

Emergence and Acquisition of Consonantal Sandhi in European Portuguese: a Prosodic Approach

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Introduction

- **Sandhi** - “(...) the merging of two words or word forms and the resulting systematic phonological changes. Internal sandhi involves two morphemes within a word; **external sandhi** takes place between two consecutive words.”

(Bussmann et al. 2013)

- **English:**

(1) a book / an egg

- **French (*Liaison*):**

(2) un livre [ɛ̃livʁə] / un ami [ɛ̃nami]

(Wauquier & Shoemaker 2013)

- **European Portuguese (EP):**

(3) V# V

a. a aluna aceitou

[ə ə] → [a]

(4) C#C

a. lápis branco

['lapiz'brẽku]

b. lápis preto

['lapiz'pretu]

(5) C#V

a. lápis azul

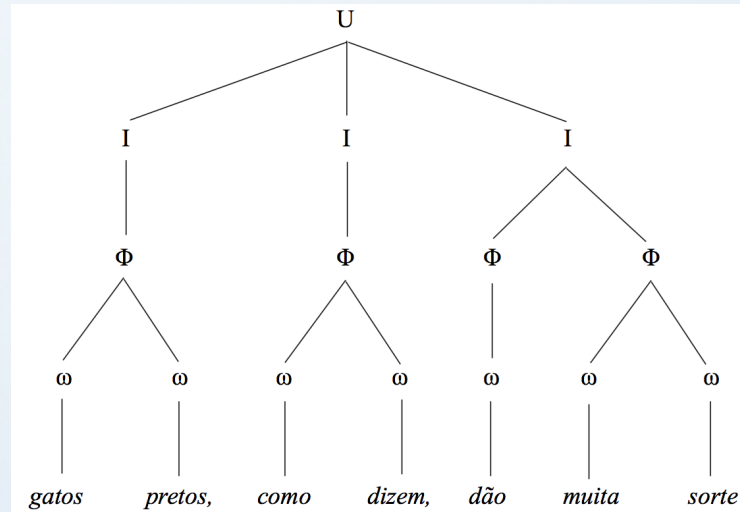
['lapizɐ'zuʎ]

(Frota 2000)

Introduction

- The production of sandhi is directly linked to the prosodic structure of a language.
- In EP, the IP is the domain of occurrence for external sandhi phenomena.

(6)



Utterance

Intonational Phrase

Phonological Phrase

Prosodic Word

(Vigário 2003)

- The higher IP boundary blocks the production of sandhi.

(7) [a[z] aluna[z]obtiveram boa[z] avaliaçãoe[j]]IP

(8) [a[z] aluna[z] estrangeiras nos Açore[j]]IP [até onde sabemo[j]]IP [obtiveram boa[z] avaliaçãoe[j]]IP

(Frota 2014)

Introduction

- **Consonantal sandhi > Coda acquisition in EP**

- The acquisition of phonology follows a “top-down” model – segments may be available in the child’s inventory, but not the syllabic constituent to accommodate them (Freitas 1997).
- In EP, Codas emerge later than Onset; Order of emergence: CFric>CLiq. (Freitas 1997; Correia 2004 – **only syllable and word level studied**).
- However, the constituents above the syllable are essential in the process of Coda acquisition (Jordão 2009; Jordão & Frota 2010).
- The IP final position facilitates the emergence of Codas. 92% of Coda production is explained by this factor (Jordão 2009).

(9) ['ɔʎaɹupɐ'tɨnuʃ] - [[[olha)ω]Φ [(os (patinhos)ω)ω]Φ]I (Luma: 3;03)

(10) [upɐ'tɨnupiki'ninuʃ] - [[[os (patinhos)ω)ω]Φ [(pequeninos)ω]Φ]I (Luma: 3;03)

(Jordão 2009)

Introduction

• Coda acquisition in other languages

French (Canadian)

- Order of emergence: (C)V > CVC.
- [ʁ], [s], [k], [l], and [p]. (Rose 2000)

