From Signal to Grammar: Rhythm and the Acquisition of Syllable Structure

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1. Background: Rhythm and language acquisition

Rhythm distinctions among languages have been proposed to result from the manifestation of constellations of phonological and phonetic properties in particular linguistic systems (Dasher and Bolinger 1982, Dauer 1983, 1987, Nespor 1990, Auer 1991), as in (1).

(1)

	Stress-timed	*Syllable-timed*
syllable structure	many syllable types	limited number of types
	more complexity	simple structure
	many intervocalic clusters	CV dominant
vowel reduction	Yes	No

The coexistence of a set of these properties in a given language may promote the perception of stressed syllables in relation to other syllables - yielding stress-timing -, or make all syllables equally salient - yielding syllable-timing.

Recently, the properties behind the rhythmic distinctions were shown to be encoded in the speech signal. A set of simple acoustic-phonetic measurements of the duration of consonantal and vocalic intervals in a sentence is able to capture the rhythmic distinctions traditionally claimed in the literature (Ramus, Nespor and Mehler 1999). These measures are the proportion of vocalic intervals (%V), and the variability of vocalic and consonantal intervals expressed by means of a standard deviation measure (respectively, ΔV and ΔC). %V and ΔC and correlate well with the standard rhythm classes, as shown in (2).

(2)

	High	Low	
ΔC	Dutch, English	*Spanish, Italian*	*Syllable-timed*
%V	*Spanish, Italian*	Dutch, English	Stress-timed

These measures also reflect the phonological properties that have been proposed to influence the perception of rhythm, namely syllable structure and vowel

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reduction (Ramus et al. 1999, Frota and Vigário 2001, Gut and Milde 2002). ΔC increases, whereas %V decreases, with syllable structure variety and complexity. The presence of vowel reduction is reflected by a high ΔC and/or a high ΔV. To sum up, there are phonological properties behind rhythmic distinctions and there are cues in the speech signal for these distinctions.

It is known that rhythm plays an important role in language acquisition (Morgan 1986, 1996, Eimas 1996, Nespor et al. 1996, Jusczyk 1997, among others). Early sensitivity to prosodic information is well established and infants (like adults) have been shown to discriminate between languages belonging to different rhythm classes but not otherwise. A summary of the results of rhythm based language discrimination experiments resorting to low-pass filtered or resynthesized stimuli is given in (3) below (*Mehler et al. 1988, 1996, *Nazzi et al. 1998, **Ramus and Mehler 1999, **Ramus et al. 2000, *Ramus 2002).

(3)			*Infants**	*Adults***
	Stress vs. *Syllable*-timed	√	Eng/It; Eng/Spa; Rus/Fre Eng+Du/Spa+It	Eng/Spa
	Stress vs. *Mora*-timed	√	Eng/Jap; Du/Jap	Eng/Jap
	Within classes	X	Eng/Du; Spa/Cat Eng+It/Du+Spa	Spa/Cat

How may rhythm help in the acquisition of syllable structure? It has been suggested by a number of researchers, following a proposal in Ramus et al. (1999), that the early sensitivity to rhythmic cues in the signal may help the language learner to specify the rhythm type of the native language and this in turn will act as a cue to develop the correct syllabic grammar (Ramus et al. 1999, Frota and Vigário 2001, Ramus 2002).

2. European Portuguese: An acquisition problem

Until recently, the literature on the rhythm of Portuguese classified European Portuguese (EP) as *stress-timed*, on the basis of impressionistic comments (Mateus et al. 1989, Brandão de Carvalho 1989). The presence of vowel reduction (centralization and deletion of reduced vowels) has also supported the stress-timed classification (Parkinson 1988). Frota and Vigário (2001) present a new account of EP rhythm following Ramus et al.'s approach. They show that the rhythmic cues in the EP signal point **both** to *syllable-timing* (%V) and *stress-timing* properties (ΔC, ΔV). When EP is added to the rhythmic chart of Ramus and colleagues, it joins syllable-timed languages in the %V axis, and stress-timed languages in the ΔC axis (Fig. 1). The compared results for EP and Dutch are the following: %V 48.0 / 42.3; ΔC 54.6 / 53.3; ΔV 40.2 / 42.3.

