How null objects affect the comprehension of Garden paths in Brazilian Portuguese

Ana Besserman & Elsi Kaiser (University of Southern California), pianibes@usc.edu

We explore a property of **B**razilian **P**ortuguese (**BP**), anaphoric null objects, to show that resolution of garden-paths with subject/object ambiguities is sensitive not only to syntax and semantics (e.g.[2]) but also to anaphoric/coreference information. Due to **op**tionally **t**ransitive verbs (**OPT**; e.g., *read*) allowing both **overt** and **implicit** objects (**IO**s, ex.2,3), structures like (1) are temporarily ambiguous: 'the book' is initially parsed as the object of 'read' (garden-path) but then the comprehender needs to re-analyze *the verb as having an IO and the book as the subject of 'fell'* [1,2]. The garden-path arises because syntactic simplicity (Late Closure) favors parsing the noun as an object. Strikingly, the misinterpretation of *book* as the object of *read* lingers even after the full sentence has been read (e.g.[2]).

1. While the man read <u>the book</u> fell on his foot. / *While the man read Ø, the book fell on his foot.*

2. O homem leu o livro. /The man read the book. | **3.** O homem leu Ø./The man read Ø.

4. ^{ok} O homem pegou o livro$_k$ e leu Ø$_k$./*****The man grabbed the book$_k$ and read Ø$_k$. [obj=implicit]

IOs of OPT verbs in BP can have <u>either</u> an underspecified <u>or</u> discourse-based anaphoric interpretation (existential/anaphoric IOs; ex.3-4). (Whether anaphoric IOs in BP are ellipses or null *pro* [4,5] is not relevant here). Thus, in the right context, when BP readers encounter a noun phrase after an OPT verb, they could **(a)** parse the noun as the direct object, **(b)** posit an underspecified IO and parse the noun as a subsequent subject, or–unlike English–**(c) posit an *anaphoric* IO** referring to an already-mentioned referent and parse the noun as a subject**.** Option (a) is preferred over (b), due to Late Closure. Crucially, BP lets us to test the interaction between syntax and discourse: Do readers go for the **syntactic route** (a) or do they pursue a **discourse-based route** (c) (**and be <u>less</u> garden-pathed**) when an antecedent is available? We test this by manipulating *presence/absence of an antecedent*.

To further probe the syntax-discourse relation, we test whether the postverbal noun's definiteness modulates the ease of (re)analyzing the verb as having an anaphoric IO. *Definite* NPs typically represent old/given information and can (be inferred to) co-refer with a preceding IO, but *indefinites* are less likely to co-refer with already-evoked entities. This predicts that garden-paths with *definite NPs may be easier to process* than ones with indefinite NPs: Even if the parser was initially garden-pathed, a definite NP can act as a cue signaling a previous (coreferring) IO; an indefinite NP provides no such cue.

In a **self-paced reading study,** we manipulated (i) ambiguity (with comma/without), (ii) presence of potential antecedent (present/absent) and (iii) definiteness of the ambiguous noun (def/indef);

5. Depois que eu {recebi uma carta e} li {,} {um/o} livro caiu no meu pé esquerdo.
After I {received a letter and} read {,} {a/the} book fell on my foot left.

Results (n=47)**:** Ambiguous conditions are read slower (p<.001, Fig.1), *even when* an antecedent was available: **presence of an antecedent** does not prevent garden-pathing by making people posit an anaphoric IO and parse the noun as a subject; in fact, conditions *with* antecedents are slower (p<.01). Sentences with definite NPs are faster than indefinites *in all conditions (including unambiguous)* at various points in the critical region (p's<.01): Instead of specifically guiding re-analysis, **definiteness** *facilitated processing across-the-board*. For every trial, a **question** (e.g. *Did I read a book?*) probed if the NP was interpreted as an object. Here we see that *presence of an antecedent facilitates recovery from garden-pathing/decreases lingering misinterpretations***:** "no" responses were more frequent when a potential antecedent was present (p<.001, Fig.2). While the discourse route available in the presence of an antecedent did not facilitate garden-path re-analysis online, it did affect their offline interpretation, drastically reducing lingering misinterpretations. Also, in <u>unambiguous</u>, no-antecedent conditions, "no" answers are less frequent with definite NPs (p<.001): Without an antecedent or a garden-path, a cataphoric relation between the IO and the NP is preferred over an underspecified referent.