Spanish

- Word-medial Coda > word-final Coda.
- Late production of CVC syllables.
- First Codas – mainly liquids and nasals.
- [n], [r], [l], [s], [θ] and [ð]. (Lleó 2003)

Catalan

- Word-final Coda > word-medial Coda.
- Early production of CVC syllables.
- Most common: [n], [s], [r] and [l].
- Also possible: plosives, fricatives, affricates, nasals, laterals and glides. (Prieto & Baliarda 2006)

English


- Order of emergence: CV > CVV > CVC. (Kehoe & Stoel-Gammon 2001)

German

- Word-final Coda > word-medial Coda.
- Early Coda acquisition.
- First Codas – nasals, liquids and obstruents. (Lleó et al. 2003)

Dutch

- Order of emergence: CV > CVCobst > CVCson > CVC₁C₂ (ERP). (Fikkert 1994)



Analyses considering higher level prosodic structure (above the word) are inexistent.

Introduction

- The acquisition of sandhi crucially relates to three aspects of prosodic development:
 - a. Coda emergence
 - It is not possible to study the acquisition of sandhi without making the connection between this phenomenon and the development of the syllabic constituent Coda.
 - b. $MLU_w > 1,5$
 - Sandhi phenomena imply the combination of words. This happens after 2;02. (Frota et al. 2016)
 - c. IP with more than 1 PW
 - The combined words must be phrased into the same IP.

The Current Study

- The emergence of sandhi in the language acquisition process may thus reveal the child's prosodic development.
- This work analyses the external consonantal sandhi in (4) and (5).

(4) C#C	a. lápis branco	$['\text{lapiz}'\text{brẽku}]$	
	b. lápis preto	$['\text{lapi}'\text{pretu}]$	
(5) C#V	a. lápis azul	$['\text{lapizẽ}'\text{zuł}]$	(Frota 2000)

- Its aim is to study the relationship between sandhi phenomena and Coda acquisition in EP, taking into account prosodic structure.

The Current Study

- Research questions:
 - When does **external consonantal sandhi** emerge and when can it be considered acquired?
 - Is the emergence of sandhi simultaneous in both contexts **C#C** and **C#V**?
 - Are all **segments** in Coda (CFric, CLiq) equally present by the time sandhi phenomena emerge?

Methods

- Longitudinal study – spontaneous speech of a portuguese child (2;04 – 4;00).
- Corpus - 3782 utterances:
 - Partly collected from three already existing databases
 - LumaLiDaOn – parental diary (<http://labfon.lettras.ulisboa.pt/LumaLiDa.htm>)
 - LumaLiDaAudy – audio files (<http://labfon.lettras.ulisboa.pt/lumalidaaudy.htm>)
 - LumaLiDaVideo – video files (<http://www.clul.ul.pt/pt/investigacao/159-acquisition-in-european-portuguese-resources-and-results>).
 - Partly transcribed for the present study, resulting in a new database built with PHON.
 - Automatic syllabification by the software PHON - manually reviewed and corrected according to the EP syllabic structure.

Methods

- Only the utterances with target Coda were considered in this research.
- The prosodic domain of the analysis was the IP.
- The data were organized by:
 - context (C#V / C#C),
 - segment (CFric, CVibr, CLat),
 - age (monthly).
- Only Codas produced according to the target were considered as “correct”.
- Repair strategies and other prosodic boundaries were signaled for later analysis.

Methods

- Some utterances with Coda were excluded for the following reasons:

- Non-native words;

(11) *Toys're Us* - ['tɔjzə'rez] (Luma: 3;04)

- Sequences of two words with similar adjacent segments;

(12) *Podem todos jogar.* - ['pɔdẽj'toduʒu'gali] (Luma: 3;02)

- Unintelligible speech;

