. More recently, Piggott (1991, 1999) has demonstrated the parallel between the segmental profile of word-final consonants and what are indisputably onsets in this language; he thereby concludes that final consonants are onsets of empty-headed syllables. We concur with this analysis. Further support comes from the coda–onset profile of final clusters (e.g. [famb]) and from the absence of closed syllable shortening (e.g. [wopuːs]).

In sum, Selayarese and Diola-Fogny are consistent with the hypothesis that codas are marked vis-à-vis onsets; codas typically license a limited range of features with the consequence that there are severe restrictions on what can appear in this position. By contrast, onsets are (virtually) unrestricted across languages. The range of options permitted among right-edge consonants in Diola is consistent with their falling into the latter category.

The unmarked status of onsets is further demonstrated by the fact that no language prohibits CV syllables and some languages only allow for syllables of this type (Cayuvava, Senufo). Yapese, the last adult language we will consider, is similar to Cayuvava and Senufo in that it forbids word-internal codas. Like Diola-Fogny, however, word-final consonants (barring [h]) can freely occur (Jensen 1977:29). (In fact, words must end in a consonant; we will return to this in §6.) Other languages with the same restrictions on syllable shape as Yapese include Luo (Stafford 1967) and Kamaiurá (Everett and Seki 1985).

Representative examples of Yapese word-final onsets are given in (7a). The illicit forms in (7b) reveal the absence of word-internal codas. Indeed, epenthesis serves to break up clusters which arise through morpheme concatenation: /bug-y/ → [buguy] ‘to bend something’, /meel-y/ → [meeliy] ‘to pull on rope’.[5]

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[5] Jensen points out that word-internal short vowels are sometimes subject to syncope, e.g. /luba - dadu/ → [lubdaːd] ‘our breath’. However, it is highly unlikely that the resulting cluster is a coda–onset sequence: the sonority profile is irrelevant to the well-formedness of the resulting cluster; word-internal clusters are otherwise subject to

(7) *Yapese (Austronesian)* (Jensen 1977):

a.	laaṭ	'type of tree'	magad	'lime container'	taaŋ	'song'
	garik	'stinging jellyfish'	pilig	'to take down'	lik'	'its root'
	lukur	'stick to pick up food'	danoop	'the world'	faraf	'floor'

b. *lukkur *piltig *dandoop *fardaf

The lack of word-internal codas, the presence of long vowels before word-final consonants, and the range displayed in the segmental shape of final consonants all strongly suggest that these consonants are not syllabified as codas. Piggott (1991, 1999) proposes that they are onsets of empty-headed syllables. Thorburn (1993), by contrast, suggests that they are extraprosodic. We concur with Piggott that final consonants in Yapese are onsets; however, there are some differences between our analysis and his which will be addressed in §6.

In sum, we have arrived at a three-way typology as concerns the syllabification of post-nuclear consonants; this typology is provided in Table 1. Languages with word-internal codas have two options for final consonants: they may be syllabified as onsets (Diola-Fogny), or they may be codas (Selayarese). Since the shape of word-internal codas plays an important role in determining the status of word-final consonants, we predict that in languages with final consonants but no word-internal codas, final consonants will always be analysed as onsets (Yapese). In other words, there should be no language where CVC is limited to the right word edge and where final consonants have a coda profile or display coda-like behaviour. Under our approach, if final consonants were syllabified as codas in such a language, there would be nothing to prevent the presence of word-internal codas.

Word-internal codas	*Word-final consonants*	*Example languages*
Yes	Onset	Diola-Fogny, French
Yes	Coda	Selayarese, Japanese
No	Onset	Yapese, Kamaiurá
No	Coda	--

Table 1. Typology for the syllabification of post-nuclear consonants

English, the language being acquired by the children under present investigation, has been noticeably absent from the discussion thus far. In some respects, it falls into the same category as Selayarese and Japanese: final consonants in CVC strings are syllabified as codas. Evidence for this comes from word-minimality effects: the minimal monosyllabic word is CVX, indicating that the final consonant in CVC is weight-bearing. However, in contrast to Selayarese and Japanese, English tolerates CVXC strings at the right edge (we ignore the extra position reserved for [t,d,s,z] inflection). In words of this shape, final consonants must be syllabified as onsets of empty-headed syllables given that, with limited exceptions (see Harris 1994), word-internal rhymes in English abide by constituent binarity discussed in §2.3. Closed syllable shortening

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epenthesis, as discussed in the text; and syncope appears to be optional (Thorburn 1993). We concur with Thorburn (1993) that the first consonant in a derived CC cluster is the onset of an empty-headed syllable.

supports this analysis; compare [faɪ.v] ‘five’ with [fɪf.tiː], *[faɪf.tiː] ‘fifty’.[6]

3.2 *Phonetic correlates of final onset status*

Thus far, the evidence we have used to determine the status of final consonants has been distributional. The question which we turn to now is whether there are any phonetic correlates of onset versus coda status of these consonants. We propose that word-final consonants which are syllabified as onsets may be characterized by release properties similar to those observed for onsets which are followed by phonetically realized nuclei. Yapese exemplifies this situation: plain voiceless stops in final position are ‘aspirated’ (Jensen 1977:27). Yapese is not anomalous in this respect: Sierra Popoluca (Elson 1947) and Nez Perce (Hoard 1978) also display aspiration of onsets followed by phonetically-empty nuclei.

