Reflexives and pronouns in picture noun phrases: Using eye movements as a source of linguistic evidence

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1 Introduction

The observation that pronouns (e.g., *him*) and reflexives (e.g., *himself*) in English have a nearly complementary distribution (see (1)) has played a central role in syntactic theory since the 1960s when generative linguists began to formulate the structural conditions that now form the basis of current theories of "binding".

(1)   a. Ken$_i$ saw him$_{j/*i}$.

         b. Ken$_i$ saw himself$_{i/*j}$.

By the late 1960s researchers had recognized that the hierarchical arrangement of phrases in a sentence was relevant to the distribution of pronouns and reflexives (Ross 1969, Langacker 1969), and research in the 1970s further clarified these syntactic conditions (Lasnik 1976, Reinhart 1976, Chomsky 1980). Binding Theory (BT) continues to play a prominent role in current syntactic theory and the patterns of distribution for pronouns and reflexives are used to diagnose and argue for syntactic structure (Larson 1988, Chomsky 1995). Binding Theory principles are also assumed to guide reference resolution in real-time human sentence processing as well (Nicol & Swinney 1989, Badecker & Straub 2002).

Despite the widespread acceptance of Binding Theory, it has repeatedly been observed that the preferred interpretation and acceptability of pronouns and reflexives can be modulated by pragmatic and discourse factors, most clearly in so-called "picture" noun phrases (e.g. Kuno 1987, Pollard & Sag 1992, Reinhart & Reuland 1993). The examples in (1) illustrate this. First, no standard structural BT predicts that a reflexive will find its antecedent in another sentence. Second, we see that the different pragmatic contexts affect the acceptability of this reflexive:

(2)   John$_i$ was going to get even with Mary. That picture of himself$_i$ in the paper would really annoy her, as would the other stunts he had planned.

(3)   Mary was quite taken aback by the publicity John$_i$ was receiving. *That picture of himself$_i$ in the paper would really annoy her, as would the other stunts he had planned. [from Pollard & Sag 1992]

In addition, the linguistic intuitions about acceptability that have formed the primary data for Binding Theory are often graded and influenced by context (Keller & Asudeh 2001). Moreover, they are often unstable within individual consultants and across consultants, most likely because the judgments are both graded and context-dependent.

2 Current Research

Our research further explores a novel experimental approach to how Binding Theory applies to pronouns and reflexives first presented in Runner, Sussman & Tanenhaus (2003). Participants were seated in front of the display in Fig 1, with three male dolls and photos of the dolls in a column directly above each doll. We monitored eye movements as participants followed pre-recorded spoken instructions containing pronouns and reflexives (e.g., *Pick up Ken. Have Ken touch Harry's picture of him/himself*). The choices made by participants provide implicit judgments about how the pronouns and reflexives are interpreted. The pattern and timing of eye movements provide information about which potential referents are considered, and how the referential domain varies as a function of the participant's interpretation.

Figure 1

The research presented here directly examines the complementarity assumption, the relevance of structural configuration, and the on-line reference resolution process for pronouns and reflexives in picture NPs containing possessors, such as *Joe's picture of himself/him.* This approach is novel since, as noted above, while many researchers have argued that a reflexive in a picture NP without a possessor is not constrained by structural BT, no currently accepted version of BT predicts such behaviour of a reflexive in a picture NP with a possessor.

Drawing on the results of a series of studies, we demonstrate that while Binding Theory is generally followed for pronouns, it is frequently violated for reflexives (Fig 2 left panel). Moreover, complementarity breaks down in ways that make it difficult to maintain the standard view that reflexives in such NPs are subject to BT. Though BT predicts that pronouns and reflexives should have complementary referential domains, we find that pronouns and reflexives may both take the subject of the sentence as antecedent (Fig 2 right panel).
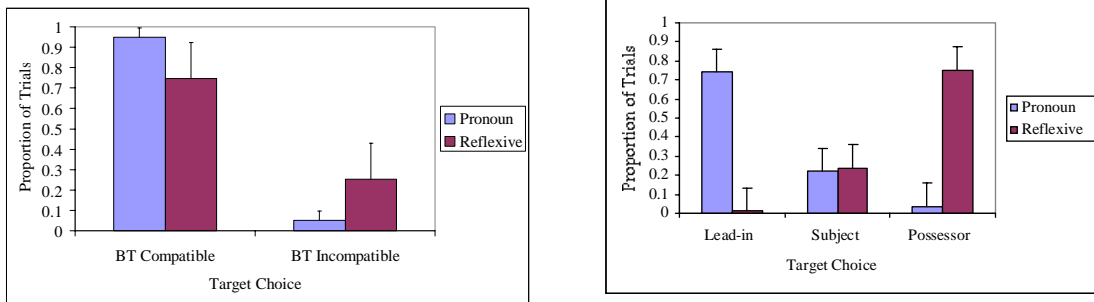

