ILLINOIS

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

PRODUCTION NOTE

University of Illinois at
Urbana-Champaign Library
Large-scale Digitization Project, 2007.

370.152
T2261
n.226

211-209

TECHNICAL REPORTS

Technical Report No. 226

DRAWING INFERENCES FROM SEMANTICALLY POSITIVE AND NEGATIVE IMPLICATIVE PREDICATES

Stella Vosniadou

University of Illinois at Urbana-Champaign

January 1982

Center for the Study of Reading

THE LIBRARY OF THE

MAR 17 1983

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN
51 Gerty Drive
Champaign, Illinois 61820

The National Institute of Education
U.S. Department of Health, Education and Welfare
Washington, D.C. 20208

BOLT BERANEK AND NEWMAN INC.
50 Moulton Street
Cambridge, Massachusetts 02138

CENTER FOR THE STUDY OF READING

Technical Report No. 226

DRAWING INFERENCES FROM SEMANTICALLY POSITIVE AND NEGATIVE IMPLICATIVE PREDICATES

Stella Vosniadou

University of Illinois at Urbana-Champaign

January 1982

University of Illinois
at Urbana-Champaign
51 Gerty Drive
Champaign, Illinois 61820

Bolt Beranek and Newman Inc.
50 Moulton Street
Cambridge, Massachusetts 02238

The research reported herein is based on a portion of the author's doctoral dissertation, submitted to Clark University. This paper was completed while the author was at the Center for the Study of Reading, and its preparation was supported in part by the National Institute of Education under Contract No. HEW-NIE-C-400-76-0116. The author would like to thank Rachel Joffe-Falmagne for her support and advice throughout this project. Special thanks are also due to Lenny Cirillo, Joseph Schmuller, and Mort Wiener for their helpful comments on earlier drafts of this manuscript.

EDITORIAL BOARD

William Nagy and Stephen Wilhite
Co-Editors

Harry Blanchard
Charlotte Blomeyer
Nancy Bryant
Larry Colker
Avon Crismore
Meg Gallagher
Anne Hay
Asghar Iran-Nejad
Jill LaZansky
Terry Turner
Janet Williams
Paul Wilson

Michael Nivens, Editorial Assistant

Abstract

Subjects were timed while they drew inferences from syntactically affirmative and negative sentences containing the semantically positive and negative implicative predicates remember/forget and bother/neglect, under different linguistic contexts that met the presuppositions of the sentences at varying levels of generality. Different patterns of inference latencies were obtained for the two implicative predicates studied, suggesting that there are important differences among semantically negative implicative predicates that influence their representation and processing. Regardless of these differences, inference latencies for all sentences decreased when they were presented in contexts that met some of their presuppositions indicating that context can facilitate inferential processing.

Drawing Inferences from Semantically Positive and Negative Implicative Predicates

The present paper reports an experiment designed to investigate the inferential processing involved in the comprehension of a class of complex predicates (such as, "remember to," "manage to," "fail to," "neglect to") which are known as "implicative." Karttunen (1971) has argued that there is an implication between a main sentence with an implicative predicate and the proposition contained in it as complement. For example, the assertion of (1) commits the speaker/hearer of English to the view that (2) is true.

(1) John managed to solve the problem.

(2) John solved the problem.

In addition to this logical component, a negative component is also involved in the semantic characterization of a subcategory of implicative predicates whose assertion commits the speaker/hearer of the language to the falsity of the proposition contained in their complements. For example, both sentences (3) and (4) commit the speaker/hearer of the language to the view that (5) is true.

(3) John failed to solve the problem.

(4) John didn't manage to solve the problem.

(5) John didn't solve the problem.

Although both (3) and (4) have the same truth value, sentence (3) does not meet Klima's (1964) criteria of syntactic negation. Implicative predicates which imply the falsity of the proposition contained in their complements are known as "inherently negative" or "semantically negative" (Clark, 1974; Just & Carpenter, 1971).

The logical and negative components included in the semantic characterization of implicative predicates make them particularly interesting for investigation. How do people draw inferences from sentences containing implicative predicates? Is the inferential process affected by the different kinds of negation? Given that semantically positive and negative implicative predicates carry opposite implications, is this information represented in the mental lexicon, and if so, how? How does the linguistic context in which sentences with implicative predicates occur influence the inferential process?