Importantly, we are not claiming that, in the absence of an appropriate phonetic correlate, final consonants are syllabified as codas. The stronger claim cannot be made, as there may be overriding constraints in a language. Specifically, languages may limit the licensing options of consonants at the right word edge, regardless of how such consonants are syllabified.[7] For example, we have seen that final consonants in Diola-Fogny are syllabified as onsets; yet Sapir (1965:5) notes that voiceless stops in this position are optionally unreleased. We return to this issue in §6, after we have provided the representations that we posit for onsets at the right word edge.

As concerns final codas, we suggest that it would be highly unlikely for a release property such as aspiration to be systematically present on a coda. Indeed, neutralization is typically observed in this position, and consonants which undergo laryngeal neutralization are often unreleased (for various approaches to laryngeal neutralization, see e.g. Westbury and Keating 1986; Cho 1990; Lombardi 1991; Harris 1997; Steriade 1997; Kawasaki 1998).

4. CVC forms in early child language

We turn now to the phonetics of CVC forms in early child language. We will see that child language resembles Yapese, as final consonants are characterized by release properties like aspiration. The parallel exists on distributional grounds as well: in child language, word-final consonants emerge before there are any word-internal codas. Thus, at the stage that we are focussing on, the only post-vocalic consonants are in word-final position. We propose that final consonants in early CVC forms are not syllabified as codas; indeed, they cannot be under the claims made in Table 1 above. We will argue that the release and timing properties of early obstruent-final CVC forms are consistent with their being syllabified as ON.ON where the features of the right-edge consonant are shared across the final onset–nuclear sequence.

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[6] The facts of English CVC words are not as straightforward as implied in the text. With the notable exception of [ŋ], the inventory of final consonants permitted in CVC words is very similar to that in CVVC words. This suggests that final consonants in CVC words may also be onsets, a problem which we leave to future research.

[7] To our knowledge, such licensing restrictions are observed for laryngeal properties but never for place. As will be seen in §6, this follows from the representations that we provide.

4.1 *Epenthesis, truncation, and word minimality*

We begin with epenthesis and truncation, two processes that are standardly used as evidence for an early preference for open syllables. Representative data are given in (8).[8] In the case of epenthesis, the epenthetic vowel may surface as a copy of the preceding vowel (8a.i), or as some default vowel (8a.ii). In both cases, as with truncation in (8b), the result is a string of open syllables. Both epenthesis and truncation are thus consistent with a constraint such as NoCoda (Prince and Smolensky 1993), or NoBranchingRhyme in our approach, being undominated in children's early grammars.

(8) a. *Epenthesis:*

i.	[ʌbʌ]	'up'	(Jacob 20 mos)
	[hɛtɛ]	'hat'	(Jacob 20 mos)
ii.	[bɪbi]	'bib'	(Mollie 18 mos)
	[wåki]	'walk'	(Mollie 18 mos)

b. *Truncation:*

[bæ]	'bath'	(Hildegard 20 mos)
[be]	'Bates'	(Hildegard 20 mos)
[ko]	'coat'	(Mollie 18 mos)
[dɔ]	'dog'	(Mollie 18 mos)

Abiding by NoCoda through truncation, however, yields forms which are subminimal. This is clearly true for words such as [bæ] where the vowel is short in the adult grammar. In fact, we contend that all the forms in (8b) are subminimal. First, vowel length is variable in the early outputs of children learning West Germanic languages, suggesting that it is not initially used contrastively (Fikkert 1994; Demuth and Fee 1995). Second, given that the quality difference observed among English vowel pairs – [iː-ɪ], [eː-ɛ], etc. – is very salient, it seems reasonable to propose that children initially analyse the difference in long–short pairs at the melodic level only, with a feature such as [tense]. If all truncated forms at this stage are then subminimal, the question which must be addressed is whether the child 'knows' this. We think not, as there is no evidence that the child has any knowledge of the Foot at this stage in development (Demuth and Fee 1995; Goad 1997). Consider for example Mollie. According to Holmes (1927:221), *all* of Mollie's two-syllable outputs at the stage we are focussing on received equal stress on both syllables. While such forms could be parsed as two degenerate feet, $(CV)_{Ft}(CV)_{Ft}$, the unmarked role that FootBinarity plays across languages makes this highly unlikely, especially in light of the commonly held view that children's early grammars reflect unmarked properties (cf. §2.1). If, by contrast, the Foot has not yet been projected, the monotonic stress pattern described by Holmes (and others) is exactly as expected. Following from this, we propose that FtBin plays no role in the emergence of right-edge consonants under our analysis; accordingly, there is no constraint to initially drive children to syllabify final consonants as codas and they are free to syllabify them as onsets (cf. Fikkert 1994; Demuth and Fee 1995).

