



The role of recognition memory in anaphor identification

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Abstract

In studies of anaphor comprehension, the capacity for recognizing a noun in a sentence decreases following the resolution of a repeated-noun anaphor (Gernsbacher, 1989). In studies of recognition memory, the capacity for recognizing a noun in a scrambled sentence decreases following the recognition that another noun has occurred before in the scrambled sentence (Dopkins & Ngo, 2002). The results of the present study suggest that these two phenomena reflect the same recognition memory process. The results suggest further that this is not because participants in studies of anaphor comprehension ignore the discourse properties of the stimulus materials and treat them as lists of words upon which memory tests are to be given. These results suggest that recognition processes play a role in anaphor comprehension and that such processes are in part the means by which repeated-noun anaphors are identified as such.

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Extensive memory resources are brought to bear in the comprehension of a discourse. Shorter-term memory supports the on-line computation of discourse meaning (Almor, 1999; Just & Carpenter, 1992). Longer-term memory provides information necessary for the drawing of inferences and preserves the content of the discourse once it is comprehended (Graesser, Singer, & Trabasso, 1994; Kintsch, 1988). Much remains to be learned about the memory processes that are involved during comprehension. We still do not understand how these processes operate and how they are related to the memory processes that are studied with traditional memory tasks (Glenberg & Kruley, 1992; Gordon, Hendrick, & Foster, 2000; Gordon, Hendrick, & Johnson, 2001; Gordon, Hendrick, & Levine, 2002).

The present study focused on a memory process that is associated with *anaphor* comprehension. Each time an entity is mentioned following its introduction in a passage, the entity is identified by means of an anaphoric expression. When such an expression is encountered, an *antecedent* must be located in the preceding material. When this is accomplished, the anaphor is said to be *resolved* (Cacciari, Carreiras, & Cionini, 1997; Garnham, 1985, 1987, 2001; Garnham, Oakhill, & Cain, 1997; Garrod, Freudenthal, & Boyle, 1994; MacDonald & MacWhinney, 1995).

Memory processes are implicated in anaphor resolution, by virtue of the fact that the capacity for recognizing words from a passage changes with the resolution of an anaphor in the passage. The anaphor's antecedent is recognized more quickly and/or more accurately at this point (Cloitre & Bever, 1989; Corbett & Chang, 1983; Dell, McKoon, & Ratcliff, 1983; Gernsbacher, 1989; O'Brien, 1987; O'Brien, Duffy, & Myers, 1986; O'Brien,

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Plewes, & Albrecht, 1990). At the same time, other words in the passage are recognized less quickly and/or less accurately (Gernsbacher, 1989; McDonald & MacWhinney, 1990; Nordlie, Dopkins, & Johnson, 2001). The present study explored the process underlying the latter phenomenon.

The phenomenon came to light in a study by Gernsbacher (1989). The stimulus materials for the critical trials in the study were short, two-clause, sentences. In the first clause of each sentence, two characters were introduced, identified with proper nouns. At the beginning of the second clause, a repeated-noun anaphor occurred whose antecedent was the proper noun that had been used to identify one of the characters (e.g., Ann predicted that Pam would lose the track race, but Pam came in first very easily). Participants performed a *recognition probe task* using these sentences as stimulus material. On each trial, the participant read a sentence, word by word, and responded to a recognition probe that was presented either before or after the anaphor. A striking pattern of results was observed when the test word was the proper noun that was not the anaphor's antecedent. The *non-antecedent* was recognized more slowly after than before the anaphor.

Gernsbacher attributed her results to a process associated with anaphor comprehension. She proposed that the function of the process is to suppress *competitors* to the antecedent of a repeated-noun anaphor and thereby promote retrieval of the antecedent. In other words, the function of the process is to suppress words that might potentially be the antecedent but actually are not. As a consequence of the process, competitors are subject to a recognition decrement following the resolution of a repeated-noun anaphor (Gernsbacher, 1989, 1990) Gernsbacher's interpretation of her results may warrant closer scrutiny in the light of some recently reported results.

Dopkins and Ngo (2002) observed something similar to Gernsbacher's recognition decrement using a procedure that followed Gernsbacher except that the order of the words in the stimulus sentences was scrambled. On each trial, the participant read a scrambled sentence, responded to a recognition probe, and indicated whether the sentence contained any repeated words. In the crucial condition, the test word was a noun from the sentence and the last word in the sentence was another noun that was repeated from earlier in the sentence. The test word was recognized less well in this condition than when (1) an adverb was inserted in place of the repeated noun, (2) a new noun was inserted in place of the repeated noun, or (3) the sentence ended immediately before the repeated noun.

Dopkins and Ngo (2002) concluded (1) that participants, perhaps under pressure from the requirement that word-repetition be monitored, recognized the repeated noun as having occurred before in the scrambled sen-

tence, and (2) that the test noun was recognized less well as a consequence of this recognition judgement. Dopkins and Ngo inferred that the process underlying their results could not be specific to anaphor comprehension because their stimulus items had no discourse properties. Instead the process must be general to recognition memory, and must operate as follows: when a word (here, the repeated noun) is recognized as having occurred in a memory set (here, the scrambled sentence), other words in the memory set (here the test noun) are subject to a recognition decrement.

Dopkins and Ngo (2005) demonstrated that the Dopkins and Ngo (2002) recognition decrement generalizes to a traditional memory paradigm. On each trial, the participant read a scrambled sentence and made recognition judgments to two common nouns in succession. The second test word was recognized less well when the first test word came from the sentence than when it did not.

The Dopkins and Ngo (2002) recognition decrement may have interesting implications for our understanding of the Gernsbacher recognition decrement and of anaphor comprehension in general. According to this line of thinking, the Gernsbacher and Dopkins and Ngo phenomena reflect the same underlying process. Thus, Gernsbacher's phenomenon reflects a memory rather than a comprehension process. This is because the comprehension of a repeated-noun anaphor depends on the general capacity for recognition memory, as follows: in order for any anaphor to be resolved, it must first be identified as an anaphor. An initial clue that a noun should be identified as an anaphor emerges by virtue of the fact that the noun is recognized as having appeared previously in the current passage. When this happens, further processing determines whether the noun is in fact an anaphor. As a consequence of the act of recognition, other words in the passage are subject to a recognition decrement, through a process such as Dopkins and Ngo proposed.

To advance the forgoing interpretation, we must deal with two objections. According to the first objection, the Gernsbacher (1989) and Dopkins and Ngo (2002) phenomena do not reflect the same underlying process. On one hand, the Gernsbacher recognition decrement reflects an anaphor comprehension process. On the other hand, the Dopkins and Ngo recognition decrement reflects a memory process. Under this view, then, the Dopkins and Ngo phenomenon has no relevance for the Gernsbacher (1989) phenomenon and thus no relevance for anaphor comprehension.

According to the second objection, the Gernsbacher (1989) and Dopkins and Ngo (2002) phenomena reflect the same underlying process, but not for the reasons suggested earlier. Under this account, participants in recognition probe tasks ignore the discourse properties of the stimulus materials and treat them as simple lists of words upon which memory tests are to be given. Thus,

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