We have claimed that the acoustic variables reflect phonological properties. In the EP case, %V is clearly correlated with syllable structure properties. It can be easily demonstrated that EP has a romance-like syllable structure with a small number of most common syllable types and a clear dominance of CV, few closed syllables and few clusters (Table 1).

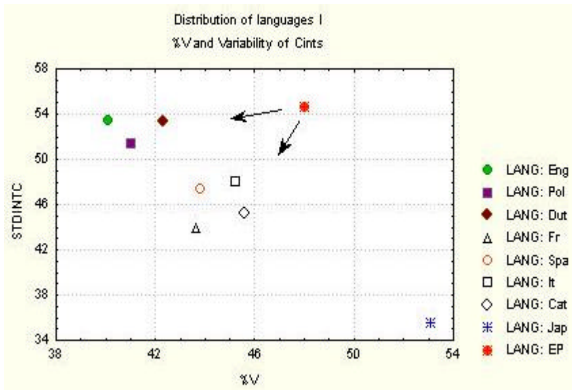


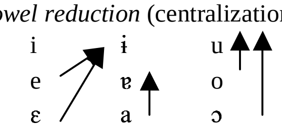
Figure 1. Distribution of languages over the %V, ΔC plane. Values for the 8 other languages from Ramus et al. (1999). Adapted from Frota and Vigário (2001), Fig.8.

Table 1. Some properties of 'complex' and 'simple' syllabic systems. [1] Data for all languages except EP from Nespor (1990); [2]data for English, Spanish and French from Dauer (1983), Dutch based on Schiller et al. (1996), EP based on Andrade and Viana (1994).

Syllable types	English	Dutch	Spanish	French	**EP**
Number[1]	16	19	9	-	6
Most frequent[2] (%)	CV 34 CVC 30 VC 15 V 8 CVCC 6	CV 36 CVC 32 VC 15 CVCC 6 V 2	CV 58 CVC 22 CCV 6 V 6	CV 56 CVC 19 V 10 CCV 7	CV 65 CVC 16 V 11 CCV 5 VC 3
Closed syllables[2] (%)	56	59	30	26	19
CC(C)[2] (%)	---	14	---	---	6

On the other hand, ΔC (and ΔV) is correlated with the presence of vowel reduction in the language, usually a trait of stress-timed systems. The 7 vowel stressed system is reduced to 4 vowels in unstressed position, as shown in (4). Optional reduced vowel deletion of [ɨ, u] may only leave [i, ɐ] in the string. Notice that optional deletion of reduced Vs yields phonetic sequences of Cs leading to a *mismatch* between the phonological representation and the phonetic string (where the phonological V target may be undershoot - Blevins 1995).

(4) *Vowel reduction* (centralization and V deletion)



- Stressed system: i, e, ɛ, a, ɔ, o, u
- Reduced system: i, ɨ, ɐ, u
  After optional reduced V deletion: i, ɐ

Examples of reduced V deletion are given in (5).

(5) [pɾufɨsóɾ]	[pɾfsóɾ]	professor	‘teacher’	(from Vigário 2003)
[ɨʃpɐ́ʎu]	[ʃpɐ́ʎ]	espelho	‘mirror’	
[ɨʃpɐ́ʎɨ]	[ʃpɐ́ʎ]	espelhe	‘(to) mirror (SUBJ)’	

(from Mateus and D. Martins 1982)

How may rhythm help in the acquisition of EP syllable structure? %V indicates syllable-timed rhythm and thus suggests a simple syllable structure, whereas ΔC (and ΔV) points to stress-timing and thus to a complex syllable structure. With such conflicting rhythmic cues in the signal, how can the rhythmic type of the language be specified and thus provide some help with syllable structure? We are facing an acquisition problem, as it would be helpful if the EP learner could know, on the basis of the cues present in the signal, whether EP is stress-timed like Dutch or syllable-timed like other Romance languages. If one considers the segmental string per se, EP and Dutch may show very similar segmental sequences (see the examples in 6). However, other phonological properties, such as the absence of quantity contrasts or the presence of resyllabification across words (see the list of properties in 7) group EP with syllable-timed languages.

