

Prosodic structure constrains word segmentation beyond the utterance edge factor

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Introduction

- Recent research has addressed the role of phrasal prosody in early word segmentation, focusing on the contrast between words at the **edge** and the **middle** of the utterance.
 - An effect of utterance edge as early as 6 months, due to its prosodic saliency (Seidl & Johnson, 2006; Johnson et al., 2014)
 - Later segmentation at utterance-internal position (Seidl & Johnson, 2006)
- In previous studies, phrasal prosody was not taken into account when testing infant's segmentation abilities in different languages (e.g., Jusczyk & Aslin, 1995; Jusczyk et al., 1999; Hohle & Weissenborn 2003, 2005; Bosch et al, 2013; Nazzi et al., 2006; Mersad et al., 2010; Nazzi et al., 2014)

Introduction

Studies with more controlled prosodic phrasing (and no pause cue) are needed

- This study revisits infant word segmentation beyond the edge factor, looking at the effects of **two different utterance-internal prosodic conditions** in European Portuguese:
 - Target monosyllable next to a word boundary > Prosodic Word (PW)
 - Target monosyllable next to a high phrasal boundary (without a pause) > Intonational Phrase (IP)
- Segmentation of monosyllabic words in EP (Butler et al., 2015, submitted)
 - Segmentation at utterance-edge > 6 month
 - Segmentation in utterance-medial position > improved at 9 month, but still not successful (pseudo-words placed at PW or lower phrase boundary - Phonological Phrase)


Introduction

- Albeit different, both IP and PW edges are marked by a clear prosodic cues in European Portuguese (unlike in other Romance languages - Vigário, 2003; Frota 2014)
 - **PW**: domain of word stress and prominence-related processes, such as vowel reduction; edge-phenomena, like phonotactic constrains, and many other processes (segmental and prominence cues) (Vigário, 2003).
 - **IP**: marked with a variety of strong cues: segmental processes, domain of sandhi and resyllibification (similar to other Romance languages), final lengthening and pause, left-edge strengthening, pitch accent distribution, nuclear accent and boundary tone (Frota 2000, 2014)
- Cues to prosodic edges may vary across languages, and infants show language-specific sensitivity (e.g., Wellmann et al., 2012)

Method: Participants

- 12 month-old infants from monolingual homes in the Lisbon area tested in two experiments
- Utterance-medial PW:
 - 20 infants (11 boys, mean age 12m 10d, range 10m 15d– 14m 22d)
 - 3 infants excluded: 2 due to fussiness, 1 experimenter error
- Utterance-medial IP:
 - 20 infants (10 boys, mean age 12m 2d, range 10m 24d – 13m 19d)
 - 2 infants excluded due to fussiness

Method: Materials

- 4 monosyllabic pseudo words: Ful, Queu, Pis, Sau
- Familiarization materials: 2 passages with 6 sentences each, one for PW edge, another for IP edge (range 11-13 syllables)
- Test materials: 4 isolated word lists 
- 4 experimental conditions based on presentation onset in the familiarisation phase: Ful-Pis, Pis-Ful, Queu-Sau, Sau-Queu

A caixa contém **ful** vermelho na tampa.
 Aquele grande **ful** branco é da Quica.
 Comeram muito **ful** doce na praia.
 Hoje vi um **ful** castanho mas duro.
 O amigo do **ful** português fugiu.
 O outro **ful** branco foi de mercedes.

