The case of the missing antecedent: (Re)solving context dependency effects in the comprehension of implicit objects
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Antecedentless pronouns can be failures or successes. Singular pronouns like "s/he" demand antecedents: Without antecedents, they normally result in referential failure and processing difficulty (ex.1a, [1]). Unlike these antecedent-*demanding* forms, plural "they" is merely antecedent-*accepting*: It can be successfully used with or without an explicit antecedent (ex.1b-c, [2,3]). The processing system needs to be sufficiently flexible to distinguish different antecedent-seeking properties of similar elements (*s/he* vs. *they*). To better understand this process, we use verbs as a tool to switch between antecedent-demanding and antecedent-accepting construals – not of overt pronouns but **i**mplicit **o**bjects (**IOs**) in Brazilian Portuguese. This provides an ideal test-bed for investigating the referential processing of implicit elements while gaining insights into the real-time effects of verbs on processing antecedent-demanding vs. antedecent-accepting elements, holding the element itself constant (always an IO).

The referential behavior of IOs in Brazilian Portuguese (BP, ex.2-5) depends on the verb: With **O**bligatorily-**T**ransitive (OT) verbs, IOs in Brazilian Portuguese are *antecedent-demanding* (ex.4-5: the implicit object of 'flip through Ø' *must* be interpreted as referring to an already-mentioned entity). With **OP**tionally **T**ransitive (OPT) verbs, IOs are *antecedent-accepting* (in ex.1, the IO of 'read Ø' evokes the existence of something that was read, independent of prior context; in ex.2, it refers to the already-mentioned magazine, see additional page).

We investigate processing consequences of **(i)** presence vs. absence of antecedents: we test the strength and timing of verb effects on whether an IO is interpreted as antecedent-demanding or antecedent-accepting, as reflected by *potential processing difficulties with IOs related to absence of antecedents*, and **(ii)** overt vs. implicit antecedents: we test whether antecedent-demanding IOs are easier to process with overt or implicit antecedents. **Design**: 45 native BP speakers did a self-paced reading task (20 targets/32 fillers). We manipulated (i) antecedent availability (present/absent) and (ii) verb type (OT/OPT, Table 2). Comprehension questions followed targets: 'yes' responses indicate the IO 'found' an antecedent.

Q1 Presence vs. absence of antecedents: If missing antecedents cause slowdowns and if the referential needs of IOs are modulated by verb semantics in real-time, we predict that conditions with OT verbs, which can only have antecedent-demanding IOs, should elicit slower RTs after the critical verb in antecedent-absent than antecedent-present conditions. On the other hand, OPT conditions - whose IOs are merely antecedent-accepting - should be easy to process in both antecedent-present and antecedent-absent conditions.

Q2 Overt vs. implicit antecedents: We also test whether processing ease of antecedent-demanding IOs depends on whether the antecedent is overt or implicit. Implicit referents are less accessible for subsequent reference [9,10], especially with reduced referring expressions [11,12]. We expect processing of antecedent-demanding IOs with implicit (less accessible) antecedents will be more difficult than overt (more accessible) antecedents, although an antecedent is available in both cases. We tested Q2 by having all targets end with another antecedent-demanding OT verb's IO (e.g., *guardou* 'put away').

Q1/Reading times (Fig.1) shows that conditions with OT verbs and no antecedent (ex.8) are read slower at the second and third words following the verb (lmer, p=.04, p=.0007) relative to the OT condition with an antecedent (ex.9). No such difference appears between OPT verbs with and without antecedents (ex.6-7). This confirms our prediction that comprehenders face difficulties when the verb signals the IO is antecedent-demanding but no antecedent is available. **Q2/Reading times** at the second verb ('guardou') show no differences between overt/implicit antecedent conditions (ex.6-7) or the control (ex.10) – contrary to our predictions.

Comprehension questions (Fig.2) show a strong bias to interpret the IO as coreferential with the antecedent whenever an antecedent is present (no effects of verb type).

We find that IOs that *require* an antecedent cause processing difficulty when no antecedent is available, but no difficulties arose when at least an implicit antecedent was available: implicit and overt antecedents are equally suitable for satisfying an antecedent-demanding IO.

1a. Anna shot at Linda as **he** jumped over the fence. (from [1]) [no antecedent]
1b. On the train, **they** served really bad coffee. (from [2]) [no antecedent]
1c. My cats love fish. **They** are particularly fond of tuna. [with antecedent]

Table 1. Examples 2-5 (Ø denotes that the object is implicit, # denotes infelicity/unnaturalness)

2. A Ana estava lendo **Ø**.	3. A Ana pegou a **revista$_k$** e leu **Ø$_k$**.
Ana was reading **Ø**.	Ana grabbed the **magazine$_k$** and read **Ø$_k$**.
4. **#** A Ana estava folheando **Ø**.	5. A Ana pegou a **revista$_k$** e folheou **Ø$_k$**.
Ana was flipping-through **Ø**.	Ana grabbed the **magazine$_k$** and flipped-through **Ø$_k$**.

Table 2. Example target items (critical regions underlined, ant=antecedent)

6.OPT -ant	A Clara entrou, **leu** no sofá da sala, depois guardou na estante e saiu. Clara entered, **read** on the couch of room, then put-away on shelf and left.
7.OPT +*ant*	A Clara escolheu *um livro*, **leu** no sofá da sala, depois guardou na estante … C. picked *a book*, **read** on the couch of room, then put-away on shelf …
8. OT -ant	A Clara entrou, **folheou** no sofá da sala, depois guardou na estante … C. entered, **flipped-through** on the couch of room, then put-away on shelf …
9. OT +*ant*	A Clara escolheu *um livro*, **folheou** no sofá da sala, depois guardou na estante ... C. picked *a book*, **flipped-through** on the couch of room, then put-away on …
10. control	A Clara escolheu *um livro*, **sentou no sofá da sala**, depois guardou na estante... C. picked *a book*, **sat on the couch of room**, then put-away on shelf and left…
Q	Did Clara {read/flip-through} a book?