4.2 *The phonetics of final consonants*

As mentioned earlier, when final consonants appear in children's outputs, they display a number of effects which suggest that they are syllabified as onsets, regardless of the constraints of the target grammar. We begin in this section by discussing the release properties of final obstruents in early CVC forms. In §4.3, we turn to properties of the medial vowel in CVC forms.

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[8] The child data in this paper come from the following sources: Mollie (Holmes 1927), Hildegard (Leopold 1939), Jacob (Menn 1978), Lasan (Fey and Gandour 1982), Scott (collected by the first author). All data are transcribed according to the conventions used by the particular author(s) with one exception: final aspiration is represented with a superscript [h] where Leopold uses an apostrophe.

The examples in (9) show that final stops may surface as aspirated (finally released). Fey and Gandour (1982:74) describe Lasan's right-edge stops as having a "distinctive oral release". Leopold (1939:108) mentions that, at 22 months of age, Hildegard's right-edge stop in 'meat' was "strongly aspirated with the exaggeration typical of the first final consonants".

(9) *Final aspiration:*

[dap^{h}]	'drop'	(Lasan 21-25 mos)	[vit^{h}]	'feet'	(Lasan 21-25 mos)
[mit^{h}]	'meat'	(Hildegard 22 mos)	[bok^{h}]	'broke'	(Hildegard 22 mos)
[bɑk^{h}]	'bike'	(Jacob 20 mos)	[ap^{h}]	'up'	(Jacob 20 mos)

If these consonants are syllabified as codas, the data seem somewhat anomalous when compared with adult languages. As mentioned earlier, in adult languages, laryngeal neutralization is commonly observed in coda, and neutralized stops are often unreleased. Westbury and Keating (1986) and Steriade (1997) provide phonetically-based accounts of laryngeal neutralization in final position, the former based on ease of articulation, and the latter, on the observation that fewer cues to voicing contrasts are available in this position. If child language reflects the unmarked state of affairs, and markedness is partly determined by articulatory and/or perceptual factors, one might wonder why we observe final aspiration in children's early outputs. Under our analysis, an explanation readily emerges: final consonants are syllabified as onsets, more specifically, as onset–nuclear sequences.

In (10), we can observe the second pattern for final consonants in CVC forms: the consonants may exhibit lengthening. With regard to Mollie's /k/-final forms, Holmes states that "the explosion of *k* was...prolonged (almost equal to a *schwa*)" (p. 221). Thus, the release, rather than the closure, was twice as long, revealing a striking parallel between the pattern in (10) and what was described as final aspiration in (9). In §5.2, we argue that final aspiration and final length are in fact equivalent.

(10) *Length on final consonant:*

[keˈkː]	'cake'	(Mollie 18 mos)	[dʒusː]	'juice'	(Jacob 20 mos)
[æˈtː]	'hat'	(Mollie 18 mos)	[s̀iːs̀ç]	'cheese'	(Jacob 20 mos)
[bæˈdː]	'bad'	(Mollie 18 mos)			

The data in (11) show that right-edge voiced stops may be followed by a homorganic nasal release. Fey and Gandour (1982:74) report that, from 21-25 months of age, Lasan's "word-final voiced stops...were consistently produced...with a distinctive nasal release". In §5.3, we will demonstrate that this CN̩ pattern is not anomalous; on the contrary, it is exactly what is expected for children who represent voicing contrasts with the feature SV rather than Laryngeal. For the present, notice that Fey and Gandour transcribe the nasal release as syllabic; they provide evidence for this analysis from the pitch contour (p. 72). Importantly, if the nasal is syllabic, then the root-final consonant is optimally syllabified as an onset, not as a coda.[9]

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9 In contrast to our view, Fey and Gandour consider the CN̩ sequences to be heterosyllabic, but they provide no evidence for this analysis.

(11) *Nasal release:*

[dabm̩]	'stub'	(Lasan 21-25 mos)	[babm̩]	'bulb'	(Lasan 21-25 mos)
[vidn̩]	'feed'	(Lasan 21-25 mos)	[dædn̩]	'dad'	(Lasan 21-25 mos)
[bəgŋ̩]	'bug'	(Lasan 21-25 mos)	[wɔgŋ̩]	'frog'	(Lasan 21-25 mos)

4.3 *The phonetics of pre-consonantal vowels*

In this section, we consider two properties that characterize the medial vowel in CVC forms. These properties are consistent with the vowel being at the right-edge of a syllable, an analysis which would only hold if the final consonant were syllabified as an onset. We begin with length on the medial vowel in (12), either half length as seen in Mollie's examples, or full length as in Jacob's examples.

(12) *Vowel length:*

[keˑkː]	'cake'	(Mollie 18 mos)	[ʌmʌːk]	'milk'	(Jacob 20 mos)
[æˑtː]	'hat'	(Mollie 18 mos)	[s̀iːs̀ç]	'cheese'	(Jacob 20 mos)
[bæˑdː]	'bad'	(Mollie 18 mos)			

Vowel length is not unexpected if the vowel is at the right edge of a syllable, but it would be highly unexpected if the following consonant closed the syllable. This is especially true in examples like [keˑkː] and [ʌmʌːk], as vowels tend to be shorter before tautosyllabic voiceless consonants in English (e.g. Ladefoged 1993:90). Notice that many of the forms in (12) are repeated from (10); it seems that children often display length on both the medial vowel and on the final consonant. As will be seen in §5, this follows from the syllabification that we propose.