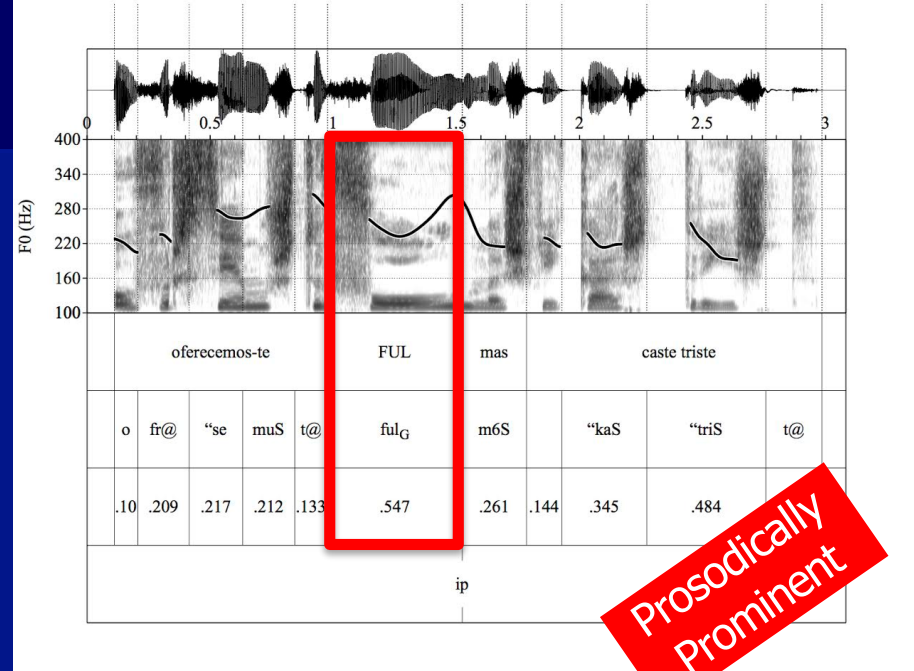
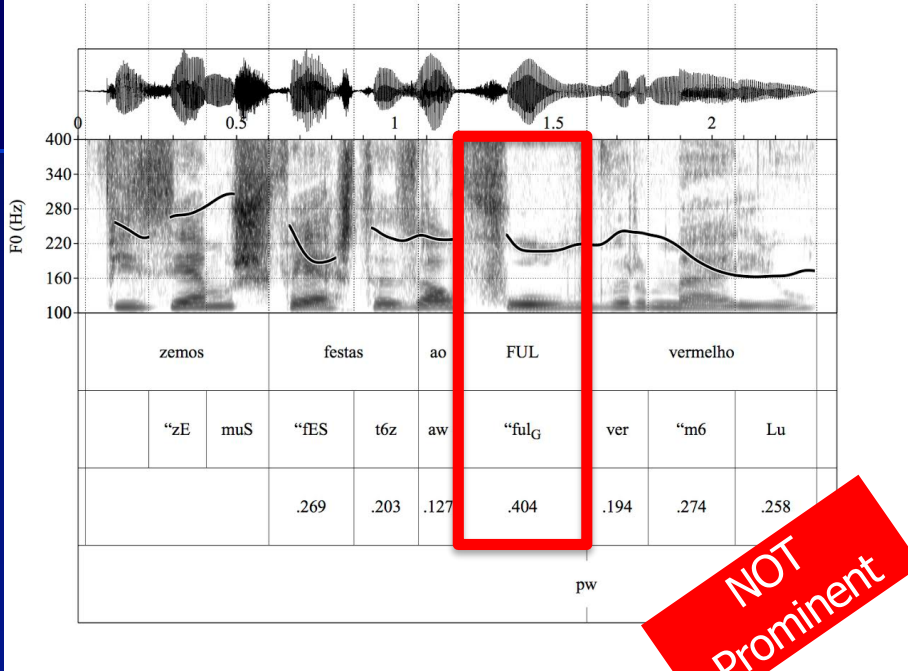
PW edge > NOT Prominent

As rãs gostam de **ful**, em vez de musgo fresco.
 Comprado o **ful**, voltamos ao parque.
 Desde que viu o **ful**, não quis brincar mais.
 Oferecemos-te **ful**, mas ficaste triste.
 Quanto à luz **ful**, nunca foi testada.
 Vocês prendem o **ful**, porém ele fugiu.

