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Author

Crawley, Rosalind A.

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SOME FACTORS INFLUENCING THE COMPREHENSION
OF PRONOUNS IN TEXTS

Rosalind A. Crawley

Department of Psychology
University of Durham
England

The interpretation of pronouns depends on a number of factors ranging from the purely linguistic through to general knowledge of the world. Thus, the study of pronoun comprehension can provide important insights into the more general question of comprehension during reading. Some of the factors influencing pronoun comprehension operate at the level of the single sentence (the local level) and others operate at the level of the text as a whole (the global level). Although there has been quite a lot of work on the factors affecting pronoun comprehension at these two levels separately (e.g. Ehrlich, 1980; Springston, 1975), they are rarely considered together. Thus, a major aim of this study was to examine the relationship between the factors affecting pronoun comprehension at the local and global levels.

Two local factors and one global factor were examined. The two local factors were the linguistic constraint of lexical agreement (specifically, gender agreement) and the heuristic strategy of subject assignment. The global factor examined was topicalisation at the text level. There is evidence to suggest that all three of these factors might be important for resolving pronominal reference. For example, the presence of a gender cue facilitates the comprehension of pronouns in isolated sentences (e.g. Ehrlich, 1980). Similarly, the use of a subject assignment strategy is suggested by the observation that in written texts the subject of the sentence is frequently the antecedent for a pronoun (e.g. Grober, Beardsley & Caramazza, 1978; Hobbs, 1976). In addition, at the global level several people have suggested that the global topic, or main character in a text is a likely antecedent for a pronoun (e.g. Clancy, 1980; Sanford & Garrod, 1981).

It seems likely that surface features of a text may signal a character as the global topic. These features include the title of a text (Kieras, 1979; Kozminsky, 1977), initial mention in a text (Kieras, 1978; Sanford & Garrod, 1981) and frequency of mention (Perfetti & Goldman, 1974). Thus, a second aim of this study was to determine whether variation in the number of features signalling the topic causes any variation in its influence on pronoun comprehension.

In the three experiments reported here, Subjects were asked to read short passages of text. Each passage contained one target sentence in which there were two pronouns and two potential antecedents. In some of the target sentences, the pronouns' antecedents could not be determined by gender cues (ambiguous pronouns), for example, "Shaun led Ben along the path and he

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called to him to be careful". In others, the pronouns' antecedents could be uniquely identified using gender cues (unambiguous pronouns), for example, "Clare led Ben along the path and she called to him to be careful". This is the gender cue manipulation. In addition, since one of the potential antecedents occurred in subject position, the influence of the subject assignment strategy could be determined. Finally, one of the potential antecedents was the topic of the passage so the effect of topicality could also be manipulated.

EXPERIMENT 1

Twelve experimental passages were presented one sentence at a time on the screen of a microcomputer. Subjects were asked to press a key as soon as they had understood each sentence. The key press caused the next sentence to appear, following on from the previous one as in normal text. Once a sentence had appeared on the screen, it remained there until the Subject had read the whole passage.

Each passage mentioned two characters; the topic and the nontopic. The topic was signalled by using the topic's name as the title of the passage, by mentioning the topic first in the passage and by mentioning the topic more frequently than any other character in the passage. The passages were six sentences long and the target sentence appeared as the fifth sentence. There were six versions of each target sentence; two containing ambiguous pronouns and four containing unambiguous pronouns. Figure 1 shows an example of the materials.

In the first clause of each target sentence, the topic and nontopic were mentioned by name and in the second, they were referred to again using pronouns. There were two versions of the ambiguous target sentences: Either the topic or the nontopic appeared as the subject of the sentence (see sentences 1 and 2, Figure 1). The second, pronominal clause was the same in the two conditions. A question at the end of each passage enabled the assignment of these pronouns to be determined. Any preference for assigning these linguistically ambiguous pronouns to the subject of the sentence or the topic of the passage would be revealed in these assignments.

The four unambiguous conditions can best be described in terms of who the subject pronoun referred to. It referred to the topic in subject position (sentence 3), the topic in object position (sentence 4), the nontopic in subject position (sentence 5) and the nontopic in object position (sentence 6). Reading rates for these unambiguous conditions were examined. If gender cues alone are used for understanding pronouns, there should be no difference in reading rates for the four conditions. Any preference for assigning the subject pronoun to the subject of the sentence or the topic of the passage should be accompanied by faster reading rates in the conditions where the linguistically constrained assignment is in accordance with these preferences.