The data in (13) exhibit the final pattern to be accounted for: VC sequences may be interrupted by a pause (marked by a period in Scott's data and by a hyphen in Hildegard's and Jacob's data[10]). Post-vocalic pause is expected if the vowel is at the right edge of a syllable, and the final consonant is the onset of the following syllable. This will be discussed further in §5.1.

(13) *Post-vocalic pause:*

[sɚ.s]	'stairs'	(Scott 23 mos)	[be-t^{h}]	'Bates'	(Hildegard 19 mos)
[ɕu.s]	'shoes'	(Scott 23 mos)	[ba-kh]	'box'	(Jacob 19 mos)
[s^{j}u.s]	'juice'	(Scott 23 mos)			

We began §4 by providing data from epenthesis and truncation for target CVC, and we suggested that undominated NoCoda was partly responsible for these patterns. We propose that this represents the first stage in development. At Stage 2, our focus in this paper, CVC target forms are realized as such. However, we have seen that they display a variety of timing and release properties which are not manifested in the target grammar. We have argued that all of these patterns can be accounted for if the final consonant is not syllabified as a coda. As such, these forms constitute further support for the dominant role played by NoCoda in early acquisition.[11] Syllabifying final consonants as onsets (onset–nuclear sequences) enables children

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[10] On Hildegard's 'Bates', Leopold (1939:51) remarks that "...the aspirated [t] [was] added after a short pause...". On Jacob's 'box', Menn (p.c. 17 Oct 1999) states: "The hyphen represents an inaudible stretch before the (rather strong) k release...".

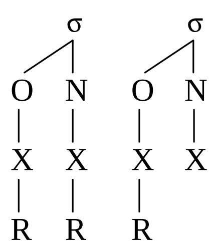
[11] Our focus has been on early obstruent-final CVC forms. One could argue that the timing and release properties observed for such forms are not due to the syllabification of the final consonant as an onset, but are

to avoid the marked representation required for a coda consonant, a branching rhyme, without severely compromising the segmental content of the adult target. This is particularly apparent for a child who at Stage 1 displays truncation, CVC → CV. At Stage 2, target CVC is realized as CV.C and the child can thereby add melodic content to his/her Stage 1 output without adding complexity to the syllable structure representation.

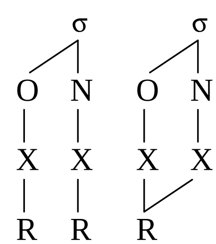
5. Representations

In this section, we detail the representations that we posit for early CVC forms. Since there are no codas (branching rhymes) at this point in development, syllables are limited to (O)N. Consistent with this, there are two options for the syllabification of CVC inputs: one, final consonants are onsets of empty-headed syllables (14a); or two, final consonants are syllabified as onset–nuclear sequences (14b). (In the interest of space, rhyme nodes have been eliminated; R abbreviates Root nodes and all dependent features.)

(14) a.



b.



For input CVC with the output representation in (14a), there is no overt nuclear material following the final consonant. Accordingly, the release properties discussed in §4.2 would be the phonetic manifestation of the right-edge consonant being syllabified as an onset. In (14b), by contrast, the release properties would be present precisely because the melody of the final consonant has spread into the nucleus; in other words, input CVC would be realized as $(C+V)_\sigma(C+Release)_\sigma$. We will see shortly that only the representation in (14b) enables us to unify the phonetic properties of final consonants observed in children's outputs – aspiration, final length, and homorganic nasal release. Before we turn to this, we will demonstrate that the phonetic properties of pre-consonantal vowels – vowel length and post-vocalic pause – both follow straightforwardly from a configuration where the final consonant in a CVC target is syllabified as an onset, rather than as a coda.

5.1 *Vowel length and post-vocalic pause*

Recall from §4.3 that, for some children, the medial vowel in a CVC target may appear with (half) length. Indeed, all of Mollie's CVC outputs during the period under investigation display half length, e.g. [æˑtː] 'hat'. For other children, we had observed that CVC forms may appear with post-vocalic pause as in, for example, Hildegard's [be-t^{h}] 'Bates' and Jacob's [ba-kh] 'box'. We suggest that both of these effects follow from the structures in (14) where the final consonant is syllabified as an onset. Concerning vowel length, the crucial consequence of such a representation is that the initial syllable is open. As vowels tend to be longer in open syllables across languages, length in this position in the children's outputs is entirely as expected.

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instead due to poor motor control. In Goad and Brannen (2000), we argue against this position by extending the analysis to children's early treatment of nasal-final targets.