In sum, the construction of anaphoric relations between IOs and previous or subsequent expressions interacts with syntactic parsing, both during online processing and offline interpretation.

Figure 1. Word-by-word reading times in milliseconds. Error bars show +/- 1 SE (critical region in purple; 47 native BP speakers, 32 target items: 16 OPT verbs appearing twice each)
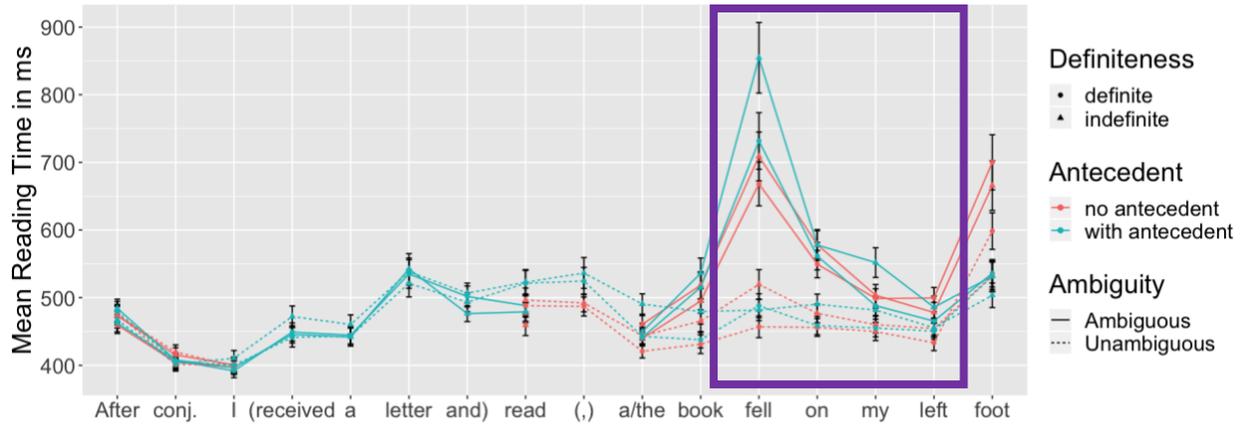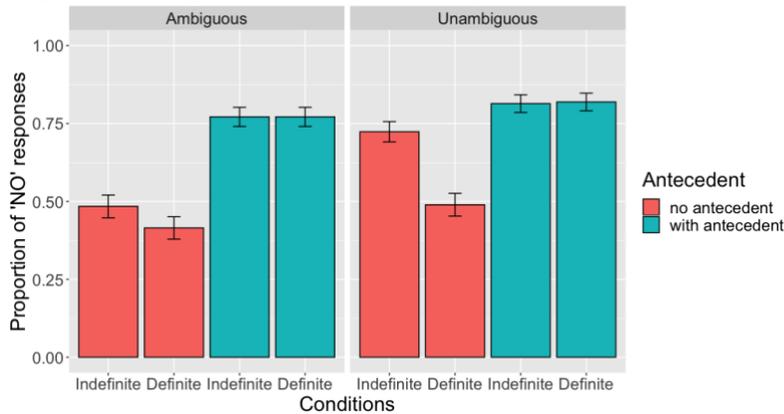

Figure 2. Comprehension Questions ("Did I read a book?")

References:
[1] Frazier, L., & Rayner, K. (1982). Making and correcting errors during sentence comprehension: Eye movements in the analysis of structurally ambiguous sentences. *Cognitive psychology*, *14*(2), 178-210.
[2] Christianson, K., Hollingworth, A., Halliwell, J. F., & Ferreira, F. (2001). Thematic roles assigned along the garden path linger. *Cognitive psychology*, *42*(4), 368-407.
[3] Slattery, T. J., Sturt, P., Christianson, K., Yoshida, M., & Ferreira, F. (2013). Lingering misinterpretations of garden path sentences arise from competing syntactic representations. *Journal of Memory and Language*, *69*(2), 104-120.
[4] Kato, M., & Roberts, I. (1993). Português Brasileiro. *Uma viagem diacrônica. Campinas: Editora da Unicamp*.
[5] Cyrino, S., & Lopes, R. (2016). Null objects are ellipsis in Brazilian Portuguese. *The Linguistic Review*, *33*(4), 483-502.