Prosodic processing of gapping sentences in Brazilian Portuguese

This work investigates the prosodic processing of Brazilian Portuguese (BP) coordinate sentences with subject versus object ambiguity: *No fim de semana, o Danilo levou a Camila na festa e o Fernando no churrasco da empresa* (On the weekend, Danilo took Camila to the party and Fernando to the company barbecue). The noun "*Fernando*" can be a subject of a new clause (gapping interpretation) or a conjoined object (conjunction reduction interpretation). Experimental evidence has shown that speakers prefer conjoining objects rather than subjects [1,2,3] because of the structural simplicity preference [4] and the Principle of Minimal Topic-Structure [2]. The gapping structure has more syntactic nodes than the conjoined reduction structure, and it has two subjects in the topic-structure of the sentence. On the other hand, the manipulation of prosodic cues (i.e., pitch accent type, position and F0 range) between the intended arguments in the two conjuncts can influence the interpretation of potentially gapping structures [1,3]. Therefore, this research intends to verify the role of parallelism in phonological structure in the processing of potentially gapping sentences.

Design. The experimental sentences were recorded in three prosodic structures: Subject Accent Prosody (pitch accent on *Danilo* and *Fernando*), Object Accent Prosody (pitch accent on *Camila* and *Fernando*), and Baseline Prosody (none of the nouns were pitch accented). The pitch accented proper nouns are prosodically parallel to each other in terms of pitch accent type, F0 range (Hz) and duration (ms). Subject Prosody condition has IPh boundaries after the first conjunct and the ambiguous noun, whereas Object Prosody and Baseline Prosody conditions have an IPh only after the first conjunct – see pictures 1 and 2 for pitch tracks. Eighteen experimental sentences were interspersed with thirty-two fillers over a Latin-square design. The experiment was an auditory questionnaire with a forced-choice task carried out in the PCIbex [5]. Participants (N = 30) listened to experimental sentences in one of the prosodic conditions, and answered a comprehension question (e.g., "What happened at the company barbecue?") by choosing between a subject reading ("Fernando took Camila there") or an object reading ("Danilo took Fernando there").

Analysis. Data from interpretation choices were analyzed in a logistic mixed-effects regression model [6], with interpretation choices as a function of prosodic conditions as fixed effects, and participants and items as random effects (c.f. Table 1). Data from the response times (RTs) to read the comprehension question and the two paraphrases, and choose a final interpretation were analyzed. The RT means under 2000ms and above 45,000ms were dropped from the final sample. The RT means were separated by the type of interpretation chosen (i.e., subject or object reading). We constructed a linear mixed-effects regression model [6] with log-transformed RTs as a function of interpretation choices as fixed effects, and participants and items as random effects (c.f. Table 2).

Results and Discussion. The results show that the prosodic parallelism between the subject of the first conjunct and the ambiguous noun increased the rate of subject interpretation to 38% in Subject Prosody condition (c.f. Graph 1). That rate was statistically significant in comparison to the rates of Object Prosody and Baseline Prosody conditions (c.f. Table 1). The RT means results suggest that participants took longer to choose subject reading than object reading regardless of the prosodic condition (c.f. Graph 2). There was a significant statistical effect for RT means in the comparison between subject readings versus object readings: $\beta = 0.16$, SE = 0.064, t = 2.567, CI [0.04 ~ 0.29], p = 0.01. The findings show that prosody plays an important role in licensing a gapping analysis of a global ambiguous coordinate sentence, but the simplest syntactic structure is the default interpretation in BP, which is aligned with [4] and [5].

