

# DISCOURSE CONSTRAINTS IN AMBIGUITY PROCESSING: EVIDENCE FROM DICHOTIC LISTENING

Ronald A. Hoppe and Joseph F. Kess

Departments of Psychology and Linguistics  
University of Victoria

## 1. INTRODUCTION

The study of ambiguous sentences has been a critical area of study in both linguistics and psycholinguistics. In linguistics, of course, the centrality of the sentence in the development of linguistic theory required responsive parsing procedures for sentences which admit more than one reading or interpretation. Similarly, in psycholinguistics understanding sentence comprehension would also require that dealing with sentences with multiple readings would be a necessary component of sentence processing, especially when one considers how common ambiguity is in natural language. It has been generally accepted that understanding the way in which ambiguous sentences are processed will be germane to understanding the way in which normal unambiguous sentences are dealt with. This has been taken by many studies to mean inquiring into how the presence of ambiguity might actually affect the computation of the sentence's interpretation, and whether ambiguous sentences as such do show processing differences from unambiguous sentences in a variety of tasks.

However, the problem with ambiguous sentences has been that no easy resolution of the way in which multiple readings of ambiguous utterances are realized in actual sentence processing has been available. There are several studies which argue for a single interpretation or a canonically ordered access approach to the selection of the more probable single reading, but the results of most experiments in ambiguity have tended to suggest that the processing of ambiguous sentences does differ from unambiguous sentences and that multiple readings are in fact considered in the process of deciding upon a single interpretation. There is even considerable evidence that multiple readings are activated for ambiguous sentences despite the presence of context.

One of the most compelling of these studies was a dichotic listening experiment by Lackner and Garrett (1972) in which subjects were dichotically presented with ambiguous sentences and a disambiguating context sentence. Subjects were required to attend to the channel in which the ambiguous sentences were presented and to then immediately paraphrase the ambiguous structure in the attended ear. Although the disambiguating

material in the unattended ear was below active comprehension recognition, its biasing contextual information significantly influenced the interpretation of the ambiguous sentences being consciously attended to. One thus argued from these results that analysis of contextual material in the unattended channel did in fact take place, and that during its input multiple readings for the ambiguity were in fact considered.

Lackner and Garrett's experiment certainly demonstrates that analysis of the linguistic material presented to the unattended ear did take place. This is of course the only reasonable explanation of how the ambiguous sentences were able to be biased in the way in which they were. Equally important is the fact that both of the readings of the ambiguous sentence would have had to be present during the actual processing procedure for the biasing to have effectively taken place, for it was possible to bias the subjects in either direction, in favor of the preferred or the less likely interpretations of the ambiguous sentence. Very simply, their findings underscore the fact that all the readings of an ambiguous sentence are considered and that this is true for all ambiguity types, lexical as well as structural ambiguities. Since the biasing sentence was provided simultaneously with the ambiguous sentence, with processing of both readings taking place in the light of the contextual information which was being presented to the unattended ear and analyzed, the results seem to negate the possibility that only a single analysis is assigned to an ambiguity at the point in time at which it occurs.

Our experiment attempts to provide enough biasing context of a specific and thematically relevant kind, so that only one interpretation is likely. Thus, we hypothesized that listeners would be guided by the organizational frame of reference provided by the flow of discourse we provided as preceding context to choose one and only one reading for the ambiguous sentence. That is, we expected that context of this type would force listeners to evaluate the ambiguities in only the one direction. We have been influenced here by discourse analysis research in the area of text comprehension and the evaluation of the thematic structures we either have or actively construct in our understanding of stories, scripts, and scenes (see Kintsch 1977; van Dijk 1977, 1979; Kintsch and van Dijk 1978; Mandler 1984). According to Kintsch and van Dijk, a discourse is coherent when its individual sentences and constituent propositions are connected by being organized at some macrostructural level. Thus, a text is not merely an unrelated list of propositions, but a set of propositional units which are cross-referenced to one another and catalogued under one or several macro-propositions within which they find their comprehensional identity. Moreover, even if such propositions are not directly expressed, they may be inferred by the listener on the basis of more general world knowledge or on the basis of a contextual knowledge of the restrictions surrounding a specific script or scenario (see Mandler 1984, for an excellent review). It is these