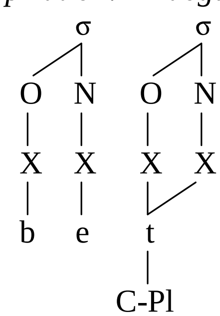
Concerning medial pause, the relevant property of the representations in (14) is that the vowel and final consonant are not internal to the same constituent. If the VC string in a CVC target were syllabified as a rhyme, post-vocalic pause would be highly unexpected as it would interrupt a sub-syllabic constituent. By contrast, under the syllabifications in (14) where the final consonant is an onset, a major constituent boundary coincides with the pause.

As we have seen, vowel length and post-vocalic pause are consistent with both of the structures provided in (14): the final consonant is syllabified as an onset and is thereby in a constituent separate from the preceding vowel. These patterns do not, however, speak to whether the final consonant should be syllabified as the onset of an empty-headed syllable (14a), or as an onset–nuclear sequence (14b). As mentioned above, when the phonetic properties of final consonants are taken into consideration, only (14b) allows for a unified account of the various patterns observed. This will be demonstrated in the following subsections. Finally, as the structure in (14b) has consequences for the representation of right-edge onsets in adult languages, we will turn to this issue in §6.

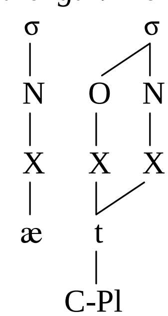
5.2 *Aspiration and final length: voiceless outputs*

The structure in (14b) reflects the fact that what is often described as final aspiration is more accurately called final *release* (cf. note 1). Consistent with this, we provide the representation for final aspiration in (15a). (Segments abbreviate Root nodes; only relevant features are provided throughout.)

(15) a. *Final aspiration: Hildegard's [be-t^h]:*



b. *Consonant length: Mollie's [æ·tː]:*



Recall from the data in (10) that Mollie's voiceless stops are transcribed by Holmes (1927) as long. While geminates are disfavoured at edges cross-linguistically, length as final release is exactly as expected if these 'geminates' are syllabified as onset–nuclear strings, as in (15b): length is audible precisely because the consonant is released as a nucleus. A comparison of (15a) and (15b) reveals that, for voiceless stops, we have provided the same representations for aspiration and final length. We believe that they are transcriptional variants of the same phenomenon. (We have not found any author who transcribes some final voiceless stops with aspiration and others with length.) Both may be described as a homorganic burst of noise.

If the input-final consonant is partly syllabified in the nucleus, one might wonder why the release does not sound vowel-like, in particular, like a voiceless schwa. We contend that this is because final aspiration is not represented in the same manner as is voiceless schwa (cf. e.g. Urbanczyk (1996); see also Dyck (1990)). To elaborate on this, we must return to (2c) where we proposed that vowels contain SV and V-Place. Given that SV refers to *spontaneous* voicing, we propose that voiceless vowels lack SV; however, they retain the V-Place specification of the corresponding voiced vowel. Voiceless schwa, being placeless, is represented as a bare V-Place node. The structure in (15a) reveals that final aspirated stops, in contrast to voiceless vowels, do not have a V-Place node; thus, although they are syllabified in the nucleus, they are still contoids.

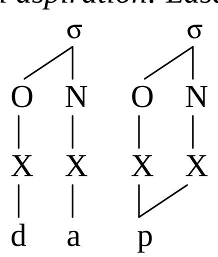
Our representation of the final aspirated stop as a ‘geminate’ ON sequence means that the final release should sometimes be audible as length on the consonant, as in Mollie’s stops and Jacob’s fricatives in (10), or as a fricative homorganic with the preceding stop, as in some of Hildegard’s forms: “...the aspiration [in ‘meat’ at 22 mos] sometimes even took the form of a homorganic fricative, [ç]” (Leopold 1939:108). Similar observations have been made for adult languages. Regarding right-edge aspirated (‘syllabic’) stops in Bella Coola, Hoard (1978:72) states: “The release or ‘burst’ that accompanies a syllabic stop...does not resemble very closely a voiceless vowel.... One does of course hear the frequencies characteristic of each of the consonantal bursts, but these are not the frequencies associated with the vowel formants of voiceless vowels.” Our geminate-like structure for right-edge aspirated stops is very similar to that proposed by Hoard (1978).[12]

In the absence of spectrographic analysis to substantiate our claims about the representation of children’s final aspirated consonants, we must rely on other evidence. The epenthesis patterns seen in (8a) offer some support for our view: vowels inserted to satisfy NOCODA are always voiced, even when the epenthesized vowel is schwa (Hildegard at 26 mos: [dɛtə] ‘get’, [dotə] ‘don’t’). If final aspiration is interpreted as schwa-insertion, one must wonder why schwa is sometimes voiceless (i.e., aspiration) and at other times voiced. The quality of adjacent segments cannot be responsible for this, as the following forms produced by Hildegard at 26 months reveal: [ʔɛt^{h}maɪhu] ‘in my room’ versus [gɔtəmaɪʒu] ‘got my shoe’. We thus reiterate our position: aspiration is not represented in the same fashion as voiceless schwa.