(6)	*EP*	*Dutch*
Phonetic	[koɾtʃ] cortes ‘courts’	[korts] koorts ‘fever’
string	[oɾdnaɾ] ordenar ‘(to) sort’	[ɔrdnər] ordner ‘file’
	[ɐvʃtɾuʃ] avestruz ‘ostrich’	[ɑfsprak] afspraak ‘appointment’

Dutch data from Booij (1995) and P. Fikkert (p.c.)

(7) Other phonological properties (Dauer 1983, Nespor 1990, Auer 1991)
Properties shown by EP in boldface

Syllable-timed languages	**no quantity contrasts; widespread deletion of one of two adjacent Vs; resyllabification across words;** cluster simplification; epenthesis
Stress-timed languages	quantity contrasts; quantitative sensitive stress; interaction between stress and Cs’ articulation; strengthening of word initial and final Cs; no phrasal resyllabification

Except for vowel reduction, EP behaves like *syllable-timed* languages. This points to %V as the crucial cue to rhythm type, and thus to syllable structure.

3. Perception of EP rhythm

We have seen that adults and infants are able to discriminate between languages belonging to different rhythm classes. The results available so far indicate that perceptually languages cluster into the traditional rhythm classes (see 3 above).

What properties in the speech signal can predict rhythm perception? Two models have been suggested in the literature: one based on %V as the predictor variable (Ramus et al. 1999), and the other based on **ΔC** as the crucial variable (Mehler and Nespor 2002). As %V and ΔC are strongly correlated in the 8 languages studied in Ramus et al. (1999), they converge on the same rhythm classification for these languages. However, the EP case is different: each of the variables points to a different rhythm type. Thus, the *perceptual weighting* of the variables becomes crucial. ΔC groups EP with stress-timed languages, like Dutch, whereas %V groups EP with syllable-timed languages, unlike Dutch (and like Spanish). If ΔC is perceptually more salient, *EP should cluster with Dutch.* If %V is perceptually more salient, then *EP should be discriminated from Dutch.*

Perceptual evidence for EP rhythm was gathered in Frota, Vigário and Martins (2002).[1] Table 2 summarizes the results of two language discrimination experiments involving Dutch and EP.[2]

Table 2. Language discrimination results

	DU/EP[a]	DU/EP[b]
Percent scores	64.29	59.26
U and Z values	10.5;2.28	U=162; Z=3.91
p-level	.022	.00009
d'-score	2.15	2.36
A' scores	0.72	0.75

1. Stimuli were low-pass filtered at 400Hz. Sample stimuli can be found at <http://www.fl.ul.pt/pessoais/sfrota/soundfiles.htm>. The Dutch and Spanish sentences used in the experiments were taken from Ramus et al. (1999) corpus, by courtesy of F. Ramus.

2. The (a) results are from a language categorization experiment involving 4 languages: Dutch (stress-timed) and Spanish (syllable-timed) as reference languages, EP and BP (data from 7 subjects). The (b) results are from a Dutch/EP discrimination experiment (data from 27 subjects). In both cases an AX discrimination task is involved. Percent scores are the total hit rate of all the different answers for the different language pairs. Significance of the % scores relative to chance level is given according to the Mann Whitney U test. d'-scores were calculated as follows: hit rate (different responses to the different pairs); false alarms (different responses to the same pairs). A' scores are according to Ramus and Mehler (1999).