Figure 2

In addition, we show that Binding Theory-incompatible referents are not excluded from consideration early on in reference resolution, even for pronouns, which do appear to be sensitive to BT. Fig 3 left panel shows the proportion of looks to the three relevant dolls on the reflexive conditions where we isolated the trials in which participants chose the (BT-compatible) possessor. Even on these trials, there is evidence of early looks to the (BT-incompatible) subject. Fig 3 right panel shows data from the first 1000 ms of the pronoun trials. Though over 90% of the trials resulted in a BT-compatible referent choice, in the earliest moments looks to the possessor and the subject are indistinguishable.
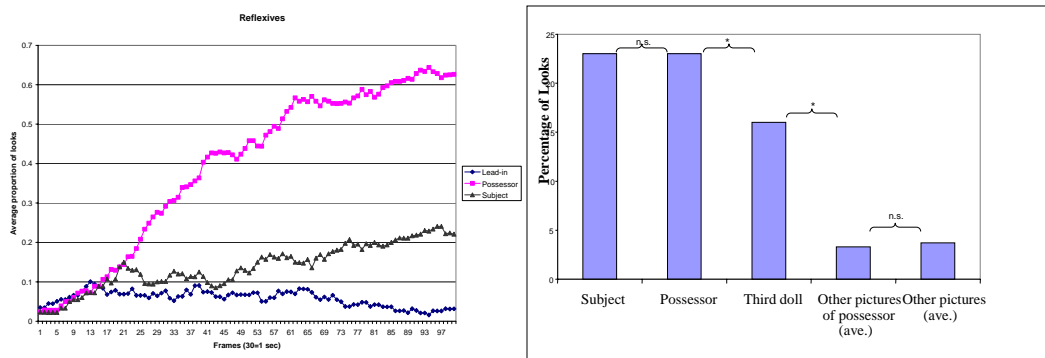

Figure 3

One manipulations allowed us to test another hypothesis. One might argue that since the word 'himself' appears to contain the word 'him', participants are briefly garden-pathed and their earliest looks would be compatible with the instructions containing 'him', thus potentially explaining the early looks to the subject on the reflexive condition. In one experiment we provided two sentence external "lead-in" phrases,

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whose order was varied. This order variation significantly affected the target choice for pronouns, but not for reflexives. The earliest looks from this experiment show that on the pronoun conditions but not on the reflexive conditions participants' eye movements already clearly distinguish between the lead-in conditions. This provides evidence against the word-internal garden path hypothesis.

These results support three major conclusions. First, Binding Theory does not provide a satisfactory account of the interpretation of reflexives in picture NPs. BT is frequently violated for these reflexives, and their antecedents are not in complementary distribution with those of pronouns as predicted by BT. Second, reflexives in picture NPs with possessors appear to behave as BT-exempt logophors rather than as argument reflexives. And third, BT cannot be viewed as an early filter that constrains the set of potential referents. BT-inappropriate referents were considered early on in processing for both reflexives and for pronouns. The results for pronouns are particularly problematic for the early filter hypothesis because pronouns generally behaved as predicted by BT.

These conclusions have several implications. First, our demonstration that reflexives in picture NPs with possessors are logophors extends the proposals of Pollard and Sag (1992) and Reinhart and Reuland (1993), which were originally limited to reflexives in picture NPs without possessors. In addition to unifying the analysis of reflexives, our results challenge the validity of arguments that use reflexives in picture NPs to diagnose syntactic structure. We show that attempts to salvage such arguments by proposing a null pronominal subject for reflexives in picture NPs without possessors cannot be extended to picture NPs with possessors.

Second, our demonstration that listeners initially consider Binding Theory-inappropriate referents highlights the importance of using paradigms that allow for interpretation-contingent analyses. We are able to carefully evaluate the early filter hypothesis (Nicol & Swinney 1989) because we could examine behaviour for trials in which we could restrict our analyses to BT-appropriate interpretations.

Finally, the linguistic community is increasingly looking to new sources of data to complement data from linguistic intuitions. The experimental approach we have adopted may prove useful in addressing other linguistic issues. A particularly appealing aspect of the paradigm is that it provides insights into real-time processing while also providing an implicit judgment. This may make it easier for psycholinguists and linguists to relate data from tasks like these to the data from intuitions – a significant step towards bridging the gap between theoretical linguistics and psycholinguistics.

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