

The Influence of Binding Theory on the On-Line Reference Resolution of Pronouns

Although eye movement studies of spoken language are increasingly used to explore a wide range of psycholinguistic questions, this methodology has only just begun to be used to explore questions of interest within linguistic theory. The current studies use this methodology to examine how binding constraints are used in processing reflexives and pronouns. Runner, Sussman & Tanenhaus (WCCFL, 2002) examined whether reflexives and pronouns in picture NPs containing possessors (e.g., "Joe's picture of himself/him") were constrained by Binding Theory (BT). The eye-tracking approach allowed them to gather two types of data relevant to this question: (1) the picture chosen by the participant indicates a kind of "judgment" of how they interpreted the NP; and (2) the time-course of looks revealed the potential (lack of) influence of BT on the reference-resolution process. They found that while the reference resolution of the pronouns was consistent with BT, that of the reflexives was not. The hypothesis they proposed was that reflexives in this construction are "exempt" from BT (Pollard & Sag, 1992), or are "logophors" (Reinhart & Reuland, 1993).

The current work focuses on pronouns. Since pronouns in picture NPs with possessors are ultimately constrained by Binding Theory, examining the time course of looks should reveal the on-line influence of BT on the reference resolution process. Two possibilities have been explored in the sentence processing literature. The early filter hypothesis (Nicol & Swinney, 1989 and more recently, Sturt, in press) claims that the structural constraints of BT are employed by the sentence processing system from the earliest moments of reference resolution, essentially "filtering" out potential antecedents for anaphoric expressions which do not satisfy BT. An alternative proposal is the multiple constraints hypothesis (Badecker & Straub, 2002), which claims that the structural constraints of BT are one subset of a larger set of constraints all applying simultaneously during sentence processing.

Our (21) participants were seated in front of a display (Figure 1) containing three male dolls (Joe, Ken and Harry). Attached to a board behind each doll was a column of digitized photos of each of the dolls. Participants were told that each doll owned the pictures behind him. Sample instructions included sequences such as:

A. Pick up Joe. Have Joe touch Ken's picture of him/himself.

The results replicated Runner et al (2002): BT did an excellent job of predicting the target choices for pronouns (5% violation) but not reflexives (20% violation). We then isolated the first 1000 ms from the onset of the pronoun and compared the proportions of fixations to the various pictures in the display, averaged over all of the subjects. Our results clearly indicate that at the earliest moments of processing BT does not filter out potential referents incompatible with BT. Using (A) as an example, 22% of the looks were to Ken's picture of Joe, the main referent compatible with BT; however, a statistically identical amount of looks (22%) were to Ken's picture of Ken, the one referent clearly ruled out by BT [1]. Participants' looks to the BT incompatible picture cannot be attributed to fixations launched for the sole purpose of searching the scene, since the third picture in the same column (Joe's picture of another doll) receives a significantly smaller percentage of looks (<14%). The looks to the BT Incompatible picture also cannot be attributed to the participants' looking at pictures of the overtly mentioned possessor more frequently, since looks to the other two photos of the possessor (here, Ken) are at 2.7% and 3.9%, and are not statistically different from the percentage of looks to other pictures outside the possessor's column in the display (3.7% on average)(Figure 2). By the end of the trials, however, the looks have come to mirror the final target choices: 84.3% to Ken's picture of Joe and only 4.9% to Ken's picture of Ken (Figure 3); This close match between the two measures further confirms that the eye movements do a good job of indicating referents under consideration.

Our results are inconsistent with the early filter hypothesis, but fully consistent with the multiple constraints hypothesis. They also demonstrate that the eye-tracking methodology can be successfully employed to study questions of interest to researchers of both syntactic theory (Binding Theory) and language processing.



Figure 1. Display

[1] All differences mentioned are reliable at standard significance levels, i.e., $p < .05$.



Figure 2. Percentage of looks to pictures in display during first 1000 ms after onset of pronoun

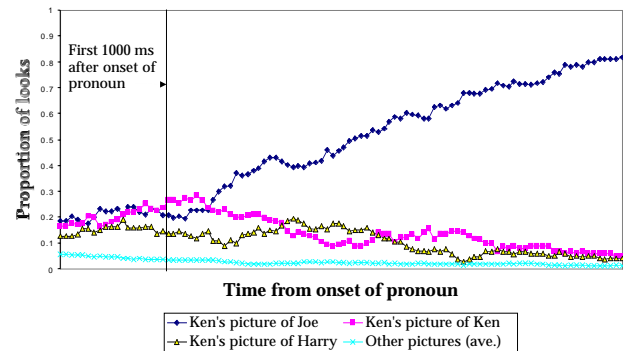


Figure 3. Proportion of looks to pictures in display beginning at onset of pronoun

References

- Badeker, W. & K. Straub (2002) "The Processing Role of Structural Constraints on the Interpretation of Pronouns and Anaphors," *Journal of Experimental Psychology: Learning, Memory, and Cognition* 28: 748-769.
- Nicol, J. & D. Swinney (1989) "The Role of Structure in Coreference Assignment During Sentence Comprehension," *Journal of Psycholinguistic Research* 18: 5-19.
- Pollard, C. and I. Sag (1992) "Anaphors in English and the Scope of Binding Theory," *Linguistic Inquiry* 23: 261-303.
- Reinhart, T. and E. Reuland (1993) "Reflexivity," *Linguistic Inquiry* 24: 657-720.
- Runner, J.T., R.S. Sussman and M.K. Tanenhaus (2002) "Logophors in Picture Noun Phrases," in L. Mikkelsen and C. Potts (eds.) *WCCFL 21 Proceedings*, Somerville, MA: Cascadia Press.
- Sturt, P. (in press) "The Time-Course of the Application of Binding Constraints in Reference Resolution," *Journal of Memory and Language* 48: 542-562.