IP edge > Prosodically Prominent

Non-prominent internal position, with absence of any phrase boundary

Sentence internal Intonational Phrase edge



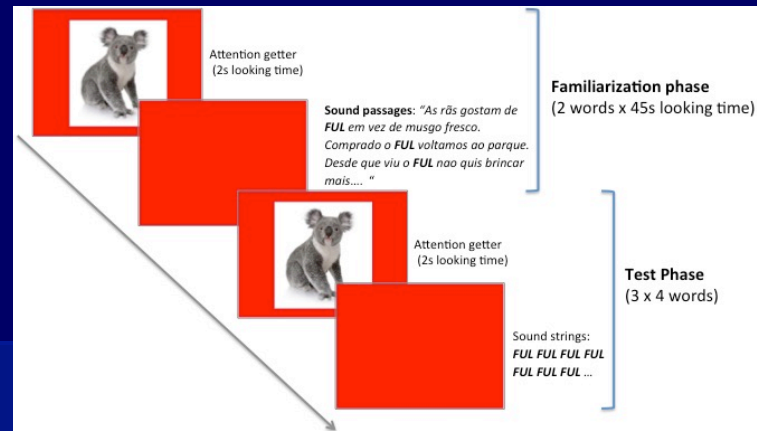
	PW boundary	sentence length (ms)	syllabic duration_before boundary (ms)	syllabic duration_after boundary (ms)	pitch range (hz)	pitch reset (hz)	tonal event
average		2,338	0,289	0,260	-29,71	-31,33	--
standard deviation		0,224	0,033	0,056	14,09	21,56	
	IP boundary						
average		2,749	0,544	0,232	85,92	-93,45	H%
standard deviation		0,224	0,043	0,054	37,43	34,06	

Acoustic analyses to describe the prosodic cues in the stimuli were performed⁸

Procedure: modified version of the Visual Habituation Paradigm (Stager & Werker, 1997; Altvater-Mackensen & Mani, 2013)



Procedure



<u>Familiarisation</u>	<u>Test</u>		
Alternating trials 45 secs accumulated listening time to each	Block 1 Randomised order	Block 2 Randomised order	Block 3 Randomised order
Passage 1 - Exp.1: PW_ Exp.2: IP	Word 1 - Familiar PW boundary	Word 1 - Familiar PW boundary	Word 1 - Familiar PW boundary
	Word 2 - Familiar PW boundary	Word 2 - Familiar PW boundary	Word 2 - Familiar PW boundary
	Word 3 - Novel PW boundary	Word 3 - Novel PW boundary	Word 3 - Novel PW boundary
Passage 2 - Exp.1: PW_ Exp.2: IP	Word 4 - Novel PW boundary	Word 4 - Novel PW boundary	Word 4 - Novel PW boundary

Trials continue until infant looks away for more the 2 consecutive seconds, or sound file ends

