

The Effect of Bias on Ambiguity Detection  
in the Presence of Context\*

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1.0 INTRODUCTION

The prime candidate for resolution of the multiple-reading/single-reading debate in the processing of sentential ambiguities would seem to be context (for a more complete discussion of the dimensions of the single-reading vs. multiple-reading question in ambiguity research, see Kess and Hoppe, 1981). However, to date, the role of context has not been sufficiently explored so as to plumb the depths of its contribution, nor has much effort been made to grade the degrees of bias that contextual constraints might offer. This study offers one aspect of the answer to ambiguity resolution by inquiring whether the presence of preceding context so limits the reading options on an ambiguous sentence that one of the readings is automatically ruled out.

To date the experimental results from psycholinguistic experiments in ambiguity have often been equivocal, favoring now the single-reading hypothesis and then the multiple-reading hypothesis. Some attempts have been made to provide an overview resolution of the seeming discrepancy in the results by positing an in-sentence strategy that is dependent upon phrasal closure (see Bever, Garrett, and Hurtig, 1973), but those have been directed at explaining ambiguity results in single, and thus isolated, sentences. More recently, attention has been directed at providing contexts for ambiguous sentences in an attempt to see whether the presence of context does make for single-reading processing rather than multiple-reading processing of such ambiguous sentences.

The present study is directed at the role of context in resolving

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ambiguity with an eye to seeing whether readings are still processed in the presence of context. One might speculate that an answer to the ambiguity controversy might be provided by the definitive role of contextual constraints in removing the possibility of a second or multiple readings for ambiguous structures. Thus, if such contextual settings do provide for such severe contextual constraints, one might argue that many of the results supportive of the multiple reading interpretation are merely the result of dealing with isolated sentences or sentences in which the context was not sufficiently spelled out by more than a single preceding word. While this methodological approach of employing single sentences was largely congruent with the generativist-inspired approach to language analysis in linguistic research, it is not the most effective in dealing with natural language inferences which demand a larger discourse to replicate actual language settings. It is obvious that this is an area which must be more fully investigated before we can claim to understand sentence processing. Some understanding of the ambiguity results reported to date must take this fact into consideration. If ambiguity does prove to be highly sensitive to certain contexts, then previous experimental results may be interpreted in light of the type and extent of context provided.

Even so, the results of current experiments which inquire into ambiguity resolution in the presence of context are divided. Like the work with ambiguous sentences in isolation, some experiments are supportive of a single reading interpretation as a result of context, while others are still suggestive of a multiple reading interpretation despite the presence of context. For example, Foss and Jenkins (1973) still found differences with ambiguous sentences which were biased with a single context-bearing word embedded in the sentence itself. (It might be noted that the Foss and Jenkins study is an elaboration of the phoneme monitoring paradigm which was introduced into the study of ambiguity by Foss (1970) as a technique for measuring processual differences between ambiguous and unambiguous sentences. Two recent experiments (Newman and Dell, 1978, and Mehler, Segui, and Carey, 1978) have questioned the usefulness of the results of the phoneme monitoring technique in the study of ambiguity.) Lackner and Garrett's (1972) persuasive but operationally difficult dichotic listening experiment showed that subjects consistently paraphrased the ambiguous sentence in a manner consonant with a disambiguating sentence presented to the unattended ear. Mistler-Lachman's (1972) depth-of-comprehension tasks served to demonstrate that not all tasks need be ambiguity-sensitive, but her work also suggests that ambiguity does indeed

slow processing time when it does not have an effect. Thus, deciding whether a sentence follows from context does require a reading sufficient to make an interpretation of the foregoing context; so also does trying to make up a sentence to follow from context.

In investigating the role of context for lexically ambiguous sentences, Holmes, Arwas, and Garrett (1977) note two findings that show ambiguous words to be more difficult in processual terms, regardless of the presence of a single-word preceding lexical context. In general, ambiguous words were reported less often than unambiguous words, and ambiguous sentences were judged to be meaningful more slowly than their unambiguous counterparts. Work by others (for example, Conrad, 1974) also seems congruent with the multiple-reading hypothesis of how ambiguous sentences are dealt with, though their experimental design is somewhat less germane to the relationship between context and ambiguity resolution.