organizational macrostructures which provide semantic coherence to a discourse and which make for a meaningful whole. Otherwise, the ongoing discourse sequence could easily be viewed as just a sequence of unrelated propositions which would have to be evaluated each and every one for their possible meanings and corresponding interpretations. What is important in processing the incoming discourse is obtaining the gist of the text, and it is the construction of a meaningful gist that consumes our attention. There is always an overriding schema which controls our comprehension, and we either extract one from the discourse which is readily available, or in those cases where the discourse does not offer a readily available schema, we construct one in order to have the input make sense to us. Such macrostructures in effect define what is most important about a given discourse sequence. According to van Dijk (1979), they are defined in such a way that propositions which are not relevant are either deleted or taken under the heading of a more general organizational proposition. By extension, we might assume that such macrostructures guide the subsequent interpretation of incoming additions to the discourse in a highly restrictive sense. If this working hypothesis is correct, then, we might hypothesize that ambiguous sentences in certain types of context exhibit few differences, if any, with normal sentences. Thus, in this experiment we hypothesized that disambiguating information provided to the unattended ear does not have as powerful an effect in contributing to the interpretation chosen, when in the presence of a more powerful attention-getting thematic context.

Our contexts attempted to restrict the interpretation of an ambiguous structure to only one of the two readings potentially available. We considered that the effect of this restrictive context would be powerful enough to override the simultaneous presentation of the other interpretation being presented to the unattended ear while the ambiguous sentence was being presented to the attended ear. Since Lackner and Garrett's previous results clearly establish the contribution of such simultaneously presented disambiguating sentences, we should expect that the disambiguating effects of such sentences should continue in the presence of such context if both readings continue to be accessed. However, we would suggest that a highly restrictive biasing context will have such an overwhelming effect as to block the second reading altogether, even in the presence of a disambiguating sentence presented to the unattended ear.

## 2. METHOD

### 2.1 Procedure

The experiment was derived from the earlier experiment by Lackner and Garrett (1972) where they, using a dichotic listening task, presented an ambiguous sentence to an attended ear of a subject and a disambiguating sentence to the unattended ear. The subject then paraphrased the ambiguous sentence, giving an

unambiguous meaning. The subjects tended to give paraphrases which were consistent with the disambiguating sentence whether it was in the direction of one meaning or the other meaning of the ambiguous sentence, thereby supporting the multiple-reading hypothesis where both interpretations of an ambiguous structure are activated when an ambiguity is encountered. The procedure of our experiment was similar except that the presentation of the sentences was preceded by the presentation of a thematically biasing context for the ambiguous sentence.

In a dichotic listening task 80 subjects were presented with a previously recorded audio tape containing 7 practice and 21 trial items. They were instructed to listen to a paragraph which "tells a story". When the paragraph was finished, they were further instructed that a short pause would appear, followed by two sentences, one presented to each ear simultaneously. Subjects were instructed to listen only to the right ear and to ignore the left ear completely. The ambiguous sentence was presented to the attended right ear and the disambiguating sentence to the unattended left ear. The disambiguating sentence was presented slightly less intensely and slightly later than the ambiguous sentence. The ambiguous sentences were read with a normal intonation and without any specific attempt at disambiguating between the two meanings by suprasegmental means. When the sentences were completed, the subject was to tell in his or her own words what the sentence meant, that is, to paraphrase it, without simply repeating what was on the tape. During practice runs, subjects could receive coaching and further instructions in response to questions, but not during the actual trials themselves.

The subjects' paraphrased responses were rated to fall into one of four categories: (1) the predetermined "A" meaning; (2) the predetermined "B" meaning; (3) subjects did not disambiguate or repeated the sentence; (4) subjects went off the topic.

## 2.2 Design

Many of the previous studies involving context have been centred around lexical ambiguities in sentential contexts. Given the relative inattention paid to syntactic ambiguities and their resolution in the face of context, our study also included structural ambiguities of the surface and underlying types. Twenty-one ambiguous sentences, seven each of lexical, surface and underlying ambiguity types, were used along with seven unambiguous control sentences. Each of the ambiguous sentences was paired with another sentence that disambiguated the ambiguity in the direction of one (A) or the other reading (B). The unambiguous sentences were paired with other unambiguous sentences and were included to make it unlikely that subjects noticed a relationship between the material presented in the two ears. The disambiguating sentence was almost identical to the ambiguous sentence, differing in one or several crucial words

which would clearly render them unambiguous as either the first or second meaning. For each subject sentences were preceded by 65-to-70-word contexts we have used in previous research. These context paragraphs were designed to "tell a story", namely, to revolve around a theme from which a thematic macrostructure could be easily inferred by the listeners. The paragraph would logically terminate with one or the other meaning of the ambiguous sentence in question. These contexts attempt to strongly bias the reading of the ambiguous sentence in one direction (DA) or the other direction (DB). There were thus four possible groups of stimulus materials.

- (1) Group 1 contained the ambiguous sentences paired with A of the disambiguating sentences and were preceded by DA of the contexts.
- (2) Group 2 contained the ambiguous sentences paired with A of the disambiguating sentences and were preceded by DB of the contexts.
- (3) Group 3 contained the ambiguous sentences paired with B of the disambiguating sentences and were preceded by DA of the contexts.
- (4) Group 4 contained the ambiguous sentences paired with B of the disambiguating sentences and preceded by DB of the contexts.

