UC Merced

Proceedings of the Annual Meeting of the Cognitive Science Society

Title
Pragmatic Factors In
Pronoun Reference Assignment

Permalink
https://escholarship.org/uc/item/9m87j8fc

Journal
Proceedings of the Annual Meeting of the Cognitive Science Society, 4(0)

Authors
Abbott, Valerie C.
Black, John B.

Publication Date
1982

Peer reviewed

PRAGMATIC FACTORS IN
PRONOUN REFERENCE ASSIGNMENT

Valerie C. Abbott and John B. Black
Cognitive Science Program
Yale University, New Haven, CT 06520

Identifying factors that influence pronoun reference assignment is a challenge to anyone attempting to characterize the process of language understanding. Because a pronoun itself carries only a small part of the meaning that the understander is expected to assign to it, he or she must use contextual information to assign the pronoun an unambiguous referent. Characterizing aspects of the context which are used for this purpose is an active area of psychological research.

Many recent studies have considered the role of syntactic context, that is, the effect of structural constraints on pronoun reference in a fragment of text, typically a sentence, without recourse to constraints which might be found in the meaning of the text (Langacker, 1969; Sheldon, 1974). Shwartz (1981) has found evidence for the use of syntactic information in the resolution of anaphoric pronouns in single sentences. However, strategies based only on syntax are not sufficient to determine unambiguously the referent of all pronouns. Consequently, investigators have examined the role of semantic factors within sentences in directing the assignment of referents (Caramazza, Grober, Garvey, & Yates, 1977; Caramazza and Gupta, 1979; Ehrlich, 1980).

The studies reported here will focus on the use of pragmatic constraints in resolving anaphoric pronouns. Hirst and Brill (1980) have found that these constraints influence the time needed to assign a referent even when that referent can be unambiguously determined by syntactic rules alone. This result indicates that pragmatic context can be expected to play a significant role in reference assignment. However, the text fragments used in their study were only two sentences long, and the nature of the pragmatic considerations involved were not specified. It remains to be determined whether there are identifiable cues in longer texts which influence reference assignment of anaphoric pronouns. We will be concerned with characterizing two major sources of contextual information in paragraph-length texts, and evaluating their influence on pronominal reference assignment.

First, the presence of a clear main character may be expected to play a role in reference assignment. Black, Turner, and Bower (1979) have shown that the point of view provided by a main character has an observable effect on story understanding. In the extreme case, there may be only one character in a story. When there is more than one character, it is still likely that the main character is given primary consideration for reference assignment. This was investigated in the current experiment.

Second, Schank and Abelson (1977) have suggested that the goals and social roles of characters in stories may contribute to reference assignment. If an act is appropriate to a particular goal or role and the agent of the act is specified by a pronoun, it is likely that the pronoun will be disambiguated to the character who has the appropriate goal or role.

Since the goals the characters in a story are pursuing, the roles they are filling, and the identity of the main character can be experimentally manipulated, we can test whether these contextual cues influence pronoun reference assignment. In the experiments reported below we first test whether subjects are sensitive to these cues alone and in combination in a task requiring explicit pronoun reference assignment. Second, in a task in which reading times for lines of text containing pronouns were measured, it was determined whether these sources of pragmatic constraint influenced the difficulty of reference assignment as measured by reading time.

Experiment I: Explicit Assignment

Four simple two-character stories were written. Each story contained an anaphoric pronoun in the final sentence. Either character could be made the main character of the story, or each character might be weighted equally. Additionally, each character was given a role or a goal in the story. Preceding the clause in which the critical pronoun appeared was a phrase containing an action appropriate to the role or goal of one character or other, or an action which was equally likely to have been performed by either of the characters. For instance, in "Brushing off a table, she smiled at her friend." the action preceding the pronoun is consistent with the role of a waitress. Note that in sentences of this sort, the subject of the main clause is interpreted as the agent of the action in the preceding phrase.

Combination of these cues yields five presentation conditions.

- The main character and goal or role cue are both present and indicate the same referent.

- The main character and goal or role cue are both present and indicate conflicting referents.

- Only the main character cue is present.

- Only the goal or role cue is present.

- Neither cue is present.

Each subject was presented with two stories of the type described above, one in each of two conditions. Following each story on a separate page was a multiple choice question requiring identification of the character to whom the anaphoric pronoun referred.