On the other hand, some experimental results do show support for a single-reading interpretation of ambiguity. Swinney and Hakes (1976) found that context did negate processing differences between ambiguous and unambiguous sentences. They also found, however, that lexically ambiguous words preceded by a neutral context showed significantly longer reaction times in monitoring for target phonemes in their phoneme monitoring task. Suls and Weisberg's (1970) experimental note on word association responses generated from ambiguous sentences with preceding paragraph context also show results compatible with a single-reading approach. Several other context-simulated experiments (for example, Perfetti and Goodman, 1970, and Tyler and Marslen-Wilson, 1977) show results which can also be taken as supportive of a single-reading approach.

It may not be, of course, that context automatically selects one reading exclusively over the other in all cases. Cairns (1973) has suggested that the bias of an ambiguity is what may lead to the processing of two meanings, if this takes place, instead of reprocessing effects. The more equal the two readings are in terms of their resolutional bias, the higher the probability that both readings will be considered at the time of processing. Such probability must be seen in the light of local biasing conditions within the sentence in Cairns' discussion, but one can expect that the same will be true of context and its relationship to the sentence in question as well. Thus, not all contexts, large or small, will automatically provide the

selection of a single-reading to the exclusion of a second reading. It may be that even a paragraph-long context will not provide sufficient key context to lead to a single-reading interpretation immediately, and thus a multiple-reading interpretation may still be considered. This interpretation is also congruent with hierarchy of sensibility and canonical ordering suggestions made elsewhere (see, for example, Oden, 1978, and Hogoboom and Perfetti, 1975), and may serve to modify the discussion to other than an all-or-none answer in resolving the single-reading/multiple-reading question.

Lastly, the multiple-reading interpretation seems to run counter to the idea of intersentential information and subsequent integration into a unified whole. Sentences are typically linked to some kind of meaningful context. They are then integrated with other information in a meaningful whole, so much so that if a meaningful theme is not present, it may even be invented. Moreover, sentences which are otherwise unrelated and thus meaningless may even be unified under a given semantic theme. There is a good deal of evidence from inference (Bransford and Franks, 1971; Bransford, Barclay, and Franks, 1972; Bransford and Johnson, 1973) and memory studies (Loftus and Loftus, 1976; Loftus, 1979) that what is thought to be seen or heard is as important as what was actually seen or heard in constructing scenarios for storage and subsequent retrieval. The rate of ambiguous sentences in such scenarios has not been addressed in terms of where they fit in more general terms of processing and inferential strategies.

Inference studies of this type clearly point to the fact that the information inferred by preceding input, pragmatic or sentential, is just as real in establishing expectations as is the information formally presented by the individual sentence itself. One cannot help but note that the multiple-reading interpretation seems at odds with this set of observations. Moreover, a view of context as providing constraints on possible interpretations is also more congruent with the given-new hypothesis (see Haviland and Clark, 1974). Here the listener or reader is characterized as actively seeking out the new information which is embedded in the immediate sentence given to him, presumably matching it up with what has transpired before in preceding input. The processing of such new information is actively matched against old information, with the latter serving as the referential backdrop against which the new information is measured. One expects that new information would be matched with preceding old information, at least along general

guidelines, rather than having the two or more readings of the ambiguous sentence tabulated for comparison each time. While such exhaustive tabulation may be the case for single sentences in isolation, it is another question whether it holds true for sentences embedded in context.

## 2.0 METHOD

### 2.1 Subjects

Sixty University of Victoria students participated in the study, 30 males and 30 females. Their names were selected from the Department of Psychology's subject pool of volunteers, and they chose to participate in the experiment when contacted by the experimenter.

### 2.2 Sentences and Contexts

The experiment involved the detection of two meanings of an ambiguous sentence under three different conditions. In two of the conditions the sentences were preceded by a context, and in the third condition the sentences were presented alone without any prior context.

The sentences were chosen from a collection of ambiguous sentences which had been used previously in the studies of ambiguity and which the evidence suggested were not strongly biased so that one meaning was much more likely to be seen than the other meaning. Also, the sentences chosen were similar in length, ranging from six to nine words. There were 21 sentences used in the main experiment; seven were lexically ambiguous, in seven the ambiguity was of the surface type, and in seven the ambiguity was in the underlying structure. There were also eight practice sentences where each kind of ambiguity was present at least once.