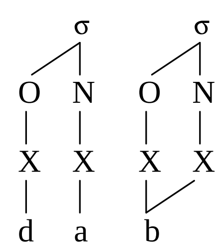
5.3 *SV voicing versus laryngeal voicing*

We turn now to consider Lasan’s grammar in some detail. Lasan is one of the children who always produces final aspiration for input voiceless stops. On the face of it, voiced stops show a different pattern. Recall that they are produced with nasal release. Lasan’s outputs for ‘drop’ [dap^{h}] and ‘stub’ [dabm̩] from (9) and (11) are repeated in (16), along with the representations that we propose.

(16) a. *Final aspiration: Lasan’s [dap^{h}]:*



b. *Nasal release: Lasan’s [dabm̩]:*



(16b) reveals that we do not consider Lasan’s nasally-released outputs to be anomalous; they are represented in the same fashion as are final aspirates and long consonants. Two facts mentioned earlier suggest a structure along these lines: 1. the nasal release is syllabic and so must occupy

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[12] Some support for our representation comes from Cayuga. Dyck (1990) mentions that in this language, there are two epenthetic elements, aspiration and [e], which are allophones of each other. Aspiration appears in three contexts: t_k, k_t, t_n; while [e] only occurs in one: k_k. Under our analysis, aspiration would arise from ‘spreading’ the features of the left-most consonant into the intervening nucleus. It would be blocked in favour of [e] in the environment k_k as a violation of the OCP would otherwise result.

the nucleus; 2. the nasal is always homorganic with the preceding stop, indicating that the string minimally shares place features. To answer the question as to why these forms surface with a *nasal* release, however, we must look at other properties of Lasan's grammar.

Voicing contrasts for Lasan's obstruents are neutralized word-initially: [bɪgn̩] 'pig' *and* 'big'. Stops display a lot of variation in this position, in contrast to what is observed finally. The variation reveals both voiced obstruent- and sonorant-like outputs: [^{n}du ~ ɗu ~ du ~ d̥u] 'two', [bədn̩ ~ mədn̩ ~ βədn̩] 'bird' (Fey and Gandour 1982:73). Recall that similar alternations among sonorants and voiced obstruents are typical of SV languages (cf. §2.2). Laryngeal is not projected in these languages, and voicing contrasts are captured through SV. We propose that the patterns of variation exhibited by Lasan's initial stops, as well as the realization of his final voiced stops as CN̩ sequences, reveal that his grammar also expresses voicing contrasts with SV. Instead of Laryngeal voicing which is used by the target English grammar, Lasan makes a contrast between (voiced) sonorant obstruents which bear an SV node, and (voiceless) 'obstruents' which are not specified either for Laryngeal or for SV. See (17).[13,14]

(17) a. *Lasan's grammar: SV language:*

```
/p/  R        /b/  R
                   |
                   SV
```

b. *Target English: Laryngeal language:*

```
/p/  R        /b/  R
     |             |
     Lar           Lar
                   |
                   Vce
```

One might question why Lasan would analyse English as an SV language. Two facts suggest that SV has a privileged status across languages. One, all languages contrast sonorants and obstruents, but not all have laryngeal contrasts; in the latter case, languages may capture voicing through SV, or voicing may be entirely predictable with no sonority node required on consonants (cf. §2.2). Two, the sonorant–obstruent contrast is acquired before laryngeal contrasts are acquired (e.g. Jakobson 1941/68; Shvachkin 1948/73; Smith 1973). On the basis of these observations, we hypothesize that SV is available to the learner before Laryngeal is available. Initially, SV is required to capture the contrast between sonorants (which bear this node) and obstruents (which bear no sonority node). As the child's set of contrasts increases, Laryngeal will be projected if required by the target language, but if the need for Laryngeal has not yet been detected, voicing contrasts can be captured through SV. This reflects Lasan's grammar.[15]

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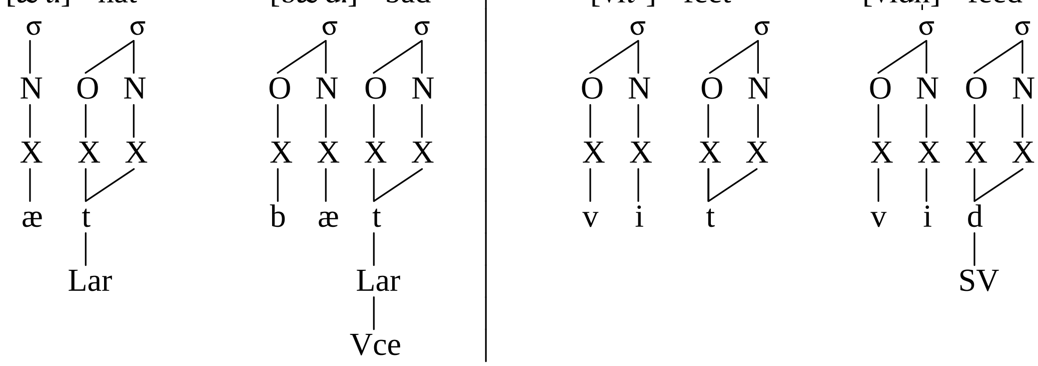
13 Avery (1996) analyses English as a 'Contextual Voice' (CV) language, rather than as a 'Laryngeal Voice' (LV) language as we have in (17b). The difference lies in how voiced obstruents are specified. According to Avery, in a CV language, voiced obstruents bear no Laryngeal node at all; they are thus more appropriately labelled as voiceless unaspirated. The facts discussed in this paper do not crucially rely on English being an LV language. What is crucial is that it is not an SV language.

