Effects of Prosody in Ambiguity Resolution by European Portuguese Children

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overview

introduction

* Understanding how speech is segmented into units and linguistic structures has been a central issue in language acquisition studies.
* It has been shown that prosody in speech perception and production take part in this process.

    * adult speakers rely on prosodic boundary cues to constrain lexical access and to process syntactic units, namely in the resolution of lexical and syntactic ambiguities (Wightman et al., 1992; Cho et al., 2007; Diley & MacAulley, 2008; Millotte et al., 2008).

    * infants can perceive prosodic boundaries in the identification of word level units (e.g. Gout et al., 2004), and children use this information in the interpretation of sentence meaning (Snedeker & Yuan, 2008).

* As for ambiguity resolution,

    * Choi & Mazuka (2003) showed that Korean 3-4 years old were able to use prosodic information in sentence segmentation and lexical ambiguity resolution, but unable to solve syntactic ambiguity even at 5-6 years of age.

> However, few studies have addressed the role of prosody in ambiguity resolution by young children.

introduction

* As for European Portuguese,

  * Online and offline perception studies demonstrated the relevance of Phonological Phrase (PhP) and Intonational Phrase (IP) boundaries in the resolution of temporary ambiguous sentences by European Portuguese adults, either at lexical or syntactic ambiguity (Frota et al, 2010; Severino, 2011).

  * Online perception studies showed to be more sensitive to detect word boundary levels disambiguation (PW, PWG)

  * Despite been described as weakly cued constituent, an effect of PhP boundary was observed in adult data.

What about children?
Is there a trend in language development?

main goals

* Following the experimental design of Brandt-Kobele & Hohle (2012), children between 2;6 and 5;0 years old are being tested to:

    * examine the role of prosody in the segmentation of speech by young European Portuguese children,
    * and their processing of words and syntactic structure in different prosodic contexts.

* The goal is to:

    * understand the role of prosody in early speech segmentation, to characterize the development of young children's abilities of word and phrase segmentation.

Prosodic contrast: No Boundary vs. Prosodic Word,

Phonological Phrase vs. Intonational Phrase

materials

* Pairs of ambiguous sentences were created for 2 experiment contrast, in which they only differed on prosodic type boundary:

    * No boundary *vs* Prosodic Word boundary

        * *O Tito gosta da Primavera $_{no\ boundary}$ (Tito loves spring)*

        * *O Tito gosta da prima $_{pw}$ Vera (Tito loves cousin Vera)*

    * Phonological Phrase boundary *vs* Intonational Phrase boundary

        * *O Tito tira o boneco $_{php}$ com o pau. (Tito takes the doll that has a stick)*

        * *O Tito tira o boneco, $_{ip}$ com o pau. (Tito takes the doll using a the stick)*

* A control unambiguous sentence for each pair was also included.

* Words used in the *corpus* were selected according to EP children lexicon, based on *PLEX5 - A production lexicon of child speech for European Portuguese / Um léxico infantil para o Português Europeu.*

experiment design

* A trained female speaker produced sentences recorded in child directed speech (2 pairs per condition+2 controls per pair)

* For each sentence, a picture of the described situation was made up. Pilot test for image validation was performed by adults.

* For experiment purpose, pictures were pairwise and counterbalanced by side (L/R; R/L)

* 2 experiment conditions were built for each prosodic contrast, and sentences for each pair were divided into 2 blocks. Subjects performed 1 block only and heard 1 sentence of each pair, but both testing boundaries.

* Total blocks: 2 Nb/PW + 2 PhP/IP

* Event trials: 4 target + 4 controls

procedure

* 28 children, 2 age groups (younger: 2;6 – 3;6, mean 2;9 , older: 4;0 – 5;0, mean 4;2) participated in the study.

* Children eye gaze was measured using SMI RED 500 Eye Tracker, with a 60hz tracking resolution, 5 points calibration.

* Experiment started with a presentation video introducing experiment characters, followed by trial presentation.
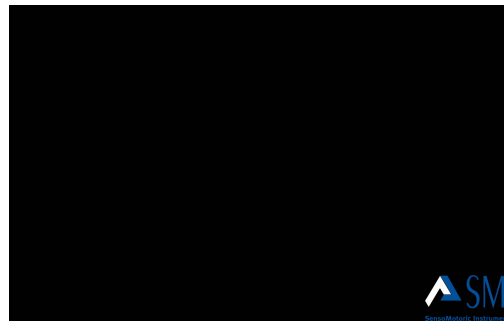
* After each 4 trials, children were rewarded with a cartoon video, to keep their interest during task.

data analysis

* Proportion of dwell looking time at the target picture was used as dependent variable.

* 2 AoI areas were defined (target/distractor)

* Repeated Measures ANOVA

  * 1 within participant factor of boundary type (low prosodic boundary level *vs* high prosodic boundary level);

  * 2 between participant factors of experiment (Nb *vs* PW / PhP *vs* IP) and age group (younger *vs* older).