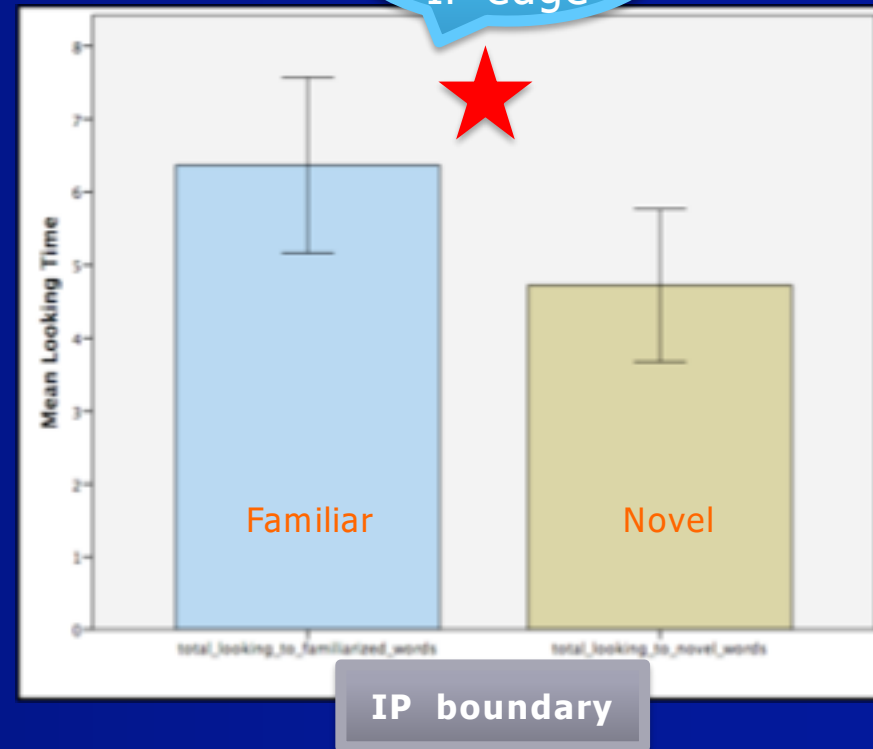
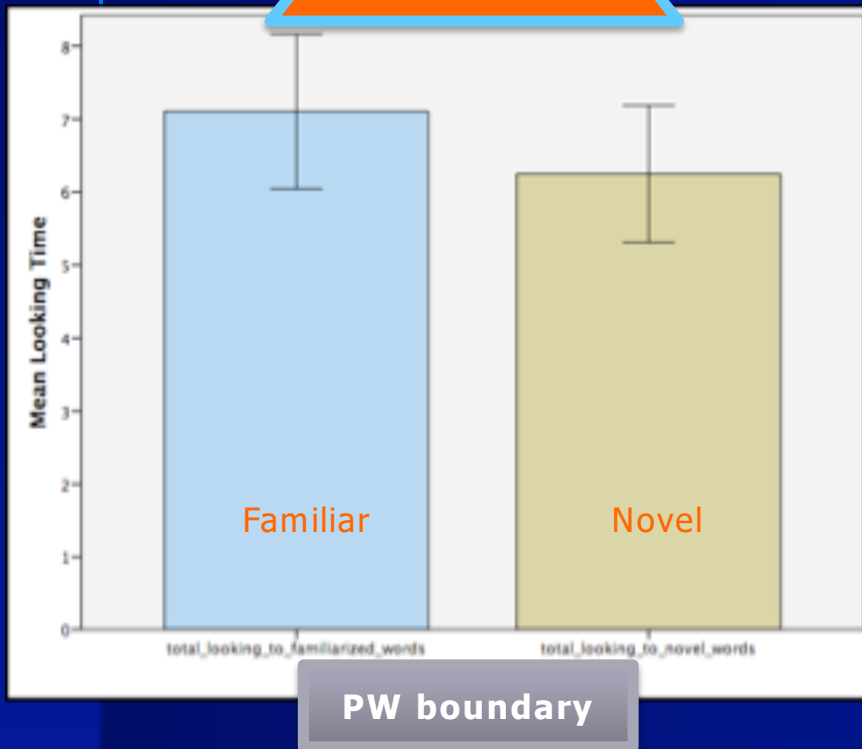
Segmentation demonstrated by longer looking times to familiar word forms compared with novel

Results

Similar behaviour,
segmentation wise, to 5-6
month olds at final IP
boundaries (=sentence edge):
See Butler et al. page 50

No!
Plain
internal

At
internal
IP edge



No significant effect of item status -
 $F(1,18) = 1,776, p > .1, \eta^2 = .090$

Significant effect of item status -
 $F(1,18) = 23.6, p < .001, \eta^2 = .57$

Discussion

- Portuguese 12-month-old infants were able to segment words in **utterance-internal** position, when the target word is aligned with an **internal IP boundary** not signaled with a pause, but NOT when it precedes a word level boundary (PW)
 - Clarifies the ability to use other prosodic cues besides the pause, such as pitch and duration cues.
 - In the utterance-edge studies a pause was always involved (Seidl & Johnson, 2006; Johnson et al., 2014)
- Segmentation abilities rely on the location of the word in the **prosodic structure** of the utterance, occurring first when high-level phrasal boundaries are involved.
- This shows a sensitivity to prosody in early segmentation, beyond the edge vs. internal position

Discussion

- More studies addressing the role of phrasal prosody in early word segmentation abilities are needed, in other languages.
- Examining early segmentation abilities at utterance-internal IP boundaries, younger infants are being tested in ongoing work.



**Obrigada!
Eskerrik!
Thank you!**

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