14 (17a) correctly predicts that we consider Lasan's inputs to contrast for SV in both initial and final position. However, initial voiceless targets show the same range of SV-like outputs as do sonorant obstruents, e.g. [^{n}du] 'two'. We propose that this is because voiceless stops share SV with the following vowel in the output. This could be due to SONNODE, a constraint which requires every segment to be specified for a 'sonority node', SV or Laryngeal (Kawasaki 1998:73). SONNODE is not satisfied when the voiceless stop is in final position, 'eat' → [i.t^{h}], *[i.dn̩], as sharing of features across a heterosyllabic VC sequence is highly marked cross-linguistically.

15 If SV is genuinely available before Laryngeal, one might wonder why there are not more children like Lasan. We suspect that this is because the bulk of acquisition research has been conducted on English, and VOT values for stops in initial stressed syllables – data which the learner has ready access to – strongly indicate that English is not an SV language. This is in contrast to a language like French where voicing lead on /b, d, g/ may be interpreted by the child as evidence for SV. In view of this, we suggest that the solution to whether the patterns that

Lasan can be compared with other children in this study who express voicing contrasts with Laryngeal. Mollie, for instance, has a voicing contrast initially (e.g. [tʌˑkː] ‘Tuck’ vs. [dʌˑkː] ‘duck’) as well as finally (e.g. [æˑtː] ‘hat’ vs. [bæˑdː] ‘bad’), and no sonorant-like outputs are observed in either position. Final stops surface as long, consistent with their being syllabified as ON sequences in her grammar, as they are in Lasan’s grammar. The different ways that final stops are realized in these two types of systems is illustrated in (18) (relevant structure only). For voiceless stops, length/aspiration will occur in both types of grammars because of the ON syllabification of final consonants. This will be true whether these consonants are specified for Laryngeal (18a), or unspecified for a sonority node (18b). A difference in surface forms is evidenced for input voiced stops only. In a Laryngeal language, these will be realized as long whereas in an SV language, they will optimally surface with a nasal release. While in the latter case, they could also surface as long, [vidː], we propose that the favoured interpretation of an SV consonant in the *nucleus* is a nasal, not a stop (cf. (2c)). One might question further why we do not find a vowel in place of the nasal; we address this issue next.

(18) a. *Laryngeal language (Mollie):* [æˑtː] ‘hat’ [bæˑdː] ‘bad’ | b. *SV language (Lasan):* [vitʰ] ‘feet’ [vidn̩] ‘feed’



5.4 *Variable interpretation of SV*

We have argued that homorganic CN̩ clusters arise from final voiced stops which are syllabified as onset–nuclear sequences in an SV language. Given that SV is a feature that both consonants and vowels can bear, one might ask why the presence of SV in nuclear position does not yield a vowel in the case of (18b). We do assume that an SV node without dependents is interpreted as a vowel in nuclear position (cf. (2c)), as will be seen shortly when we discuss final epenthesis. Accordingly, if both CN̩ clusters and vowel epenthesis arise as a consequence of a ban on codas (cf. §4), we must ensure that the variable interpretation of nuclear SV can be predicted from some property of the representation.

Recall from §5.3 that Lasan’s CN̩ clusters are always homorganic: [dabm̩], *[dabn̩]. Further, the data in (11) reveal that he has acquired a range of C-Place contrasts: [dabm̩], [vidn̩], [bəgŋ̍]. We can thus conclude that Lasan’s CN̩ clusters share C-Place and dependent features. The structure in (19a) demonstrates that it is the combination of SV and C-Place (without V-Place) that yields the interpretation of the final nucleus as a nasal (cf. Rice 1992).

Turning to the case of epenthesis in (19b), where ‘bib’ → [bɪbi], one can see that, in contrast to (19a), C-Place is not shared between the epenthesized vowel and the preceding consonant (inserted material is boxed). Consequently, nuclear SV is interpreted as a vowel (cf. (2c)). We propose that vowel epenthesis is primarily driven by two constraints, Nuc ⊃ SV and Nuc ⊃ V-

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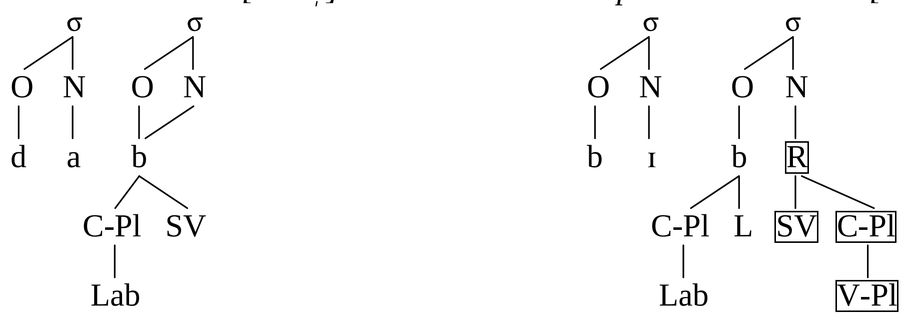
Lasan exhibits are more widespread than presently documented lies in cross-linguistic acquisition studies.