These results indicate that EP is discriminated from Dutch. The scores obtained are within the range of those reported and/or predicted for discrimination between rhythm classes (Ramus et al. 1999, Ramus and Mehler 1999). Using the d'scores as a measure of perceptual distance between languages (Johnson, in press), the distance between Dutch and EP is similar to that between Dutch and Spanish (DU/SP: d'= 2.59, from Frota et al. 2002).

In conclusion, there is evidence for the perceptual salience of %V relative to ΔC. This supports models of rhythm perception that use %V as the predictor variable. Recall that %V specifies the rhythm of EP as syllable-timed and is correlated with a simple syllable structure (see section 2). As the evidence accumulated so far suggests that infants are sensitive to the same cues as adult listeners (Ramus et al. 1999, Ramus and Mehler 1999, Ramus 2002), it makes sense to believe that %V can be used by infants in rhythmic discrimination of EP.

4. Rhythm and syllable structure acquisition: A proposal

Based on the acoustic-phonetic measurements (section 2) and the perception results (section 3), the following proposal can be made: **%V is the relevant parameter in the speech signal that triggers rhythm identification, which in turn cues basic syllable structure properties**, as in (8) below.

(8)	*Signal*	*Rhythm*	*Properties of syllable structure*
	> %V	Syllable-timed	'simple'
	< %V	Stress-timed	'complex'

This early information on syllable structure helps the learner in the processing of the signal and may condition his/her early production strategies (under the view that speech production is largely driven by perceptual representations - see Eimas 1996, for a review). For EP, this means that a high %V will trigger a syllable-timed classification which cues syllable structure as 'simple', that is CV dominant, including a limited number of frequent syllable types and composed of few closed syllables and C-clusters. This general basic information on syllable structure will help in the processing of the EP signal and thus strings like [oɾdnaɾ] 'to sort' (see 6 above) will be mapped into simple structures and not into the stress-timed complex syllable structure types. In other words, the *EP acquisition problem* is solved: the basic information on syllable structure properties provided by a high %V plays an important role in the development of a **Romance-like syllabic grammar** (the adult grammar – see Table 1 above).

What about the *mismatch* between the syllabic grammar and the phonetic string (due to deletion of reduced vowels)? The same basic syllable structure properties triggered by %V will condition the strategies developed to deal with the mismatch. Therefore, the proposal we put forward in this paper makes the following two predictions: (a) EP learners will show production strategies different from Dutch learners (due to differences in the input, i.e. %V, and thus in the syllabic grammar); (b) EP learners will show strategies dominated by the *presence of vowels* (as a way to reconcile the mismatch between the syllabic grammar and the segmental sequences in the phonetic input string). In the remainder of the paper it will be shown that both predictions are borne out by early production data from EP and Dutch.

5. Independent support from early production data from EP and Dutch: Dominance of V in the acquisition of EP

Quite a number of empirical arguments (a) show that Dutch and EP children resort to different production strategies and (b) support the dominance of V in the acquisition of EP. First, Portuguese children (see 9), unlike Dutch ones (see 10, from Fikkert 1994), are faithful to target V syllables in early production.

(9)	a.	pato	/'patu/	→	['tɐ]	(João: 0;11.6)	‘duck’
		dá	/'da/	→	['da]	(Inês: 0;11.14)	‘give’
		quer	/'kɛɾ/	→	['ke]	(Marta: 1;2.0)	‘wants’
	b.	água	/'agwɐ/	→	['aβɐ]	(João: 0;11.6)	‘water’
		é	/'ɛ/	→	['ɛ]	(Inês: 1;0.25)	‘is’
		água	/'aɣwɐ/	→	['awɐ]	(Marta: 1;2.0)	‘water’
(10)	a.	daar	/da:r/	→	[dɑ]	(Jarmo: 1;4.18)	‘there’
		poes	/pu:s/	→	[pu:]	(Jarmo: 1;5.2)	‘she-cat’
		tok	/tɔk/	→	[kɔ]	(Jarmo: 1;5.27)	*onomatopoeia*
	b.	auto	/'o:to:/	→	['to:to:]	(Tom: 1;2.27)	‘car’
		aap	/a:p/	→	[ba:p]	(Tom: 1;3.24)	‘monkey’
		auto	/'o:to:/	→	['to:t]	(Jarmo: 1;6.27)	‘car’