For the contexts approximately 70-word paragraphs were constructed. One context was written to dispose the subject to see one meaning of the sentence, arbitrarily labelled context A, and the other context was set for the other meaning of the sentence, context B. Attempts were made to devise meaningful neutral contexts which did not provide any bias one way or the other, but this was found to be impossible to do, and for this reason a neutral context condition was not included in the experimental design.

Sentences which were ambiguous on the lexical, surface structure, and deep structure levels were tested for their susceptibility to domination by context. Lexical ambiguity is simply the result of words having more than one meaning, as for example, paper in He read the paper. Surface structure ambiguity, on the other hand, is the result of two distinct sets of hierarchical syntactic relationships being shown by the same surface linear arrangements, as in The tribal custom regarding old men and women was known to all. Finally, deep or underlying structure ambiguities are the result of two distinct sets of logical relationships being shown by the same sentence, as in Visiting relatives can be a nuisance.

### 2.3 Contextual paragraphs

Each ambiguous sentence was preceded by a full paragraph of context which attempted to limit the reading of the ambiguous sentence to only one reading. The ambiguous sentences were taken from previous experiments in the ambiguity literature. The context paragraphs were on the average 72 words in length and were provided for each of the three types of ambiguity. For example, for the lexically ambiguous sentence He wears a light suit in the summer, the following two paragraphs were provided. The first paragraph of context suggests the reading to be His suit is of a light weight in the summer, while the second paragraph of context instead suggests that the reading should be His suit is of a light color in the summer. The paragraphs are as follows:

He wears a light suit in summer = His suit is of a light weight  
in summer.

Mr. Jones has many suits in his closet. Mainly, they are heavy, dark woolen suits that he feels are suitable for a man in his position. But as soon as the weather grows milder, Mr. Jones takes another look into his wardrobe to find something more comfortable. Something suitable, yet not too heavy and warm. He likes to wear linen suits when the weather permits. He wears a light suit in summer.

He wears a light suit in summer = His suit is of a light color  
in summer.

Mr. Jones feels that heavy woolen suits should be of dark colors like black and brown and blue. He thinks that these colors set the mood of winter perfectly. But, as soon as warm weather comes, Mr. Jones looks like another person. His suits are always linen in light, bright hues. His favourite colors for spring and summer are light blue, beige, and white. He wears a light suit in summer.

Similarly, the ambiguous surface structure sentence The doctor saw the old Indian dance is provided with a context which limits the readings to either a sentence in which the meaning is clearly inclusive of the theme The dance was an old Indian one or The old Indian was dancing. The contextual paragraphs are as follows:

The doctor saw the old Indian dance = The dance was an old  
Indian one.

As an anthropologist, Doctor Barnes' major area of research was the songs, dances, and music of the American Indians. Although he had seen and collected data on thousands of dances, there was a very old one which he had not seen. By chance, he found it was performed by a small Western tribe once every five years. He got to their camp just in time. The doctor saw the old Indian dance.

The doctor saw the old Indian dance = The old Indian was dancing.

Although there was nothing really wrong with the old Indian, he had convinced himself that he had little time left to live. His doctor assured him that he was in fine physical condition, but the old Indian would not listen. The Indian remained in bed for many weeks until, one day, the doctor heard a phonograph playing. The doctor was astonished when he walked into the room. The doctor saw the old Indian dance.

Finally, the deep structure ambiguous sentence The mayor requested the police to stop drinking is limited to the two interpretations of The mayor wanted the police to enforce

anti-drinking regulations or The mayor thought the police drank too much by the appropriate contextual paragraph. The paragraphs are as follows:

The mayor requested the police to stop drinking. = The mayor wanted the police to enforce anti-drinking regulations.

Night after night, the city had been torn apart by drunken brawls. Drunken driving was such a problem that any driving was dangerous. The churches banded together to oppose the free beer being given away at all the local pubs. A committee of concerned citizens demanded a meeting with the mayor. Their appeal was favorably received. The police chief was called to city hall. The mayor requested the police to stop drinking.

The mayor requested the police to stop drinking. = The mayor thought the police drank too much.

The city council was adamant. The police force must do everything it could to win back the respect of the people. They had bought new, faster cars, dressed the men in impressive new uniforms. They even increased the policemen's salaries. But still the citizens jeered at them and refused to obey. Perhaps the police force would have a better image if they behaved better. The mayor requested the police to stop drinking.