Some of these questions have been addressed by Just and Clark (1973) in two experiments investigating the effects of semantic negation on the verification of probes derived from the implications and presuppositions of implicative sentences. The results of these experiments indicated that, in many respects, semantic negation functions like syntactic negation. Namely, when subjects were asked to assess the truth or falsity of probes derived from the implications of implicative sentences, longer verification latencies were obtained for semantically negative (hereafter SEM-NEG) than for semantically positive and syntactically affirmative (hereafter AFF) sentences. Moreover, while true negatives took longer to verify than false negatives, true positive sentences had shorter verification latencies than false positive sentences (at least for one of the two semantically positive/negative implicative predicate pairs they studied).

This true-false/affirmative-negative interaction, which has usually been obtained in the case of syntactic negation (e.g., Clark & Chase, 1972;

Gough, 1965; Trabasso, 1972), has been interpreted as indicating that sentences with semantically negative lexical items (including implicative predicates) are represented like syntactically negative sentences; i.e., in terms of an affirmative core and a negative polarity marker (Carpenter & Just, 1975; Clark, 1974; Clark, Note 1).

The purpose of the present experiment was to carry out a deeper investigation of the process of drawing inferences from sentences with implicative predicates under conditions of both semantic positiveness/negativeness and syntactic affirmation/negation. Some exemplar affirmative and negative sentences with semantically positive and

---

Insert Table 1 about here.

---

negative implicative predicates are presented in Table 1.

One question of interest was whether the inferential process for semantic negation would be different from the process for syntactic negation. This question is of interest because, unlike AFF and SEM-NEG implicative predicates, SYN-NEG and SEM-NEG predicates do not differ in their implications; both imply the falsity of the proposition contained in their complements, and thus both involve a negative component. In comparing the possible inferential processes involved in the comprehension of AFF and SEM-NEG implicative predicates, one should expect longer inference latencies for SEM-NEG than AFF sentences because only the former involve a negative component. It is not clear, however, whether one should

expect any differences in the inferential processing of SEM-NEG and SYN-NEG sentences since they both involve a negative component. The only difference between SEM-NEG and SYN-NEG sentences is in their "scope."

The "scope of negation" hypothesis was originally proposed by Klima (1964) who argued that syntactic negation has a larger scope than semantic negation because it applies to the whole sentence, while semantic negation applies only to certain of the subordinate constituents of the sentence. Following a similar vein, Clark (1974) has argued that syntactic negation has a larger scope than semantic negation because it negates both the assertions and the "suppositions" of a sentence. Clark (1974) defines suppositions as temporary assumptions that speakers and listeners usually make when they use (in this case) negative sentences. For example, the sentence "John didn't remember to come" is used to deny the positive supposition that John was supposed to come. In this case negation applies both to the assertion and the supposition of the sentence (It was false to suppose that John would come). Semantic negation, however, is used to affirm negative suppositions. For example, the sentence, "John forgot to come" is used to affirm the negative supposition that John was not supposed to come. In this case negation does not apply to the assertions of the sentence but only to its suppositions (It was true to suppose that John would not come).

Suppositions are closely related but not identical to "presuppositions" as identified by Austin (1972), Fillmore (1971) or Lakoff (1971). The reason is that different criteria have to be applied to

determine whether part of the meaning of a sentence is a presuppposition or a supposition.

In previous investigations of syntactic and semantic negation (not involving inferential processing), shorter latencies have been obtained for SEM-NEG than SYN-NEG sentences when the two types of negation are compared in the same task (Carpenter & Just, 1971; Clark, 1974; Jones, 1968). Clark (1974) has attributed the difference in the latencies of the two negation types to differences in their scope. In order to account for such differences within their information processing models of negation, both Clark (1974) and Carpenter and Just (1975) have proposed that information about the presuppositional (or suppositional) nature of negative sentences should be part of their proposed representations, otherwise consisting of an affirmative core and a negative polarity marker.

In view of the general agreement among psychologists, and also linguists (Chomsky, 1971; Lakoff, 1971), that the presuppositions of a sentence are an important aspect of its meaning, the following questions were raised in this study. First, would such assumed differences in the presuppositions of negative sentences influence the process of drawing implications from SEM-NEG and SYN-NEG implicative predicates? And if so, would the obtained results support the present proposals regarding the representations of semantically and syntactically negative sentences?