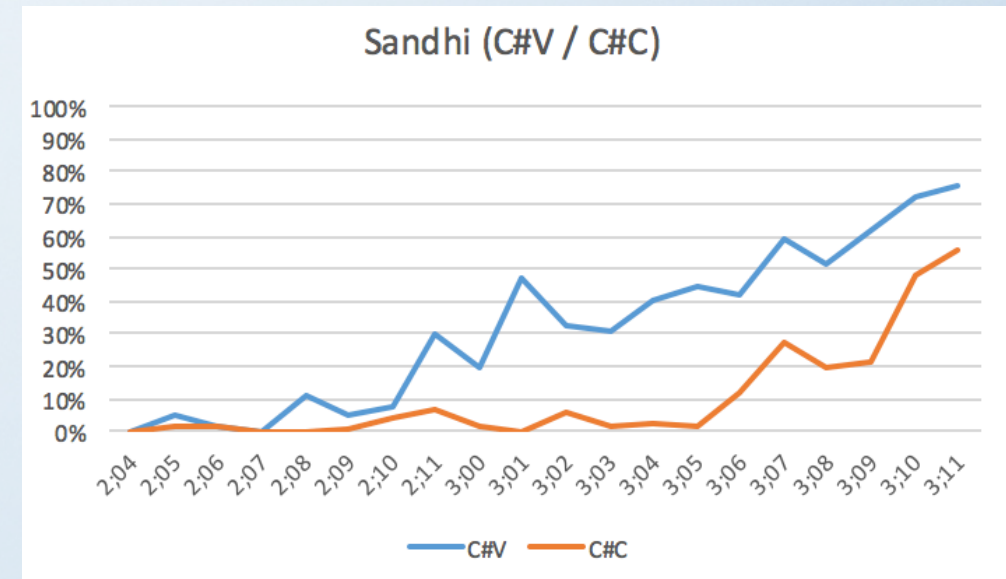
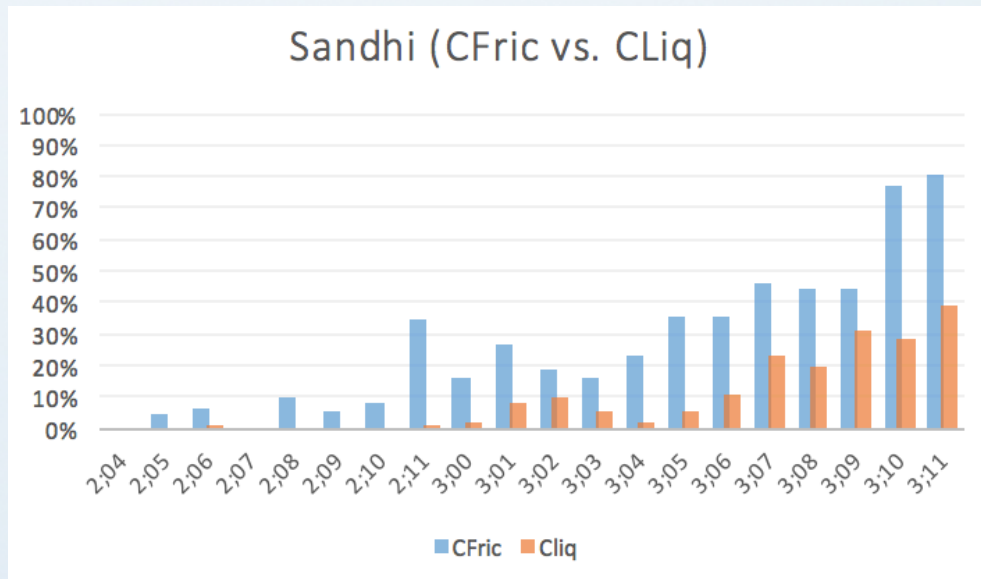
(13) *Dos barquinhos.* - [du*be'kiɲuʃ] (Luma: 3;09)

- Mismatch between the target orthographic transcription and the actual production of the child, where the same potential sandhi context does not occur.

