

Psycholinguistic Perspectives on the Core Nature of Pronoun Interpretation

Tiana V. Simovic & Craig G. Chambers

Department of Psychology, University of Toronto, Toronto, Canada

Pronoun interpretation involves using linguistic and non-linguistic cues to identify an intended referential candidate. Within psycholinguistics, two core ideas have strongly guided our understanding of how this process works. First, pronoun interpretation has often been described as a “retrieval” process [e.g., 1], whereby a pronoun inherits its interpretation from an antecedent in discourse memory. Although this framework cannot account for cases where no such antecedent exists, it is possible that such a process constitutes the “default” case, in turn facilitating anaphoric processing. Second, the mechanisms guiding the identification of a referent have been assumed to have a pragmatically shallow character, drawing on heuristics and biases [2]. The present work directly addresses these assumptions. We begin by demonstrating that pronouns do not reflect a process of retrieving the semantics of their antecedents, even when a clear antecedent exists (Study 1). Next, we show that the factors guiding antecedent selection extend well beyond the types of “superficial” cues explored in most experimental work (Study 2). Specifically, we show that sophisticated forms of perspective reasoning and pragmatic inference can be involved.

Study 1 (spoken language eye tracking, $N_{ppts}=24$) used novel situations where the content of an antecedent expression is no longer viable when pronoun interpretation occurs. To illustrate,

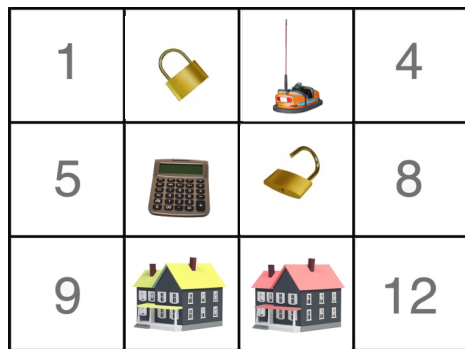


Fig. 1: Example display. Accompanying instructions:
i. Move the house on the left to [area 12/area 9].
ii. Now move it to area 4.

Figure 1 shows a visual environment where objects are located within a grid. Here, the outcome of the instruction “Move the house on the left to area 12” entails that the unmoved/unmentioned house is now the leftmost one. If a subsequent instruction contains a pronoun (e.g., “Now move it...”), critically, the antecedent expression in discourse memory no longer accurately describes the intended referent. Thus, if retrieving the antecedent term’s semantics is central to the process of efficient pronoun interpretation, some measurable processing cost should be observed relative to when the semantics are *still relevant* (e.g., when Instruction 1 was “Move the house on the left to area 9”), despite the intuition that the previously mentioned object is ultimately the intended referent. There were 24 critical trials, intermixed with 24 filler trials that disguised the purpose of the study. Each trial had a sequence of two instructions. Of interest was the pattern of eye fixations upon hearing the pronoun in Instruction 2. (Previous studies have shown that these fixations provide extremely fine-grained measures of sensitivity to semantic information. As such, any effect of a semantic mismatch should be evident in the fixation pattern.) In critical trials, when Instruction 2 contained a pronoun (“Now move it to area 4”), fixation patterns were strikingly similar regardless of whether the antecedent’s semantics were still relevant (Figure 2),

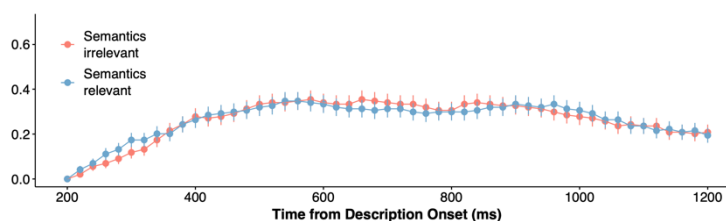


Fig. 2: Fixation patterns over time as the pronoun is heard.

corroborated by contemporary statistical methods. That is, there was no processing penalty when the antecedent term’s semantics were no longer relevant, suggesting little reliance on the antecedent’s linguistic content, which is fully inconsistent with any notion of retrieval.

Study 2 explored perspective reasoning in three antecedent judgement tasks [cf. 3]. **Study 2A** ($N_{pts}=54$) assessed judgements for antecedents of ambiguous pronouns using short sentences like those below (1a-b). There were 24 critical and 24 filler items. Intuitively, a character telling an interlocutor about the information expressed in the subordinate clause should lead readers to interpret the pronoun as coreferring with the main-clause subject, whereas asking should entail main-clause object selections. The results overwhelmingly supported this intuition: Participants selected the antecedent we expected to be “perspectivally-congruent” 99.8% of the time, and there was no order-of-mention bias (which would predict stronger effects for *tell*, where the antecedent is the first-mentioned character). But does this show genuine pragmatic reasoning, or a shallow reliance on cues provided by the verbs *tell* and *ask*?

Study 2B ($N_{pts}=60$) answered this question by manipulating a context sentence containing information that, critically, could shift Study 2A’s patterns (“shifting” condition, 2a-b). A “neutral context” condition, which should preserve the patterns, was also included (2c). There were 20 critical and 24 filler items. In the shifting context cases, readers *reversed* the preferences shown earlier, selecting object antecedents 77% of the time for *tell* cases and subject antecedents 68% of the time for *ask* cases (neutral: 5% for *tell*, 10% for *ask*). This provides compelling evidence that Study 2A’s patterns are not solely due to *tell/ask*, but reflect deeper forms of pragmatic reasoning.

Study 2C ($N_{pts}=60$) explored whether the interpretive patterns from Study 2B occur spontaneously within a standalone sentence, where readers cannot rely on a situation model generated from a previous sentence, but instead must incorporate intrasentential cues on the fly. There were 20 critical and 24 filler items. We kept the main verb constant (*ask*) but made simple changes that varied what readers knew about the object antecedent. For example, in (3a, “neutral”), Max is likely asking if the addressee (his son) understood an assignment, yet in (3b, “shifting”), it seems more likely that Max is asking the addressee (his tutor) about himself, as a tutor would hold the relevant expertise to make this judgement. In neutral cases, readers selected object antecedents 87% of the time. However, in shifting cases, readers now preferred subject antecedents 86% of the time, showing a reversal from default preferences. This further shows the effects are not driven solely by the main verb, and that readers make nimble and rational inferences from any information available to them. Taken together, Studies 1 and 2 highlight how even very straightforward cases of pronoun interpretation go beyond superficial, form-based connections, and how antecedent accessibility is driven by sophisticated reasoning processes.

Supplemental Example Sentences

- (1) a. Madeline told Anna that she remembers when the lecture starts.
b. Madeline asked Anna if she remembers when the lecture starts.
- (2) a. Molly, a tour guide, was talking to Hana, who is unfamiliar with Japanese currency. Molly told Hana that she had enough cash to buy a sandwich. *[shifting-tell]*
b. Molly, who is unfamiliar with Japanese currency, was talking to her tour guide, Hana. Molly asked Hana if she had enough cash to buy a sandwich. *[shifting-ask]*
c. Molly, who noticed it was almost 12:30 PM, was walking with her good friend Hana. Molly [told/asked] Hana [that/if] she had enough cash to buy a sandwich. *[neutral]*
- (3) a. Max asked his son Gerald if he understood the assignment correctly. *[neutral]*
b. Max asked his tutor Gerald if he understood the assignment correctly. *[shifting]*

References: [1] Cunnings & Sturt (2018). *Language, Cognition and Neuroscience*. [2] Arnold et al. (2000). *Cognition*. [3] Smyth (1995). *Journal of Child Language*.