A second related question centered around the possible effect that a linguistic context meeting the presuppositions of sentences with implicative predicates can have on the inferential process. It has been

shown that comprehension is facilitated when sentences occur in contexts that meet their presuppositions than in contexts which do not (Haviland & Clark, 1974; Olson & Filby, 1972; Wason, 1965, 1972; Wason & Johnson-Laird, 1972). For example Wason (1965) has argued that the function of syntactic negation is to deny a positive presupposition, and has shown that much of the difficulty subjects have with syntactically negative sentences disappears when these sentences are presented in contexts that meet these presuppositions.

In this experiment, the inferential processing of implicative sentences was investigated both in isolation from context and under different linguistic contexts meeting the presuppositions of the sentences at different levels of generality. The psychological question related to context was whether the linguistic contexts meeting the presuppositions of the negative implicative sentences would facilitate the task of drawing the implications of these sentences.

Method

Subjects

Subjects were 64 adults, undergraduate and graduate students at an eastern university. They were paid $2.50 to participate in this experiment.

Materials and Procedure

The experiment was an inference-drawing task. Subjects were timed while they read and answered sentence triads consisting of a context sentence, a target sentence, and a probe, presented one at a time.

All sentences were presented visually on the oscilloscope screen of a PDP-12 computer. Each trial was initiated by the word READY, which appeared on the screen of the computer for 100 msec. 1500 msec after the offset of this signal, a context sentence appeared in the center of the screen for 2000 msec. Immediately after its offset, a target sentence appeared and remained in the screen for 1500 msec. Immediately after the offset of the target, a probe appeared on the screen and remained in view until the subject responded. The subjects were timed in milliseconds from the appearance of the probe to the first push of the response button. There was an interval of 2000 msec between trials.

A context sentence appeared on the screen of the computer first. There were, in all, four context conditions: no context, an unbiased context, a bad context, and a good context. The no-context condition consisted of a broken line (----------) in the place of a context sentence. Its function was to control for the possibility that the context sentences acted as a preparatory signal for the appearance of the target sentence and as such decreased response time.

The unbiased context was a simple affirmative sentence, of the form "X has a y" (i.e., Fred has a safe). It was designed to meet some of the general presuppositions of all the target sentences. For example, all target sentences presupposed the existence of the object denoted by the complement noun (i.e., that Fred had a safe). The unbiased sentence met this general presupposition of all context sentences. In addition, it acted as a control for the presentation of the complement noun of the target sentence in the other context sentences.

The bad context was a sentence of the form "X is usually bad about taking care of y" (i.e., Fred is usually bad about taking care of the safe). It was assumed that this negative context sentence would create a negative supposition and thus facilitate the processing of semantically negative target sentences. The good context had the form "X is usually good about taking care of the y" and was assumed to facilitate the processing of semantically positive target sentences.

After the offset of the context sentence, a target sentence appeared in the screen of the computer. The target sentences were simple declarative sentences of the form "X has(n't) 'implicative verb' to 'complement'," (i.e., Fred has(n't) remembered to open the safe). The target sentences differed in semantics, in syntax and in their truth value as indicated in Table 1.

There were two implicative verb sets, each consisting of one semantically positive and one semantically negative verb. The implicative verbs were, remember/forget and bother/neglect. In addition, there were four complement types, each consisting of two sentences differing only in their complement verbs. These complement verbs were binary in the sense that, within the context of the sentences used, the negation of one implied the affirmation of the other. The complement sentences used were the following: to load the rifle/to empty the rifle, to open the safe/to close the safe, to lock the door/to unlock the door, and to free the parrot/to cage the parrot.

Each target sentence was followed by a probe. Probes presented subjects with the complement noun and the two complement verbs associated with the preceding target sentence. For example, if the target sentence stated that Today John has remembered to open the safe the probe consisted of the word safe and the verbs opened and closed placed below it, one to its right and the other to its left. The subjects were asked to draw the implication of the target sentence and indicate their answer by pressing, from two buttons located in front of them, the button corresponding to the correct complement verb.

In addition to the context sentences, target sentences, and probes, 32 memory checks were also inserted randomly between experimental trials in order to force subjects to read the context sentences. These memory checks presented the subjects with a list of three context-target sentence combinations and asked them to identify the context-target sentence pair that had immediately preceded.