Figure 1: Example of Subject Accent Prosody Condition

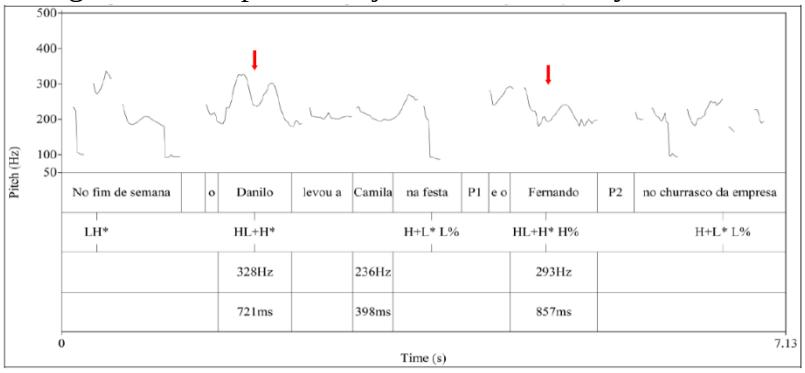
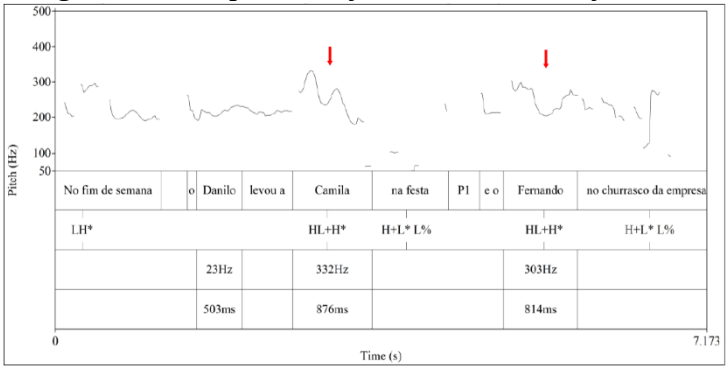
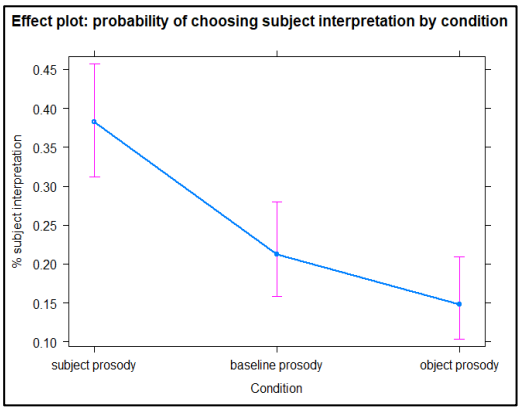


Figure 2: Example of Object Accent Prosody Condition



Graph 1: Effect plot of subject reading choices in each condition



Graph 2: Effect plot of RT means to choose subject and object readings

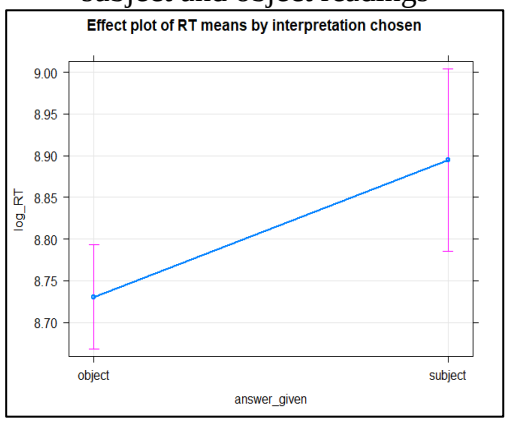


Table 1: Statistical analysis for Comprehension Question Responses

	Comprehension Question Answers		
Predictors	*Odds Ratios*	*CI*	*p*
(Intercept)	0.60	0.40 – 0.89	**0.010**
condition [baseline prosody]	0.41	0.25 – 0.68	**<0.001**
condition [object prosody]	0.25	0.15 – 0.44	**<0.001**
Random Effects			
σ^2	3.29		
$\tau_{00\ item}$	0.00		
$\tau_{00\ participant}$	0.40		
ICC	0.11		
$N_{participant}$	30		
N_{item}	54		
Observations	519		
Marginal R^2 / Conditional R^2	0.080 / 0.180		

References. [1] Carlson, K. (2002). *Parallelism and Prosody in the Processing of Ellipsis Sentences*. Outstanding Dissertations in Linguistics Series. New York, NY: Routledge. [2] Hoeks, J. C. J.; Vonk, W.; Schriefers, H. (2002). Processing Coordinated Structures in Context: The Effect of Topic-Structure on Ambiguity Resolution. *Journal of Memory and Language*, 46, pp. 19-119. [3] Hoeks, J. C. J.; Redeker, G.; Hendriks, P. (2009). Fill the Gap! Combining Pragmatic and Prosodic. *Journal of Psycholinguistic Research*, 38, pp. 221-235. [4] Frazier, L. (1979). *On comprehending sentences: Syntactic parsing strategies*. PhD dissertation, University of Connecticut. [5] Zehr, J. & Schwarz, F. (2018). *PennController for Internet Based Experiments* (IBEX). https://doi.org/10.17605/OSF.IO/MD832. [6] Baayen, R. H., Davidson, D. J., & Bates, D. M. (2008). Mixed-effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language*, *59* (4), pp. 390-412.