Considering that CV is the unmarked syllable structure and that the setting of the non-branching Onsets parameter predicts obligatory C-type Onsets in first productions (Fikkert 1994), one would expect children acquiring different target systems to behave similarly in production, i.e., all children should start exclusively with CV-type syllables. However, this is not the case. We observe that Dutch children produce both CV and V targets as CV (ØV→CV), whereas Portuguese ones faithfully produce CV targets as CV and V targets as V:

(11)	*Dutch*	daar /da:r/	•	[dɑ]	(Jarmo: 1;4.18)	‘there’
	(Fikkert 1994)	aap /a:p/	→	[ba:p]	(Tom: 1;3.24)	‘monkey’
	EP	pé /'pɛ/	•	['pe]	(Marta: 1;2.0)	‘foot’
	(Freitas 1997)	olha /'ɔʎɐ/	→	['ɔj]	(Marta: 1;2.0)	‘look’

In fact, the emergence of syllable types in Dutch and in EP is as shown in (12).

(12)	*EP*	CV/V > CVC > CCV	(Freitas 1997)
	Dutch	CV > CVC > V > CCV/CVCC	(Levelt and van de Vijver 1998)

Since both systems have the two syllable Onset structures (CV and V) and onsetless syllables have similar frequencies in the input (Dutch: 17%; EP: 14% - see Table 1 above), why then do Dutch and Portuguese children exhibit different behavior? We propose that Dutch and Portuguese children are picking up from the signal different rhythmic properties of their respective target systems, which are cued by %V. In our view, these properties constrain the development of grammar and legitimate the use of different repair strategies in the path of acquisition. Further arguments in this direction are given below.

It is known that children use unmarked patterns when faced with problematic target structures (Segui, Dupoux and Mehler 1990, among others). The fact that Portuguese children use empty Onsets (therefore, V(C) patterns) as a repair strategy to deal with problematic Onset fricatives, Onset liquids and branching Onsets seems to indicate that syllables starting with V are not marked in this system. Such a repair strategy, by contrast, is not attested for the acquisition of Dutch (Fikkert 1994):

(13) *Problematic Onset fricatives in EP* ($C_{fric}V \rightarrow ØV$)

vês	/'veʃ/	→	['eʃ]	(Marta: 1;3.8)	'see'
zebra	/'zebrɐ/	→	['ɛbɐ]	(Luís: 1;9.29)	'zebra'
sapo	/'sapu/	→	['apu]	(João: 2;2.28)	'frog'

(14) *Problematic Onset liquids in Portuguese* ($C_{liq}V \rightarrow ØV$)

lobo	/'lobu/	→	['opu]	(João: 2;8.27)	'wolf'
polícia	/pu'lisjɐ/	→	[pu'isɐ]	(João: 2;8.27)	'police'
mulher	/mu'λɛɾ/	→	[mu'ɛ]	(Raquel: 2;10.8)	'woman'

(15) *Branching Onsets in Portuguese* ($C_1C_2V \rightarrow ØV$)

flor	/'flor/	→	['olɨ]	(Inês: 1;9.19)	'flower'
bicicleta	/bisi'klɛtɐ/	→	[pisi'ɛtɐ]	(Luís : 2;0.27)	'bycicle'
fotografia	/futugɾɐ'fiɐ/	→	[ftuɐ'fiɐ]	(Raquel: 2;10.08)	'picture'

Notice that the use of empty Onsets as a default strategy to deal with problematic target Onsets often generates hiatus, which are rather infrequent in the EP target system.