#### 2.4 Procedure

When the subjects arrived for the experiment, they were told that it was an experiment dealing with ambiguity and that they were to detect two meanings of an ambiguous sentence as quickly as possible.

There were two context conditions; in one the ambiguous sentence was preceded by context A, and in the other it was preceded by context B. The context was presented by having the subject pick up and read a paragraph card on which the context was typed. This was followed by the subject picking up a sentence card, turning it over, reading the sentence, and saying "Yes" when two meanings of the sentence were seen. The experimenter timed how long it took the subject to say "Yes" after turning the sentence card over. This was the detection time for the sentence

for that subject (even though the time involved both the reading time of the sentence as well as the time it took to detect two meanings). Immediately after saying "Yes", the subjects reported the two meanings of the sentence they saw, reporting first the meaning that was seen initially and then the meaning that was seen subsequently. Subjects were given 90 seconds to see two meanings. If they failed to see two meanings, their detection time was recorded as 90 seconds, and they gave the one meaning they saw and were told the second meaning of the sentence.

In the no context condition the subjects simply picked up a sentence card without any previous paragraph card, and the rest of the procedure was the same as that for the context conditions.

In both conditions the eight practice sentences were presented first — those in the context conditions were preceded by a context, and the subjects were given a chance to ask questions after which the 21 experimental sentences were presented. Following this the experiment was explained to the subjects before they left.

Twenty different subjects, 10 males and 10 females, participated in each of the three conditions. Each subject received all of the sentences, the lexically ambiguous, those ambiguous in surface structure, and those ambiguous in the underlying structure, presented in a random order, and each subject received a different random order. While each subject saw the same sentences, the difference between subjects was whether the sentences were preceded by context A, context B, or no context.

### 3.0 RESULTS

The essential datum collected from each subject was the time it took him or her to detect two meanings of each sentence. The number of instances where two meanings were not seen did not seem excessive: 46 of 1260 detections, or less than four per cent.

Median detection times for each subject for each type of ambiguity, lexical, surface, and underlying, were taken as the basic datum for the first analysis of the data. The data were submitted to a 3X2X3 ANOVA with repeated measures on the last factor. The first factor was context A, context B, or no context; the second factor was sex, and the third factor was type of ambiguity, lexical, surface, or underlying. The results indicated that the context was significant ( $F = 6.88$ ,  $df = 2$ , 414,  $p < .01$ ), sex

was marginally significant ( $F = 5.20$ ,  $df = 1,414$ ,  $p = .023$ ), type was significant ( $F = 11.30$ ,  $df = 2, 828$ ,  $p < .001$ ), and the interaction between context and type was also significant ( $F = 6.35$ ,  $df = 4, 828$ ,  $p < .001$ ). An examination of the means (of the medians) indicated the following: Contexts A and B tended to produce faster recognition times than no context except for lexical ambiguity where context A showed faster recognition times than no context, but context B showed slower recognition times than no context. Females tended to show slightly faster recognition times than males. The underlying type of ambiguity was easiest to detect, lexical was the next easiest, and surface the most difficult to detect.

The differences between context A and B were puzzling since there was nothing systematic in choosing whether a context was labelled A or B, and the placement as context A or context B was arbitrary. It was believed that perhaps the initial bias of the ambiguous sentence without any context might interact with context in a way that would influence the detection time even though the sentences were chosen so that they should not be strongly biased toward one meaning or the other. Contributing to this belief was the fact that it was difficult, if not impossible, to select ambiguous sentences where one meaning was as equally likely to be seen as the other. We could only pick those that were relatively unbiased.

Therefore, all the sentences in the no context condition were examined to determine which meaning was given first — an indication of the bias of the sentence. Proportions of subjects who saw meaning A versus meaning B were calculated, and it was found that in no instance was one meaning given as the first meaning equally as often as the other meaning. In some cases meaning A or meaning B was seen first by over 80 per cent of the subjects. The data suggested that each sentence had some initial bias when presented without a context.