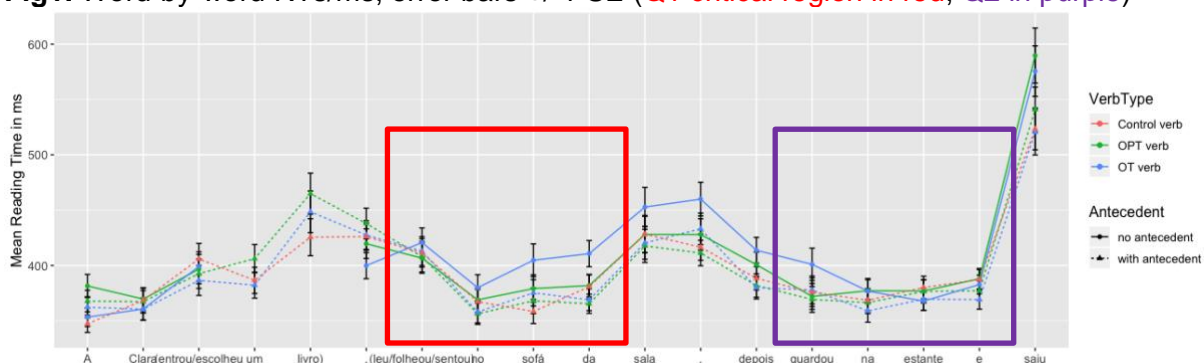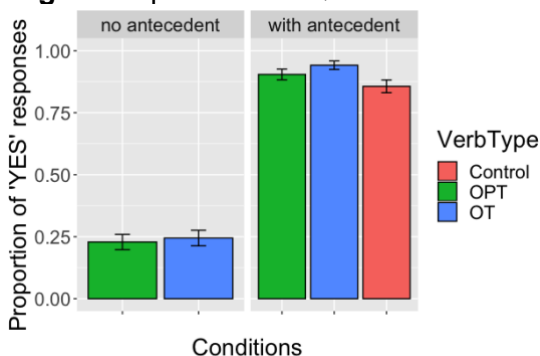**Fig1.** Word-by-word RTs/ms, error bars +/-1 SE (Q1 critical region in red, Q2 in purple)

Fig.2 Comprehension Questions

References
[1] Van Berkum et al., Brain research, 2007 [2] Sanford et al., Quat. Journal of Exp. Psych., 2008 [3] Gerrig et al., Advances in Cog. Sci., 1986 [4] Condoravdi & Gawron, In Quantifiers, Deduction, and Context, 1996 [5] Fillmore, In Annual Meeting of BLS 1986 [6] AnderBois, In WCCFL, 2012 [7] Kato & Roberts, Português Brasileiro. Uma viagem diacrônica, 1993 [8] Cyrino & Lopes, The Linguistic Review, 1996 [9] Williams, Arguments in syntax and semantics, 2015 [10] Besserman & Kaiser, Proceedings of CLS, 2019 [11] Ariel, Text representation, 2001 [12] Gundel et al., Language, 1993

Information about implicit objects in Brazilian Portuguese (BP)

Implicit objects (IOs) in BP can be of two kinds: Existential IOs (ex.2) or Anaphoric IOs (ex.3,5).

Existential IOs like the object of "read" in (2) are *context-independent*, i.e., they do not require a referent provided by context for interpretation; instead they entail the existence of an object (e.g., (ex.2) means "Ana read *something*.", i.e. there is an x such that it was read by Ana) [e.g., 4,5,6]. Existential IOs arise only within the class of Optionally Transitive verbs (OPT verbs; e.g. "read", "eat", "study", "bake"...), and are not felicitous with Obligatorily transitive verbs (OT verbs), as in (ex.4).

Anaphoric IOs in BP (also known as 'null objects'), in contrast, can appear with any transitive verb (i.e., both OPT and OT verbs) and are *context-dependent* (ex.2-4). That is, they are interpreted anaphorically and require a referent/antecedent (e.g., (3) means "Ana grabbed the magazine and read *the magazine that she grabbed*").

Anaphoric IOs in BP appear to be in complementary distribution with overt referential pronouns: the former are typically used to refer back to [-animate] antecedents, and the ladder are generally used to refer back to [+animate] antecedents [7,8].

There is currently debate whether anaphoric IOs in BP are null-anaphora or argument ellipsis [e.g., 7,8]: the current work does not address this question. Crucial to our purposes is that Anaphoric IOs, unlike Existential ones, *require* a referent from context.

OPT verbs can have either Existential or Anaphoric IOs: they are antecedent-accepting. If an antecedent is present, OPT verbs have an Anaphoric IO. If an antecedent is absent, OPT verbs have an Existential IO.

OT verbs, in contrast, can only have Anaphoric IOs: they are antecedent-demanding. If an antecedent is present, OT verbs have an Anaphoric IO. If an antecedent is absent, the construction is infelicitous/unnatural.

There is no evidence suggesting that anaphoric IOs in BP can be used in a generic/institutional way, such as English "they". That is, whereas English "they" is antecedent-accepting but not demanding: "they" can be felicitously used without an antecedent present, in circumstances in which an antecedent can be broadly inferred (ex.1b). Anaphoric implicit objects in BP, in contrast, seem to be antecedent-demanding.