Third, vowel epenthesis in target branching Onsets is a frequent strategy in the acquisition of EP. It is not attested, or is neglectable, in the acquisition of other languages, including Dutch (Fikkert 1994, Lleó and Prinz 1996, Barlow 1997, Bernhardt and Stemberger 1998, Rose 2000, Goad and Rose in press, Demuth p.c.). This repair strategy is used in 16% of the productions of target words with Onset clusters uttered by the Portuguese children observed, rising up to 32% in Luís and to 29% in Laura, the children already exhibiting strategies other than cluster reduction to its right-edge member:

(16)	pedra	/'pɛdɾɐ/	→	[' pɛdɨɾɐ]	(Luís: 2;5.7)	'stone'
	livro	/'livɾu/	→	['livɨɾu]	(Laura: 2;8.23)	'book'
	cobra	/'kɔbɾɐ/	→	['kɔbɨɾɐ]	(Pedro: 3;5.18)	'snake'

Fourth, given the productivity of reduced vowel deletion in EP, it might be expected that Portuguese children acquire this phonological process quite early. However, this is not the case. Productions with [ɨ] (see 17a) clearly precede productions with deletion of [ɨ] (see 17b).

(17)a.	menino	/m(ɨ)'ninu/ → [mɨ'ninu]		(Laura: 2;2.30)	'boy'
	creme	/'kɾɛm(ɨ)/	→ ['kɾɛmɨ]	(Laura: 2;3.20)	'cream'
b.	flores	/' flɾ(ɨ)ʃ/	→ ['floɾʃ]	(Laura: 3;0.5)	'flowers'
	meninos	/m(ɨ)' ninʃ/	→ [m'ninʃ]	(Laura: 3;2.4)	'boys'

Table 3. [ɨ] as output of unstressed /e, ɛ/ neutralization (Freitas 2002).

	nº of target σ	[ɨ]	[i]	other vowels	[ɨ] → Ø	σ → Ø
João	*212*	**18.4**	29.3	7	Ø	45.3
Inês	*104*	**11.5**	23.1	11.5	6.7	47.2
Marta	*277*	**35.4**	12.6	11.3	13	27.7
Luís	*270*	**35.6**	5.2	7	25.9	26.3
Raquel	*131*	**33.5**	12.1	8.3	26.6	19.5
Laura	*347*	**47.3**	3.2	2.7	43.3	3.5
Pedro	*302*	**44.4**	6.3	5	27.5	16.8

The results in Table 3 show that the percentage of [ɨ] deletion is below 45% in all the children observed, and deletion is rare in the youngest (João, Inês and Marta). For all children, producing this vowel or replacing it with another vowel is always more frequent than deleting it.

Fifth, rhymes in Dutch are more complex than in EP: (i) lengthening contrasts in the Nucleus domain are present in Dutch and absent in EP; (ii) CC in syllable-final position is allowed in Dutch but not in EP; (iii) the segmental inventory under the Rhyme domain is larger in Dutch than in EP. Strikingly, Portuguese children acquire the Rhyme structure much later than Dutch children (Fikkert and Freitas 1998):

(18) *Acquisition of syllable-final liquids*

Dutch	bal	/bɑl/	→	[bɑl]	(Jarmo: 1;11.20)	‘ball’
	bril	/brɪl/	→	[pʊɪl]	(Jarmo: 2;3.9)	‘glasses’
EP	verde	/'verdɨ/	→	['veid]	(Pedro: 3;7.24)	‘green’
	alto	/'aɫtu/	→	['awtu]	(Pedro: 3;7.24)	‘tall’

Fikkert and Freitas (1998) argued that this difference in development is due to the fact that evidence for both branching Rhymes and branching Nuclei in Dutch is phonologically far more salient than in EP, leading Dutch children to (re)structure their representation of the input form early on. We now add that the dominance of %V in the signal leads EP children to focus on vowels in order to build their lexical representations and to develop their grammar. They are busy dealing with the mismatch between the basic syllabic properties acquired and the segmental sequences found in the string. In other words, they are busy with vowels, the consonantal structure being consequently left to later stages.

