

The real-time interpretation of pronouns and reflexives: Structural and non-structural information

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The observation that English pronouns and reflexives have a (nearly) complementary distribution is central to traditional Binding Theory (BT, ex.1). Picture NPs (PNPs) are a well-known exception, since both pronouns and reflexives are possible. Existing research suggests that semantic/pragmatic factors influence the use of pronouns and reflexives especially in possessorless PNPs (ex.2a), but also in PNPs with possessors (ex.2b), e.g.[14],[8],[15], see also [20],[1]. Here we focus on two complementary claims regarding semantic/pragmatic effects with possessorless PNPs: (i) According to [19], pronouns have a preference for antecedents that are *perceivers-of-information* (see [5],[2] for related discussion of implicit arguments and control). (ii) According to [11], reflexives prefer *source-of-information* antecedents (see also [16],[5],[2]). We approach these claims from an experimental perspective, with three main aims. **First**, we aim to complement existing work by investigating the hypothesized source/perceiver preferences experimentally. Our **second** aim is to investigate how different kinds of information are integrated during real-time processing of PNP pronouns and reflexives. Does source/perceiver information have an effect only after an initial ‘syntax-only’ stage, as two-stage parsing models might predict (e.g.[7], see also [17]), or does it have an impact from the earliest moments onwards, in the spirit of multiple-constraint processing models (e.g.[12],[3])? Our **third** aim is to test the hypothesis, argued for by [9], that anaphoric forms can differ in degree of sensitivity to syntactic and semantic/pragmatic information. According to this approach--based on cross-sentential pronouns and demonstratives--anaphor resolution is guided by multiple factors which are weighted differently for different anaphoric forms. To investigate the time-course of processing and to probe the validity of [9]’s hypothesis for intra-sentential PNP pronouns and reflexives, we used the visual-world eye-tracking paradigm [18] to obtain both fine-grained time-course data and action-based reference resolution information.

Exp.1--Eye-movements were recorded as participants (n=16) listened to sentences with possessorless PNPs while looking at displays with two characters and a picture of each character (ex.3). Verb type (*heard/told*) and anaphoric form (pro/refl) were crossed to create four conditions. The task was to click on the picture mentioned in the sentence. **Results:** With pronouns, participants show a perceiver preference, choosing the subject picture more with *heard* than *told* ($p < 0.01$). In contrast, there is no significant verb effect with reflexives; participants usually chose the subject picture (>85% with both verbs)--a pattern compatible with BT. Eye-movements show that with pronouns, a clear perceiver preference emerges 200ms after pronoun-onset ($p < 0.05$), the earliest point at which input-driven eye-movements are expected (given the time it takes to program and launch an eye-movement [13]). With reflexives, eye-movements reveal an early but more subtle sensitivity to source, starting 200ms after onset; participants look more at the object-picture when it is the source (with *heard*) than when it is the perceiver (with *tell*) ($p < 0.05$). In sum, pronouns and reflexives are sensitive to the verb manipulation early on; there is no sign of an initial syntax-only stage. However, pronouns show a stronger susceptibility to the verb manipulation than reflexives, supporting [9].

Exp.2--Using the same methodology, we further probed the strength of source/perceiver effects by testing possessed PNPs (PPNPs, ex.4). In PPNPs, both Subj and Obj are BT-compatible antecedents for pronouns, but according to traditional BT, PPNP reflexives are constrained to refer to possessors [4]. **Results:** Pronouns again prefer perceivers, as shown by picture choices ($p < 0.01$) and eye-movements ($p < 0.05$). Reflexives strongly prefer possessors, but there are also some subject-picture choices (~8%). Neither picture choices nor eye-movements show clear verb effects for reflexives; the (overt) possessor seems to create a syntactic configuration that prevents reflexives from being sensitive to source-of-information.

Conclusions--In possessorless PNPs, reflexives show an early preference for sources and pronouns a strong early sensitivity for perceivers, indicating that semantic/pragmatic factors influence anaphor resolution from the first moments onwards. In PPNPs, the perceiver preference persists for pronouns, but reflexives show no source bias and mostly refer to what BT predicts, i.e. possessors. Overall, pronouns are

more susceptible to the verb manipulation than reflexives, indicating that in the intra-sentential domain, as well as in cross-sentential reference resolution [9], anaphoric forms can differ in how sensitive they are to different kinds of information. As a whole, these results suggest a theory of anaphor resolution must be fine-grained enough to allow for multiple factors, weighted differently for different anaphoric forms.

(1) Principles A, B and C of Binding Theory (based on [5])

A. A reflexive is bound in a local domain.

B. A pronoun is free in a local domain. C. An R-expression is free.

Binding: A binds B iff A c-commands B, and A and B are coindexed.

C-command: A node A c-commands a node B iff the first branching node dominating A also dominates B, and A does not dominate B.

(2a) PNP without possessor: Lisa likes the picture of herself/her.

(2b) PNP with possessor: Lisa likes Mary's picture of herself/her.

(3) **Exp.1** Scene = Peter, Andrew, picture of Peter, picture of Andrew

(3a) Peter_{source} **told** Andrew_{perceiver} about the picture of {him/himself} on the wall.

(3b) Peter_{perceiver} **heard** from Andrew_{source} about the picture of {him/himself} on the wall.

(4) **Exp.2** Peter {told/heard from} Andrew about Greg's picture of {him/himself} on the wall.

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