The results of this experiment are summarized in Figure 1 below. When main character and role or goal cues led to assigning the same character as referent, pronoun reference was determined in accord with both by 84% of the subjects, a significant difference from chance ($\chi^2 = 10.72$, $p < .01$). This shows that main character and role and goal manipulations are powerful enough to influence pronoun assignment when used together. In the case in which neither main character nor the phrase preceding the pronoun provided a cue concerning pronoun reference, subjects chose both characters almost equally often as the referent of the pronoun, 46% of the subjects choosing one and 54% choosing the other ($\chi^2 = 0.12$, ns). When the phrase preceding the pronoun was neutral with respect to the roles or goals of both characters in the stories, but there was a main character,

this character was adopted as the referent of the pronoun by 82% ($\chi^2 = 9.02$, $\underline{p} < .01$) of the subjects. This is essentially the same level of performance as was observed with both sources of information avalable to the subjects. However, when both characters were given equal weighting in the story, but the phrase preceding the pronoun was appropriate to the role or goal of one character, the referents chosen were consistent with this character for only 62% ($\chi^2 = 1.07$, ns) of the subjects. This pattern of results seems to indicate that subjects are not making extensive use of information about the relationship between an action the agent of which is specified by a pronoun, and the known goals and roles of characters, in assigning the pronoun a referent.

However, this interpretation is complicated by the results of the condition in which subjects had to make a choice between an assignment to the main character of the passage, or to another character with the role or goal appropriate to the action preceding the pronoun. In this situation, subjects chose the assignment which agreed with the main character 38% of the time, and chose the assignment which agreed with the role or goal context 62% of the time. Although this result is not significantly different from chance ($\chi^2 = 1.07$, ns), a difference in the opposite direction would be expected if only main character cues were influencing the choice. This result indicates that although a character's goal or role is not always sufficient to influence pronoun assignment alone, it is important when seen in combination with other information. The difference between the choice of

| | CHOICE | |
CONDITION	CONSISTENT WITH CUE(S)	INCONSISTENT WITH CUE(S)
BOTH CUES (CONSISTENT)	84	16
MAIN CHAR CUE ONLY	82	18
GOAL OR ROLE CUE ONLY	62	38
BOTH CUES[a] (CONFLICT)	62	38
NEITHER[b] CUE	54	46

[a] consistent = consistent with goal or role cue
[b] consistency arbitrarily determined

Figure 1: Subjects' choice of pronoun referents in percent.

referent in this condition and in the condition in which main character identity is the only cue available is significant ($\chi^2 = 15.47$, $\underline{p} < .001$). The utility of main character information thus seems to be dependent on the absence of conflicting information.

The results of the this experiment indicate that the extent to which subjects chose one referent or the other was governed by the contextual cues manipulated. The main character of the story was most effective in influencing reference assignment, with consistency of the pronoun's context with the goal or role of a character effective in nullifying this main character effect.

It is conceivable that in this experiment asking explicitly about the referent of a pronoun altered subjects' responses. Thus, it seemed desirable to obtain another measure of the difficulty of assigning referents to anaphoric pronouns in the same texts.

In the following experiment reading times for the sentences of these texts containing anaphoric pronouns were measured. It was expected that reading times would be fastest for pronouns in the condition in which there was a main character, and the phrase preceding the pronoun was appropriate to the role or goal of that character. Reading times should increase as it becomes increasingly difficult to assign a referent unambiguously to a pronoun.

Experiment II: Reading Time

Materials were the four stories used above and six additional stories of the same type written for this study. Each story could appear in any of the five conditions discussed above. The penultimate line of the story contained the action which was consistent with the role or goal of one character or the other, or with either. The final line of each story was constant over conditions and contained an anaphoric pronoun.

Each subject read the 10 stories, two in each of the five conditions. They were instructed to read the stories for comprehension. Each story was presented one line at a time on a computer terminal, subjects pressing the "Return" key when they had finished reading each line. Reading times for the final line of the story were compared between conditions.
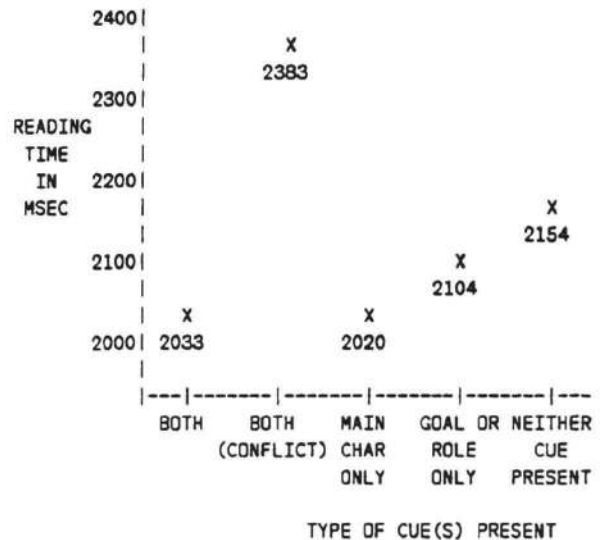