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Topic = Shaun / Clare Nontopic = Ben

a. First four sentences

SHAUN

Shaun started to get worried as it became darker and the mist grew thicker. He was the leader of this walking expedition in the Lake District and he felt responsible for the others following him. He hadn't realised it would take them so long to walk back. They came to a place where the path narrowed over a steep drop and Shaun decided to go ahead with his friend Ben to make sure it was safe before the others followed.

(Clare was substituted for Shaun in the unambiguous passages.)

b. Six versions of the target sentence

Ambiguous

1. T=S Shaun led Ben along the path and he called to him to be careful.
2. NT=S Ben led Shaun along the path and he called to him to be careful.

Unambiguous

Pronoun refers

to:

3. T,S Clare led Ben along the path and she called to him to be careful.
4. T,O Ben led Clare along the path and she called to him to be careful.
5. NT,S Ben led Clare along the path and he called to her to be careful.
6. NT,O Clare led Ben along the path and he called to her to be careful.

c. Final sentence

They got safely over to the proper path and shouted to the others that it was all right and eventually they all made their way down to their minibus at the bottom.

FIGURE 1 EXAMPLE PASSAGE FROM EXPERIMENT 1
(T = Topic, NT = Nontopic, S = Subject, O = Object)

The ambiguous conditions will be considered first. Table 1 shows the number of subject and object assignments in these two conditions. There were far more assignments to the subject than to the object (Min F' = 52.21, df = 1, 24, p <.01). Thus, there was a strong preference for making assignments in accordance with the subject assignment strategy. There was also an interaction between condition and assignment to the subject or object (F1 = 8.31, df = 1, 119, p <.01; F2 = 4.17, df = 1, 11, p =.06). This indicates a stronger tendency to assign the subject pronoun to the subject of the sentence when it was also topic of the passage. Thus, the topic of the text also influenced

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TABLE 1 ASSIGNMENTS - EXPERIMENT 1, AMBIGUOUS PASSAGES

	Assignment to	
	SUBJECT	OBJECT
T = S	194	46
NT = S	167	73
Means	181	60

the assignment of the linguistically ambiguous pronouns.

Reading rates for the two conditions also showed an effect of topic (see Table 2). Sentences in which the topic was subject were read faster than sentences in which the nontopic was subject (Min $F' = 4.86$, $df = 1, 19$, $p < .05$).

The unambiguous conditions will now be considered. Table 3 shows the reading rates for the unambiguous conditions. (Here, the discussion will be confined to the assignment of the subject pronoun in each target sentence.) The clearest effect in these unambiguous conditions is an effect of topic. Reading rates were faster when the pronoun referred to the topic rather than the nontopic (Min $F' = 5.39$, $df = 1, 31$, $p < .05$). There was also some suggestion of an effect of the subject. Sentences in which the pronoun referred to the subject were read faster than sentences in which the pronoun referred to the object. However, this effect only held up in the $F1$ analysis ($F1 = 4.23$, $df = 1, 119$, $p < .05$; $F2 = 1.46$, $df = 1, 11$, $p = .25$). There was no interaction.

The results of Experiment 1 show that both local and global factors act together to influence pronoun comprehension. While the local subject of the sentence was clearly preferred as the antecedent for linguistically ambiguous pronouns, this effect was modified by an influence of the global topic. The global topic also influenced the ease of reading the ambiguous target sentences. Similarly, even when there was a clear gender cue present in the unambiguous conditions, both the local subject and the global topic influenced the ease of assignment, although in these sentences, the effect of the topic was stronger than the effect of the local subject.

TABLE 2 MEAN READING RATES (WORDS PER SECOND) - EXPERIMENT 1, AMBIGUOUS PASSAGES

T = S	NT = S
4.25	3.65

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TABLE 3 MEAN READING RATES (WORDS PER SECOND) - EXPERIMENT 1, UNAMBIGUOUS PASSAGES

Pronoun referent	TOPIC	NONTOPIC	Means
SUBJECT	4.37	4.05	4.21
OBJECT	4.14	3.87	4.01
Means	4.26	3.96	

However, it is not clear exactly which features of the topic produced these effects (title, initial mention or frequency of mention). In the next two experiments, the number of features signalling the topic was reduced to two (title and initial mention) to see whether or not frequency of mention was critical for the topic's influence on pronoun comprehension. In the next two experiments, ambiguous and unambiguous pronouns were studied separately; ambiguous pronouns in Experiment 2 and unambiguous pronouns in Experiment 3.