(14) *Vamos ao parque de cima.* - ['vɛmupɔ'paki'fime] (Luma: 3;04)

Results

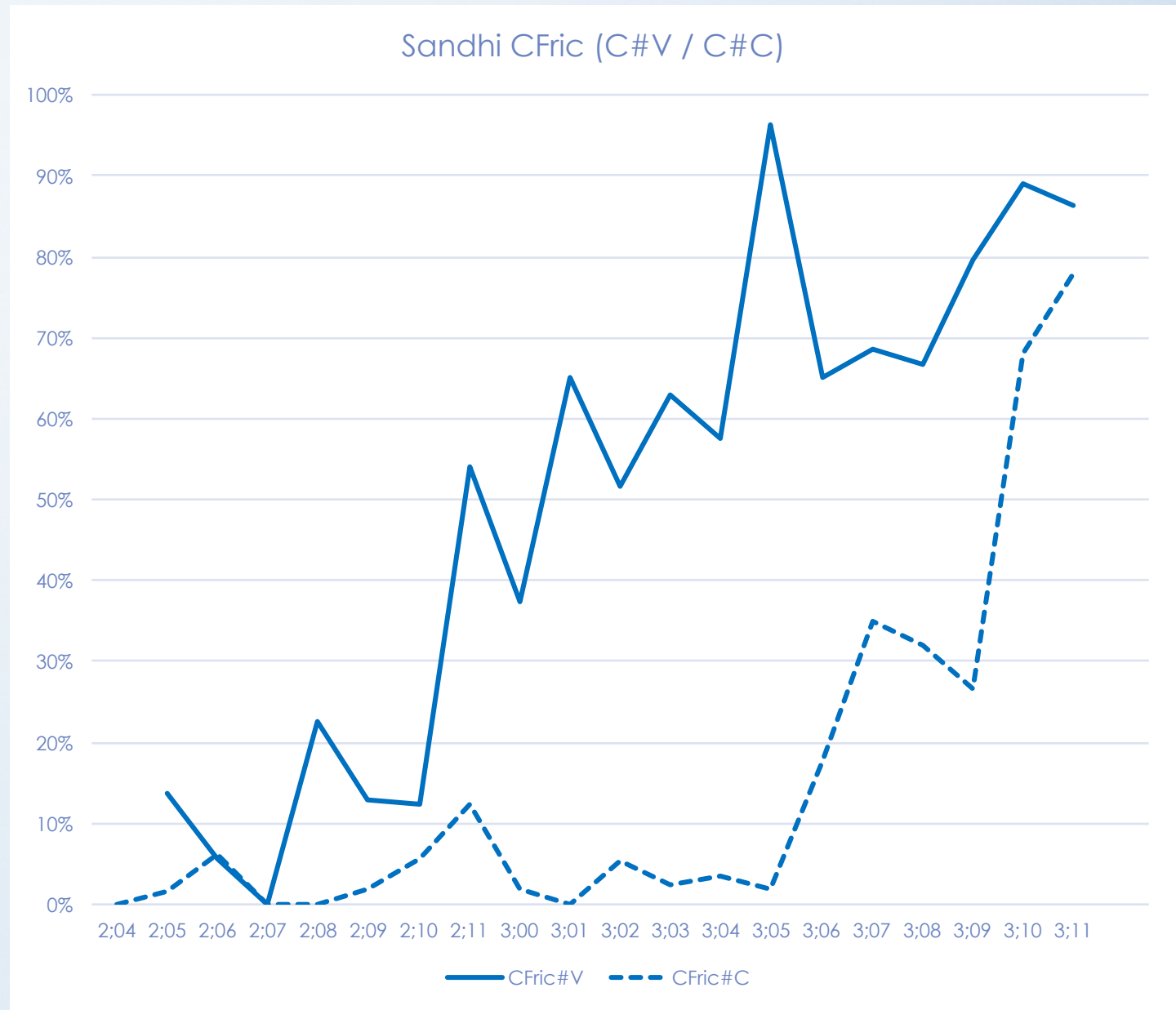
- Results show that the acquisition of sandhi varies according to:
 - the segment in Coda (CFric, CLiq);
 - the context of sandhi (C#V / C#C).