The design was a (2 x 2 x 2) x (4 x 4 x 2 x 2 x 2) factorial design. The three between-subjects factors were counterbalanced for order of presentation, complement verb (open/close), and right/left position of the correct complement verb in the probes. The within subject factors were (a) context (no context, unbiased, bad and good), (b) implicative verb type (remember/forget and bother/neglect), (c) complement type (to load/empty the rifle, to open/close the safe, to lock/unlock the door and to free/cage the parrot), (d) syntactic affirmation/negation, and (e) semantic positiveness/negativeness.

The experiment started with a practice session of 32 trials identical in form to the experimental trials but with different implicative predicates. The test session consisted of 128 experimental trials presented randomly for all subjects. The 128 experimental trials represented all the possible combinations of the two implicative predicate types under conditions of syntactic affirmation/negation and semantic positivenes/negativeness, in combination with the four different complements and under the four context conditions.

For each subject, erroneous responses were reinserted until correct responses were obtained on all trials. Two subjects were dropped and replaced because they made more than 10 errors. The practice and experimental sessions lasted approximately 35 minutes.

Results

The No-Context Condition

An analysis of variance was first computed for the inference latencies representing the no-context condition. Results indicated a main effect for syntactic affirmation/negation, $F(1,56) = 13.522$, $p < .001$. This main effect was due to longer inference latencies for syntactically negative sentences (1301 msec) than for syntactically affirmative sentences (1125 msec). There was also a main effect for semantic positiveness/negativeness, $F(1,56) = 24.878$, $p < .001$, a result of longer inference latencies for sentences with semantically negative predicates (1299 msec) than for sentences with semantically positive predicates (1128 msec).

There was an interaction between implicative verb type, syntactic affirmation/negation and semantic positiveness/negativeness, $F(1,56) = 14.246$, $p < .001$, which is presented in Figure 1. This interaction shows that the relationship between the different types of negation is different in the case of remember/forget than in the case of bother/neglect.

Insert Figure 1 about here.

In the case of remember/forget syntactic affirmation/negation interacted with semantic positivenes/negativeness. As can be seen in Figure 1 this interaction was due to the fact that semantically positive implicative predicates had shorter inference latencies than semantically negative implicative predicates only under conditions of syntactic affirmation, not under conditions of syntactic negation. In other words, sentences with remember (AFF sentences) had shorter inference latencies than sentences with forget (SEM-NEG sentences), but sentences with not remember (SYN-NEG sentences) had longer inference latencies than sentences with not forget (SEM/SYN-NEG sentences). No such interaction between syntactic affirmation/negation and semantic positiveness/negativeness was obtained in the case of bother/neglect.

Planned comparisons were used to investigate further the interaction between syntactic affirmation/negation and semantic positiveness/negativeness for remember/forget; this interaction and was found to be statistically significant, $F(1,56) = 5.68$, $p < .05$. The

overall difference between the semantically negative forget and the syntactically negative not remember was not, however, statistically reliable.

A tentative account of this differential pattern of results for the two predicate pairs will be given in the discussion.

Context Effects

An analysis of variance was then computed for the inference latencies representing all 128 experimental trials, including context.

The main effect of context was statistically reliable, $F(3,180) = 93.868$, $p < .001$. The mean inference latencies for this main effect are presented in Table 2. Using a planned comparison, the mean inference latency for the no context condition was found to be significaly longer than the mean inference latencies for each of the three context conditions, $F(1,180) = 7.98$, $p < .01$. The three context conditions were not reliably different from one another.

Insert Table 2 about here.

Context decreased inference latencies for sentences with semantically negative implicative verbs more than for sentences with semantically positive implicative verbs. The interaction between context and semantic positiveness/negativeness was statistically significant, $F(3,180) = 3.906$, $p < .01$. Overall, sentences with semantically negative implicative verbs had significantly longer inference latencies than sentences with

semantically positive verbs only in the no context condition. In contrast, syntactically negative sentences had significantly longer inference latencies than syntactically affirmative sentences under all context conditions. In other words, context did not facilitate all types of sentences equally; it facilitated semantic negation more than syntactic negation.

The context X syntactic affirmation/negation X semantic positivenes/negativeness interaction was not statistically significant. However, in view of the different pattern of inference latencies obtained for the two implicative verb types, this interaction was examined separately for remember/forget and bother/neglect using planned comparisons. Figure 2 shows the mean inference latencies for the two implicative verb types as a function of context, syntactic

---

Insert Figure 2 about here.