EXPERIMENT 2

The twelve experimental passages used in this experiment were similar to the ambiguous passages used in Experiment 1 except that the frequency with which the topic and nontopic were mentioned was equalised. Thus, the topic was no longer distinguished from the nontopic in terms of how often it was mentioned. There were also a few other minor changes to the materials. For example, most of the target sentences were shortened so that any information superfluous to the assignment of the pronouns was discarded, and the recency with which the topic and nontopic were mentioned before the target sentence was counterbalanced. In every other way, the materials were the same as the

TABLE 4 ASSIGNMENTS - EXPERIMENT 2

	Assignment to	
	SUBJECT	OBJECT
T = S	57	14
NT = S	55	17
Means	56	16

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TABLE 5 MEAN READING RATES (WORDS PER SECOND) - EXPERIMENT 2

T = S	NT = S
4.03	3.63

ambiguous passages used in Experiment 1. As before, there were two versions of each target sentence: The topic or nontopic was subject of the sentence. The task was the same as in Experiment 1.

Table 4 shows the number of assignments to the subject and object in each condition. There were more assignments to the subject than to the object (Min $F' = 32.05$, $df = 1, 17$, $p < .01$). But there was no difference in the pattern of assignments in the two conditions and no interaction. Thus, while there was still a strong effect of the local subject, there was no effect of topic on assignments in this experiment. However, there was an effect of topic on reading rates. Table 5 shows the mean reading rates in each condition.

Sentences in which the topic was subject were read faster than those in which the nontopic was subject ($F_1 = 6.78$, $df = 1, 23$, $p < .05$; $F_2 = 3.06$, $df = 1, 11$, $p > .1$). (This effect was also significant by passages (F_2) when only sentences in which subject assignments had been made were considered (Min $F' = 4.24$, $df = 1, 29$, $p < .05$) - see Crawley, 1985.)

EXPERIMENT 3

The passages used in this experiment were identical to those used in Experiment 2 except that the topic and nontopic were different genders so that the pronouns in the target sentences could be disambiguated by gender. As in Experiment 1, there were four versions of the unambiguous target sentences (see Figure 1).

The mean reading rates in each condition are shown in Table 6.

TABLE 6 MEAN READING RATES (WORDS PER SECOND) - EXPERIMENT 3

Pronoun referent	TOPIC	NONTOPIC	Means
SUBJECT	3.86	3.63	3.75
OBJECT	3.54	3.69	3.62
Means	3.70	3.66	

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Analysis of these reading rates showed no reliable differences. An examination of the effect of recency of mention of the topic and the nontopic revealed no significant effects either here or in Experiment 2.

Thus, when unambiguous pronouns were presented in the modified passages of Experiment 3, neither the local subject nor the global topic affected the ease of pronoun comprehension. It seems that readers relied on gender cues alone in this experiment.

Overall, the results of these three experiments suggest that both local and global factors act together during pronoun comprehension. At the local level, both gender cues and the local subject affected pronoun comprehension. (Strictly speaking, the subject assignment strategy could in fact be a parallel function strategy; Sheldon, 1974. These two strategies are not distinguished here.) The subject appeared to have a stronger influence on the comprehension of ambiguous pronouns than on the comprehension of unambiguous pronouns. In the absence of linguistic constraints, the subject was the preferred antecedent in both Experiments 1 and 2. When there were linguistic cues available, however, the subject had no influence except for a weak effect in the unambiguous passages of Experiment 1. Thus, heuristics like those involving the subject may only operate in the absence of other strong cues to assignment.

The global topic also influenced pronoun comprehension (Experiments 1 and 2). The topic's influence appeared to depend on the number of factors signalling it. In Experiment 1, where the topic was signalled by the title, initial mention and frequency of mention, it had an effect on both the assignment of ambiguous pronouns and the ease of reading both the ambiguous and unambiguous sentences. In Experiment 2, however, where frequency no longer distinguished the topic from the nontopic, the topic had no effect on the assignment of ambiguous pronouns, although it still had an effect on the ease of reading the target sentences. And in Experiment 3, where frequency did not signal the topic and where gender cues determined assignment unambiguously, there was no effect of topic. This contrasts with the results from the unambiguous sentences of Experiment 1. In the presence of gender cues, the topic clearly has to be very salient before it influences the ease of pronoun comprehension. A tentative explanation for these results is that the topic effect is graded and that topicality is a continuum rather than an all-or-none feature. A more systematic investigation of this proposition is currently in progress.

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