Our sixth argument concerns the emergence of s+C clusters. Portuguese and Dutch children exhibit different strategies when faced with these clusters (Fikkert 1994, Freitas 1997, Fikkert and Freitas 1999): Dutch children treat the left-edge member of the cluster as an appendix; Portuguese children treat it as a Coda fricative and therefore assume a Nucleus in word-initial position (see the productions of word-initial V at stage 2 in EP):

(19) *Stage 1*	EP	/ʃk/ova	→	['tukɐ]	(Inês: 1;8.2)	‘brush’
	Dutch	/st/oel	→	[ty]	(Jarmo: 1;9.23)	‘chair’
Stage 2	EP	/ʃt/ou	→	[ɨ'to]	(Laura: 2;2.30)	‘to be’
		/ʃt/á	→	[ɨʃ'ta]	(Laura: 2;4.30)	‘to be’
		/ʃt/á	→	[ʃ'ta]	(Laura: 2;4.30)	‘to be’
	Dutch	/st/oel	→	[su:]	(Tyrza: 2;0.5)	‘chair’
Stage 3	EP	/ʃt/rela	→	[ʃ'telɐ]	(Pedro: 3;1.1)	‘star’
	Dutch	/st/aart	→	[sta:t]	(Tyrza: 2;5.5)	‘tail’

This behavior is consistent with our proposal: the properties of the input, in particular the role played by %V in cuing syllable structure, help children to build different representations for similar phonetic strings.

Our last argument is final [ɨ] epenthesis. EP children often produce a final [ɨ] in target words with word-final liquids (Marta does so obligatorily – see 20). This behavior is not attested for the acquisition of Dutch (Fikkert 1994).

(20)	quer	/'kɛɾ/	→	['kɛɾɨ]/['kɛɾi]	(Inês: 1;10.29)	‘wants’
	azul	/ɐ'zuɫ/	→	[ɐ'zulɨ]	(Luís: 1;11.20)	‘blue’
	papel	/pɐ'pɛɫ/	→	[pɐ'pɛlɨ]	(Marta: 2;2.17)	‘paper’
	dormir	/duɾ'miɾ/	→	[du'miɾɨ]	(Pedro: 2;8.19)	‘to sleep’

Table 4 summarizes the contrastive analysis presented in this section for the acquisition of syllable structure in Dutch and EP.

Table 4. Summary.

	EP	Dutch
V-type at the initial state	Yes	No
Empty Onset as a repair strategy	Yes	No
Epenthesis of V in branching Onsets	Yes	neglectable
Presence of deleted [ɨ]	Yes	______
Speed in development of Rhymes	slower	faster
s+C clusters	V+s-Coda	s-appendix
Word-final [ɨ] insertion	Yes	No

6. Conclusion

Early production data supports our proposal, which was initially based on acoustic-phonetic measurements of the signal and results of rhythm perception: **%V is the relevant parameter in the speech signal that triggers rhythm identification, which in turn cues basic syllable structure properties**, as those summarized in (21). This early information on syllable structure is available as potential help in the processing of the signal and may condition early production strategies. Not only do EP learners show different repair strategies from Dutch learners, but the strategies displayed by EP learners all converge on the same goal: by focalizing on the presence of vowels, children are attempting to implement the basic properties of the syllabic system to which they were initially guided by the rhythm type of the language (cued by %V).

(21) *Signal* *Rhythm* *Properties of syllable structure*
> %V Syllable-timed ‘simple’ EP
< %V Stress-timed ‘complex’ Dutch

limited nº of types
CV dominant
few closed σ
very few C-clusters
......

many types
non-CV dominant
many closed σ
more C-clusters
......

The testing of this proposal and its predictions in other languages (stress and syllable-timed) is a matter for future research.

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