### 3. RESULTS

Most of the subjects' responses could be characterized as paraphrases of an A-meaning or a B-meaning. Approximately one-quarter of the responses could not be so categorized and almost all of these repeated the ambiguous sentence which had been presented to the attended ear. Therefore, for each sentence it was possible to compare the proportion of responses which were consistent in meaning with the previous context by using z-tests of proportions.

Considering first the condition where the context was consistent with one meaning of the ambiguous sentence and was also consistent with the meaning of the disambiguating sentence (Groups 1 and 4), there was a total of 42 of these instances. Of those 42 instances, 36 produced a significant difference of proportions ( $p < .05$ ), such that subjects gave more meanings which were consistent with the context and the meaning of the disambiguating sentence than were inconsistent with both; that is, the A-meaning was given when the context was DA and the B-meaning was given when the context was DB more than instances in which the B-meaning was given when the context was DA or instances in which the A-meaning was given when the context was DB. Five of the 42 instances produced no significant differences in proportions. In only one instance of the 42 did the ambiguous sentence produce a significant difference ( $p < .05$ ) where more subjects gave the meaning which was inconsistent with both the

meaning of the context and the meaning of the disambiguating sentence.

The crucial conditions are groups 2 and 3 where the context was consistent with one meaning of the ambiguous sentence and inconsistent with the other meaning of the ambiguous sentence, that meaning, however, being consistent with the disambiguating sentence being presented to the unattended ear. There was also a total of 42 of these instances; of the 42, in 28 there was a significant difference ( $p < .05$ ), such that the proportion of meanings consistent with the context and inconsistent with the meanings of the disambiguating sentences was greater than the proportions of meanings which were inconsistent with the context and consistent with the meaning of the disambiguating sentences. That is, the proportion of A-meanings given when the context was DA and the B-meanings given when the context was DB was significantly greater than the proportion of meanings consistent with the disambiguating sentences in 28 of the 42 instances. In the remaining 13 of the 42 instances there were no significant differences in the proportions of one meaning versus the other meaning; however, of these 9 were in the direction of the context and 4 in the direction of the disambiguating sentence. Finally, in only 1 instance of the total 42 was the proportion of meaning consistent with the disambiguating sentence and inconsistent with the context significantly greater ( $p < .05$ ) than the proportion of meaning consistent with the context and inconsistent with the meaning of the disambiguating sentence.

Clearly, the context strongly influenced the perceived meaning of the ambiguous sentence over the influence of the disambiguating sentence presented to the unattended ear. It is interesting to note that the influence of context was across all types of ambiguity (lexical, surface, and underlying), since no differences were found among the types.

While the subjects were not asked specifically if they noticed that the sentence presented to the unattended ear was different from that presented to the attended ear, 10 percent volunteered the fact that one was different from the other on at least one occasion.

#### 4. DISCUSSION AND CONCLUSIONS

The results suggest that the context preceding an ambiguous sentence strongly biases the meaning of the sentence. Lackner and Garrett's (1972) results, which demonstrated the influence of a disambiguating sentence presented to an unattended ear, thus supporting a multiple-reading hypothesis of ambiguity processing, were likely due to the ambiguous sentences appearing isolated from context. While we may process separate ambiguous sentences in a multiple-meaning way, the more natural way of processing sentences in a thematic context is to process only one meaning of

an ambiguous sentence, that meaning which is consistent with the context. Many of us have recalled, anecdotally, that when an ambiguous sentence begins a passage the ambiguity is more likely to be noticed than when it occurs embedded in a passage. Single-sentence ambiguity seems to be an attention-getting factor, considering the current spate of it in advertising (Kess, Copeland & Hoppe 1984). It is probably attention-getting because the two meanings are recognized when it is presented in an isolated sentence, offering support for the multiple-reading hypothesis at the conscious level. However, in the more typical instance of comprehending sentences in context, a prior or post-retrieval selective access hypothesis is more appropriate. These results do not distinguish between a prior or post-retrieval of a single meaning.

During the early period of the study of ambiguity, many experiments supported one form or another of the multiple-reading hypothesis, but many used ambiguous sentences or sentence fragments in isolation (Kess and Hoppe 1981). Since then some studies have used a context prior to the presentation of the ambiguous sentence and the findings have been mixed, with some supporting the multiple-reading hypothesis and some not. The present study offers strong support for a selective access hypothesis since it demonstrates that the dichotic listening support of the multiple-reading hypothesis disappears when the ambiguity occurs following a thematically biasing context.

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