Figure 2: Reading times for a clause containing an anaphoric pronoun

The results for the five conditions are presented in Figure 2. The reading time data is quite consistent with the data seen in Experiment I above. A comparison between the condition in which both cues are present and lead to the same choice of referent and that in which both cues are present but lead to conflicting choices shows faster reading times in the former condition ($F = 4.895$ $\underline{p} = 0.033$). Having only one cue in the form of a main character leads to almost identical reading times as having both cues and results in significantly faster

reading times than the confusing condition ($\underline{F} = 9.487\ \underline{p} = 0.005$). However, although there is a trend, having only the cue of consistency with the goal or role of a character does not lead to significantly faster reading times than the confusing condition ($\underline{F} = 3.022\ \underline{p} = 0.089$). The condition in which neither main character nor consistency with a goal provided a cue as to the reference of the pronoun is a puzzle. Although it is not significantly faster than the confusing condition ($\underline{F} = 1.325\ \underline{p} = 0.258$), it is also not significantly slower than the condition in which both cues are available ($\underline{F} = 0.527\ \underline{p} = 0.480$), the condition in which only the main character is available ($\underline{F} = 0.608\ \underline{p} = 0.448$), or the condition in which only consistency with a goal or role is available as a cue ($\underline{F} = 0.146\ \underline{p} = 0.705$). One possible explanation is that subjects are fairly quick to realize that they have no information with which to make a decision, and proceed in hopes of obtaining the information they need in the remainder of the text. In other words, in the confusing condition, enough information is available, so an attempt is made to find the referent. This proves difficult, leading to increased reading times for such sentences. In the absence of relevant information, the attempt at resolution is deferred.

The results of these two experiments show the influence on pronoun reference assignment of manipulation of pragmatic aspects of the text in which they appear. The main character of the text, in the absence of disconfirming evidence, is quickly and reliably assigned as the reference of these pronouns. They also point out that the influence of some possible pragmatic cues cannot be characterized simply. For example, if the action of an agent represented in the text by a pronoun is consistent with the role or goal of a character, this is not sufficient to lead reliably to assignment of that character to the pronoun. However, the influence of this cue is substantial enough to lead to confusion if there is other evidence indicating another character as the referent. Additionally, it cannot be assumed that the less information available for pronoun reference assignment, the longer it will take subjects to read the sentence in which it appears. From the results of experiment II we can see that subjects proceed rather quickly when they have no information on which to base their choice.

Acknowledgments

References

Black, J. B., Turner, T. J., & Bower, G. H. Point of view in narrative comprehension, memory, and production. *Journal of Verbal Learning and Verbal Behavior*, 1979, **18**, 187-198.

Caramazza, A. & Gupta, S. The roles of topicalization, parallel function and verb semantics in the interpretation of pronouns. *Linguistics*, 1979, **17**, 497-518.

Caramazza, A., Grober, E., Garvey, C. & Yates, J. Comprehension of anaphoric pronouns. *Journal of Verbal Learning and Verbal Behavior*, 1977, **16**, 601-609.

Ehrlich, K. Comprehension of pronouns. *Quarterly Journal of Experimental Psychology*, 1980, **32**, 247-256.

Hirst, W., & Brill, G. A. Contextual aspects of pronoun assignment. *Journal of Verbal Learning and Verbal Behavior*, 1980, **19**, 168-175.

Langacker, R. On pronominalization and the chain of command. In D. Reibel, S. Schane (Ed.), *Modern Studies in English*, Englewood Cliffs: Prentice-Hall, 1969.

Schank, R.C., and Abelson, R.P. *Scripts, Plans, Goals, and Understanding*. Hillsdale, NJ: Lawrence Erlbaum Associates, 1977.

Sheldon, A. The role of parallel function in the acquisition of relative clauses in English. *Journal of Verbal Learning and Verbal Behavior*, 1974, **13**, 272-281.

Shwartz, S. *The search for pronominal referents*. Technical Report 10, Cognitive Science Program, Yale University, 1981.