PLACE, which together reflect the fact that nuclei are in the unmarked case voiced vowels. In Mollie's grammar, where the epenthetic vowel is realized as [i], other features (not shown in (19b)) must be inserted in order for the vowel to receive its interpretation. We suggest, however, that Mollie's cases of epenthesis are remnants from an earlier stage in development. Her current grammar, like that of Lasan, shows a preference for ON feature sharing. This enables her to produce outputs that are more faithful to the input segmental content while at the same time abiding by NOCODA.

(19) a. *Nasal release: Lasan's [dabm̩]:* b. *Vowel epenthesis: Mollie's [bɪbi]:*



6. Representation of right-edge onsets in adult languages

Before concluding, we will briefly address the status of final consonants in adult languages such as Diola-Fogny and Yapese. An issue that arises is whether our analysis of right-edge onsets in child language as onset–nuclear sequences forces us to make the same claim about the syllabification of right-edge onsets in adult languages. The alternative is that in (some) adult languages, right-edge onsets are syllabified as onsets of empty-headed syllables, as proposed in much of the literature (references in §1). At this early point in our investigation, we see no reason not to allow for both options. We do, however, address two aspects of this issue here. What kind of constraint would favour the onset–nuclear syllabification in child language? What type of evidence could we use to determine which option a particular adult language employs?

With regard to the first question, we suggest that there is a constraint which disfavours empty nuclei and that this constraint is initially undominated. Together with NOCODA, this will ensure onset–nuclear syllabification for CVC strings for children whose grammars are faithful to the segmental content of the input. For grammars that do not tolerate the latter, the result will be epenthesis (8a) or truncation (8b).

With regard to the second question, it may be the case that the presence of an onset-like release such as aspiration indicates that the final consonant has 'spread' into the nucleus (cf. Hoard 1978). Thus, in Yapese, final consonants would be syllabified as onset–nuclear sequences, while in Diola-Fogny, they would be onsets of empty-headed syllables. At first glance, an additional fact about Yapese, discussed at length in Piggott (1999), would appear to suggest that this analysis is not correct: words in this language must end in consonants; final vowels are subject to apocope. If final consonants are syllabified as ON sequences in Yapese, we must explain why vowels at the right edge appear to delete. We contend that while the melodic content of these final nuclei deletes, the nuclear position and X slot remain. Melody deletion is motivated by cues to word edge. Specifically, recall from §2.1 that we had mentioned that in Goad and Brannen (2000), we argue that the best way to signal the right edge of a word is to end the word in an onset (or onset–nuclear sequence). Since Yapese only has open syllables word-internally, the constraint that words must end in a consonant is a particularly good cue to the right edge of this domain.

7. Conclusion

In conclusion, we have proposed that children's first word-final consonants are syllabified as onset–nuclear sequences, not as codas as is standardly assumed. First, we argued that distributional evidence supports the view that NOCODA is still operative when CVC forms emerge: word-final consonants appear in development when word-internal codas are absent; drawing on parallels with adult languages, we demonstrated that the final consonant in a CVC# string would thus have to be an onset.

Second, we demonstrated that children's first CVC forms display release and timing properties – aspiration and/or length on the final consonant, homorganic nasal release, vowel length, and post-vocalic pause – which do not support the traditional claim that final consonants are syllabified as codas. Instead, we proposed that they motivate an analysis where a right-edge consonant is syllabified as the onset of an independent syllable. We argued further that aspiration/length on the final consonant and homorganic nasal release support a representation where this onset additionally shares its features with the following nucleus. We demonstrated that the advantage for the developing grammar is that syllabifying final consonants as onset–nuclear sequences allows children to avoid building the marked representation required for a coda, while at the same time permitting them to be more faithful to the segmental content of adult CVC inputs.

Finally, we demonstrated that in some adult languages where right-edge consonants are syllabified as onsets, relevant phonetic properties may be systematically present on these segments as well, for example, aspiration in Yapese. We speculated that in such languages, final onsets may be syllabified as onset–nuclear sequences, as in early child language, and thereby suggested that there may be two options for the syllabification of right-edge onsets in adult languages: onset–nuclear sequences and onsets of empty-headed syllables.

We have focussed on an early stage in production when CVC forms are first emerging. We have seen that a diverse range of consonants which are accompanied by onset-like releases are observed in final position at this stage. A logical next step in the investigation would be to look at subsequent stages in development when children begin to syllabify singleton final consonants (after short vowels) as codas in English-type languages. In these later stages, we would expect final consonants to observe restrictions characteristic of codas, and thus, to display accompanying effects such as debuccalization. Some preliminary evidence that this expectation is met can be found in Goad and Brannen (1998).

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