- Sandhi develops earlier for CFric than CLiq.
- Order of emergence: CdFric (2;05) > CdLat (3;00) (Jordão 2009)
- Regardless of the segment in Coda, sandhi in C#V context is in advantage compared to C#C context.

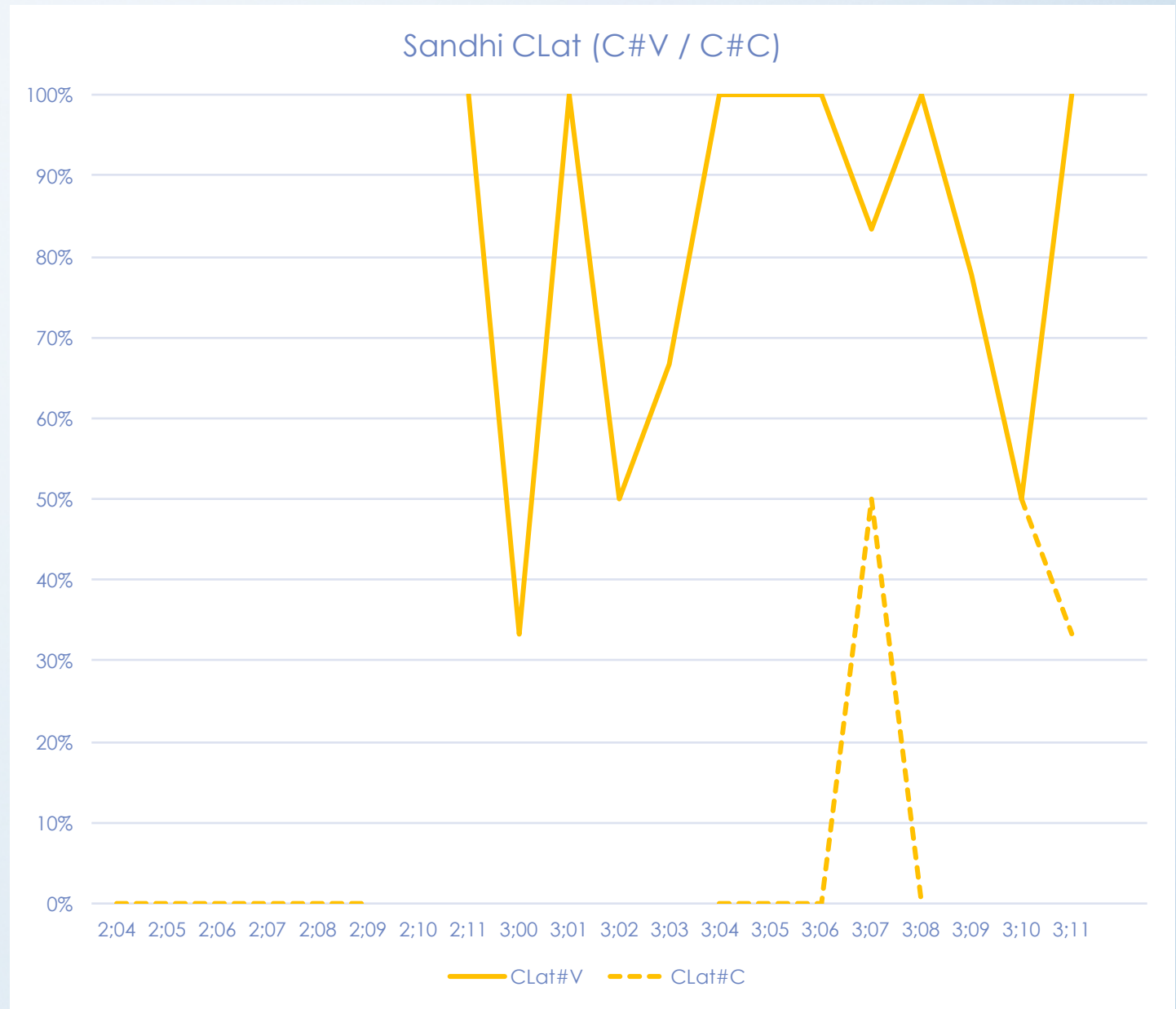
Results

- Sandhi in C#V context presents a steady and gradual development along the studied period.
- Sandhi with CFric exhibits an early emergence (2:05), coinciding with emergence of the fricative in Coda in IP-final position (Jordão 2009).
- Sandhi in C#C context shows a sudden increase after 3:06.