The second analysis examined the influence of the context, depending upon whether the context favored the bias of the sentence or was against it. That is, what was the effect when the meaning of the sentence that was cued by the context was the same or different from the meaning of the sentence that was given first by a majority of subjects in the no context condition? In order to accomplish this, means for each subject for each type of ambiguity — lexical, surface, and underlying — were calculated for those instances when the context favored the bias of the sentence. Means were also

calculated for each type for those that were against the bias of the sentence as well as when the sentences were presented without any context. There were essentially two types of sentences, those where a majority gave meaning A first and those where a majority gave meaning B first. These sentences were unsystematically distributed among the conditions that received context A, context B, or no context. Recall that subjects were tested with context A or context B or no context, and within these conditions each subject received three types of ambiguous sentences. This necessitated a 2X3X2X3 ANOVA with repeated measures on the last factor. The factors were: sentence bias, A or B; context biased in favor of, against, or no context; sex; and ambiguity type, lexical, surface or underlying.

The results indicated the following: Sentences biased in the A direction produced significantly faster detection times than sentences biased in the B direction ( $F = 12.58$ ,  $df = 1, 108$ ,  $p < .001$ ). When the context was against the bias of the sentences, the detection times were significantly faster than when there was no context or the context favored the bias of the sentence ( $F = 6.38$ ,  $df = 2, 109$ ,  $p < .01$ ). Females were not quite significantly superior to males ( $F = 3.10$ ,  $df = 1, 108$ ,  $p = .08$ ). The differences in the type of ambiguity were similar to the first analysis where the fastest detection times were when the ambiguity was in the underlying structure, the next fastest were for lexical ambiguity, and the slowest was when the ambiguity was in the surface structure ( $F = 11.91$ ,  $df = 2, 216$ ,  $p < .001$ ). The interaction between the type of ambiguity and bias of the sentence, A or B, was significant ( $F = 6.81$ ,  $df = 2, 216$ ,  $p < .01$ ), indicating that while the above order of ease of detection was true for the A sentences, it was not so for the B sentences where the surface ambiguity was as easy to detect as the lexical ambiguity. The interaction between the type of ambiguity and whether the context was in favor of or against the bias, or no context was present, was also significant ( $F = 11.8$ ,  $df = 4, 216$ ,  $p < .001$ ). This suggested that while detection times were faster when the context was against the bias of the sentence for lexical and underlying ambiguity, this was not the case for surface ambiguity. The nature of this interaction can be seen in Table 1. Table 1 presents the means when sex and sentences A and B are combined. An inspection of the table can illustrate some of the findings mentioned above regarding the significance of the main factors.

Table 1  
Mean Detection Times

		Type of Ambiguity			Total means
		Lexical	Surface	Underlying	
Context	Favoring bias of sentence	19.20	11.93	9.62	13.58
	Against bias of sentence	6.54	13.62	5.92	8.71
	No context	9.27	20.72	13.36	14.45
Total means		11.67	15.42	9.65	

#### 4.0 DISCUSSION AND CONCLUSIONS

Instead of context limiting the availability of two readings of ambiguous sentences, the evidence suggests the continuing presence of two readings. Subjects were typically able to retrieve two meanings for sentences despite the presence of context which specifically called for only one reading.

The results suggest that sentences have an inherent bias. A majority of subjects saw one meaning as opposed to the other meaning of the sentence in the absence of context. Furthermore, as a consequence of this, when the context is in line with the more common meaning of the sentence, then it takes longer to elicit the second reading of the ambiguous sentence. On the contrary, when the context is in line with the less common reading of the sentence, recognition of the other reading exhibits shorter detection times. It is as if the less common reading of the sentence was provided by the context while the more common reading is automatically provided by its a priori biased status. If the two readings of ambiguous sentences were roughly equal in terms of their bias, then one would not expect to see significant differentiation in the detection of one reading as opposed to the other reading in the presence of context.

These results are consistent with the canonical access modification of the multiple-reading approach to ambiguous sentence processing. Sentences are decoded in an ordered

access fashion with the inherent biased reading of the sentence playing a role as well as the context. Thus, for example, when the context provides for the second reading, the normal avenue of considering the first is bypassed. Hogaboam and Perfetti (1975) found similar support for a canonical access model when subjects were asked to decide whether an ambiguous word in a context had another possible meaning. When the context required a secondary sense of the word, decision times were faster than when the context required the primary sense. If sentences were roughly equal in terms of their biasing, one would also expect them to be roughly equal in their detection times. Moreover, the influence of context should stand in direct relationship to the reading of the sentence. A context should elicit the intended reading of the sentence first, as was the case here, and then the second reading would be detected within an average time span. One would not expect to find significant differences for second readings in that time range.