7. experiment * Age_group * boundary_type

Measure: MEASURE_1

experiment	Age_group	boundary_type	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
1,00	,00	1	,437	,082	,272	,602
		2	,530	,076	,377	,683
	1,00	1	,552	,105	,342	,763
		2	,578	,098	,382	,773
3,00	,00	1	,454	,082	,290	,619
		2	,545	,076	,392	,698
	1,00	1	,447	,123	,199	,694
		2	,537	,114	,307	,766

# preliminary results: Experiment 1

Experiment 1_No boundary vs PW

* No main effects or interaction were significant (reduced sample size).
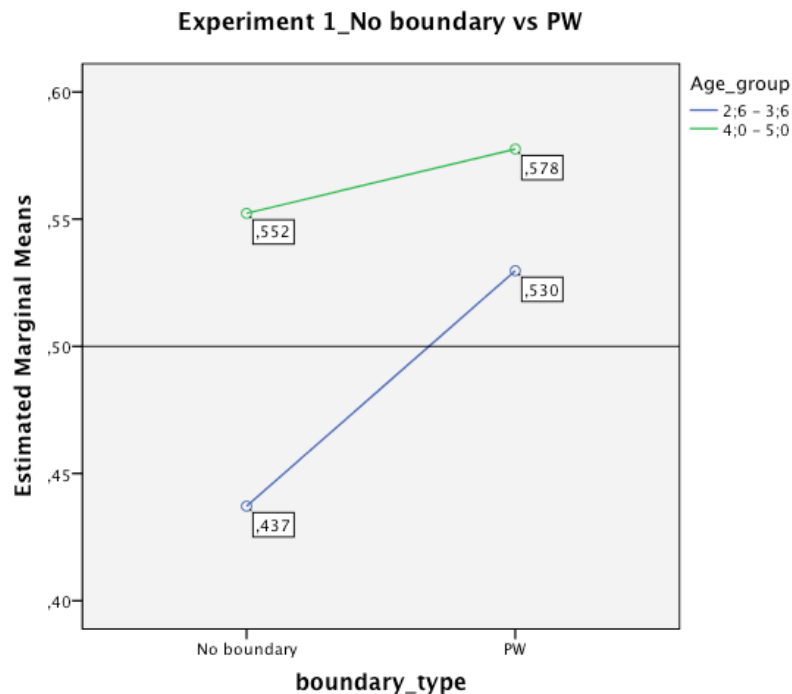
* Older children looked more to target picture in both prosodic boundaries (primavera & prima Vera not treated as same word) > prosodic disambiguation at lexical level.

* Younger children struggled to distinguish boundary types, showing no difference in the results between boundary types > preference for boundary.

preliminary results: Experiment 3

Experiment 3_PhP vs IP

* No main effects or interaction were significant (reduced sample size).
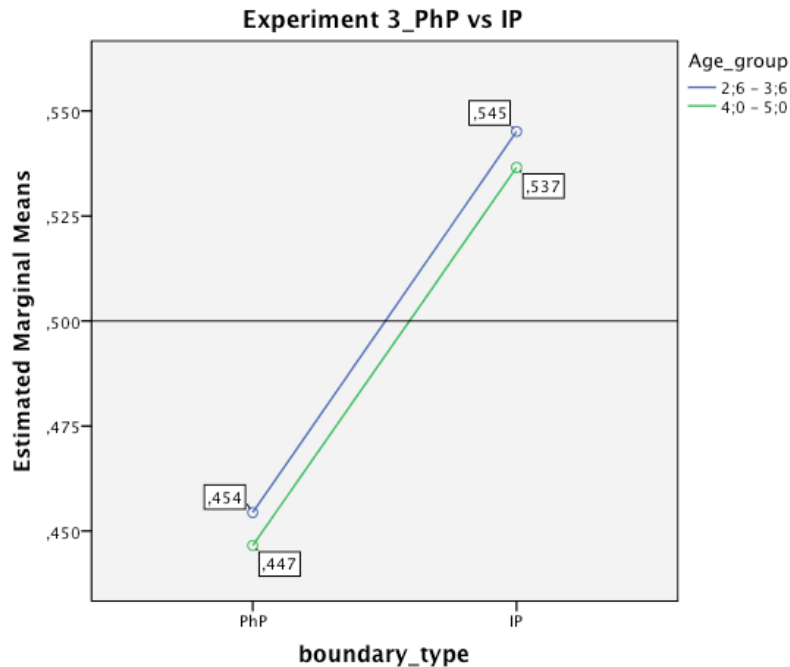
* Both age groups showed no difference between PhP and IP. Regardless boundary type, children looked longer to IP picture target.

* PhP > tendency to treat PhP as higher level boundary.

More data is needed

discussion

* None of the main effects or interactions were significant.

    * However, preliminary results suggest that olderchildren deal with word boundary levels during word segmentation in ambiguous contexts, when compared with younger children:

        * Development trend in language acquisition
        * In line with adult perception data for European Portuguese, performing online task.

    * As for syntactic ambiguity resolution, involving PhP/IP levels, no differences in treating high boundary levels:

        * In line with findings by Choi & Mazuka (2002), sentence segmentation and lexical ambiguity resolution, but unable to solve syntactic ambiguity even at 5-6 years of age.

    * more data needs to be collected for each condition, since there isn´t sufficient power to detect an effect with the collected sample size.

discussion

* Current data allows to attune analysis criteria:

  * Check looking proportions during picture baseline presentation > Ensure no novelty or preference effect for images

  * Compare two temporal regions of interest (RoI) > baseline event *vs* test event

  * More work will be needed to explain the differences between adult and infant data > Adults will be tested, for direct experiment results comparison

  * Other data measurement types need taken in account, namely first fixation and proportion of looking over test phase time course.

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