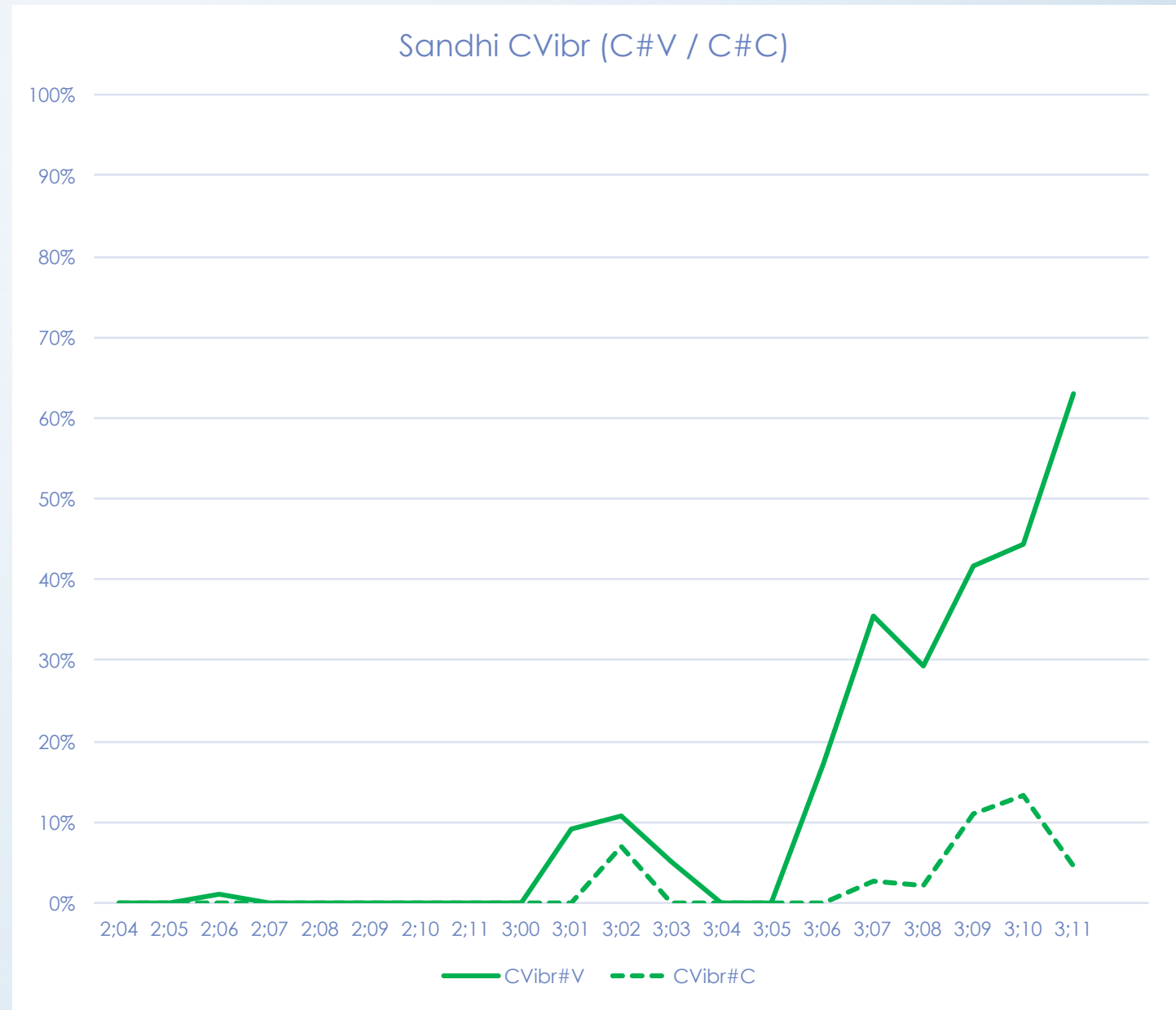
Results

- When sandhi with CLat emerges, its production is quite irregular.
- This is due to the sparse number of utterances with this segment in Coda.
- Nevertheless, it is possible to verify that the percentage of sandhi production according to target is much higher in C#V context.