Generally, while one can say these results can be taken as consistent with the multiple reading hypothesis, the processing of ambiguous sentences is not as simple as just entertaining two readings for an ambiguity. A realistic explanation of what goes on will call for attention to the interaction between context and the inherent bias of the sentence.

#### REFERENCE

- Bever, T. G., M. F. Garrett, and R. Hurtig. 1973. The interaction of perceptual processes and ambiguous sentences. *Memory and Cognition*, 1 (3):277-286.
- Bransford, J. D., and J. J. Franks. 1971. The abstract of linguistic ideas. *Cognitive Psychology*, 2:330-350.
- Bransford, J. D., J. R. Barclay, and J. J. Ranks. 1972. Sentence memory: A constructive versus interpretive approach. *Cognitive Psychology*, 3:193-209.
- Bransford, J. D., and M. K. Johnson. 1973. Consideration of some problems in comprehension. *Visual Information Processing*. New York: Academic Press. 383-438.

- Cairns, Helen S. 1973. Effects of bias on processing and reprocessing of lexically ambiguous sentences. *Journal of Experimental Psychology*, 97 (3):337-343.
- Conrad, Carol. 1974. Context effects in sentence comprehension: A study of subjective lexicon. *Memory and Cognition*, 2 (1A):130-138.
- Foss, Donald J. 1970. Some effects of ambiguity upon sentence comprehension. *Journal of Verbal Learning and Verbal Behavior*, 9:699-706.
- Foss, Donald J., and Charles M. Jenkins. 1973. Some effects of context on the comprehension of ambiguous sentences. *Journal of Verbal Learning and Verbal Behavior*, 12:577-589.
- Haviland, S. E., and H. Clark. 1974. What's New? Acquiring new information as a process in comprehension. *Journal of Verbal Learning and Verbal Behavior*, 13:512-521.
- Hogaboam, Thomas W., and Charles A. Perfetti. 1975. Lexical ambiguity and sentence comprehension. *Journal of Verbal Learning and Verbal Behavior*, 14:265-274.
- Holmes, V. M., R. Arwas, and M. F. Garrett. 1977. Prior context and the perception of lexically ambiguous sentences. *Memory and Cognition*, 5 (1):103-110.
- Kess, Joseph F., and Ronald A. Hoppe. 1981. Ambiguity in Psycholinguistics. *Pragmatics and Beyond*, 2 (4), Amsterdam: John Benjamin B.V.
- Lackner, J. R., and M. F. Garrett. 1972. Resolving ambiguity: Effects of biasing context in the unattended ear. *Cognition*, 1 (4):359-372.
- Loftus, E. F. 1979. *Eyewitness Testimony*. Cambridge, Mass.: Harvard University Press.
- Loftus, F. R., and E. F. Loftus. 1976. *Human Memory: The Processing of Information*. Hillsdale, N.J.: Lawrence Erlbaum Associates.
- Mehler, Jacques, J. Sequi, and Peter Carey. 1978. Tails of words: Monitoring ambiguity. *Journal of Verbal Learning and Verbal Behavior*, 17:29-35.

- Mistler-Lachman, Janet L. 1972. Levels of Comprehension in processing of normal and ambiguous sentences. *Journal of Verbal Learning and Verbal Behavior*, 11:614-623.
- Oden, Gregg C. 1978. Semantic constraints and judged preference for interpretations of ambiguous sentences. *Memory and Cognition*, 6 (1):26-37.
- Perfetti, Charles A., and Doba Goodman. 1970. Semantic constraint on the decoding of ambiguous words. *Journal of Experimental Psychology*, 86 (3):420-427.
- Suls, J. M., and R. W. Weisberg. 1970. Processing syntactically ambiguous sentences. *Journal of Experimental Psychology*, 86 (1):112-114.
- Swinney, David A., and David T. Hakes. 1976. Effects of prior context upon lexical access during sentence comprehension. *Journal of Verbal Learning and Verbal Behavior*, 15: 681-689.
- Tyler, L. K., and W. D. Marslen-Wilson. 1977. The on-line effects of semantic context on syntactic processing. *Journal of Verbal Learning and Verbal Behavior*, 16:683-692.