Results

- The production of CVibr in Coda in IP-internal position is not present until 3;06.
- After its emergence, sandhi with CVibr in C#V context shows a steep rise.
- The values of the production of [r] in Coda in C#C context are marginal.



Discussion

- In the sandhi acquisition process, C#V context has an advantage comparing to C#C context, regardless of the segment in Coda (CFric, CVibr, CLat).
- Sandhi which implies resyllabification is acquired sooner and shows higher rates of production throughout the studied period.
- Sandhi with CFric is characterised by an early emergence, unlike sandhi with CLiq (the segment effect).

Discussion

- When does external consonantal sandhi emerge and when can it be considered acquired?

- The first productions of sandhi in Luma occur around 2;06.

(15) Quero tirar fotografias aos animais.

[ˈkɛrutiˈrafutugɐˈfiɛɔzɐniˈmazi]

(Luma: 2;09)

- By the end of the period analysed in this study, the sandhi acquisition process is not yet stable. Sandhi production depends on the context (C#V or C#C) and on the segment in Coda position.

(16) Mami, vamos ver qual é que nós temos.

[maˈmi/vɐmuʒˈveriˈkʷɔˈlɛkˈnɔˈtemuʃ]

(Luma: 3;11)

Discussion

- Is the emergence of sandhi simultaneous in both contexts (C#C and C#V)? How does it relate to the Coda?
 - At an earlier stage, the child is producing the segment in Coda only in IP final position, and crucially not IP-internally (Jordão 2009; Jordão & Frota 2010).
 - Later, the segment in Coda is produced as the Onset of the following syllable, thanks to C#V sandhi (and in the prosodic contexts that allow sandhi).
 - Finally, the child starts producing it in C#C context IP-internally, as a real Coda.
 - The results suggest that prosodic structure constrains the emergence of coda production, and that sandhi in C#V context may play a role in the acquisition of the syllabic constituent Coda in IP-internal position.

Discussion

- Are all segments in Coda (CFric, CLiq) equally present by the time sandhi phenomena emerge?
 - Despite the fact that they are generally available in the Onset position in the child's productions, Coda segments (CFric, CVibr, CLat) do not appear simultaneously at IP final position, nor when sandhi phenomena emerge.
 - The present findings suggest that the obstruents (CFric) are acquired before the sonorants (CLiq) in Coda (supporting Freitas 1997; Correia 2004; Jordão 2009), both in IP final position, and IP internally regardless of the context (C#V / C#C).
 - This is consistent with the idea that children detect more easily bigger contrasts in the sonority hierarchy – the vowel in the Nucleus constitutes a sonority peak and the obstruent in Coda has the lowest sonority of all the Coda consonants.

Conclusion

- By analysing Coda production at a higher level of the prosodic structure, and by taking into account utterances with more than one word phrased within the same IP, we realise that upper level constituents seem to affect the Coda acquisition process.
- Sandhi, firstly by involving resyllabification in C#V context, may boost the emergence and development of the syllabic constituent Coda in prosodically non-prominent positions (e.g. IP-internally).
- Overall, the results contribute to a better understanding of the relationship between the acquisition of Coda segments and the emergence of sandhi, as well as the role of the prosodic structure in both processes.
- Follow-up research:
 - To further investigate the effect of the prosodic structure in the sandhi acquisition process.
 - To conduct a systematic analysis of CVibr in Onset and compare the results with Coda acquisition data.

Thank you!
Obrigada!

<http://labfon.letras.ulisboa.pt/babylab/english/>

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