---

affirmation/negation, and semantic positiveness/negativeness. The planned comparisons showed a significant interaction between context, syntactic affirmation/negation, and semantic positiveness/negativenes, only in the case of bother/neglect, $F(1,180) = 7.22$, $p < .01$. This interaction was due to the fact that while the semantically negative sentences neglect and not neglect had shorter inference latencies in the bad contexct condition as compared to the unbiased and good context conditions, the semantically positive sentences bother and not bother did not.

Discussion

The obtained results indicated that, overall, inferential processing was influenced by differences in the presuppositions of the implicative predicates studied and by the linguistic context in which they occurred. Although this general conclusion applies to both implicative verb types studied, there were also important differences in the way the two implicative verb types functioned in the present experiment both in the absence of context and under the various linguistic contexts. In the following pages, results involving the no-context condition will be discussed first. Results involving the context conditions will be discussed second.

The No-Context Condition

It will be argued that the obtained results support Clark's (1974) and Carpenter and Just's (1975) hypothesis that semantically negative sentences are represented in terms of an affirmative core and a negative polarity marker in the case of forget, but not in the case of neglect. This argument is based on the assumption that the interaction between syntactic affirmation/negation and semantic positiveness/negativeness in the present inference-drawing task is equivalent to the true/false-affirmative/negative interaction obtained in verification experiments.

In a verification experiment, an affirmative or negative sentence is posited against the presence or absence of a picture (or another sentence), which makes it either true or false of the situation it describes. In the present experiment, the truth or falsity of the situation is not

manipulated, but the sentences examined have a truth value by virtue of the logical aspects of the implicative predicates involved. While both AFF and SEM-NEG sentences are syntactically affirmative, only AFF sentences have positive implications. SEM-NEG sentences have negative implications. AFF sentences can thus be characterized as true affirmatives (since they imply the truth of the proposition contained in their complement), while SEM-NEG sentences can be characterized as false affirmatives (since they imply the falsity of that proposition). Similarly, while SYN-NEG and SEM/SYN-NEG sentences are both syntactically negative, only SYN-NEG sentences have negative implications; SEM/SYN-NEG sentences have positive implications. SYN-NEG sentences can thus be characterized as true negatives (since they imply the falsity of the proposition contained in their complement), and SEM/SYN-NEG sentences as false negatives, (since they imply the truth of that proposition).

If so, the obtained interaction between syntactic affirmation/negation and semantic positiveness/negativeness in the case of remember/forget is equivalent to the true/false-affirmative/negative interaction obtained in verification experiments, thus supporting the hypothesis that sentences with forget are represented in terms of an affirmative core and a negative polarity marker, as discussed in Clark (1974) and Carpenter and Just (1975).

With respect to the scope-of-negation hypothesis, SYN-NEG sentences were found to have longer inference latencies than SEM-NEG sentences in the case of remember/forget, although this difference was statistically

reliable only when the context conditions were also taken into consideration. This finding agrees in general with the scope-of-negation hypothesis and indicates that sentences which are logically equivalent but whose negative components differ in scope function differently in an inference-drawing task just they do in other language comprehension experiments.

The pattern of inference latencies for bother/neglect was not consistent with the scope-of-negation hypothesis nor with the hypothesis that subjects represent semantically negative sentences as explicit negations of their equivalent affirmatives, since no interaction between syntactic affirmation/negation and semantic positiveness/negativeness was obtained. The lack of such an interaction could be explained if we assume that subjects treated neglect independently of bother. This is a very plausible assumption if one takes into consideration the meaning relation between bother and neglect, as compared to that between remember and forget. Whereas not remember necessarily implies forget, and vice versa, not bother does not necessarily imply neglect. As Karttunen (1971) notes, neglect (like avoid), although a semantically negative predicate, differs from forget in that it does not have a semantically positive predicate which it completely negates.

If neglect is represented independently of bother, then neglect is a very different kind of semantically negative predicate than forget. More specifically, a distinction can be drawn between semantically negative implicative predicates which deny a positive counterpart, such as forget

and fail (hereafter SEM-NEGp), and semantically negative implicative predicates which do not have such semantically positive counterparts to deny, such as neglect and avoid (hereafter SEM-NEGn). SEM-NEGp lexical items can be processed either as negations of their positive counterparts or not. SEM-NEGn lexical items, however, cannot be processed as negations of a positive core. Thus, the obtained results suggest that there are important differences among semantically negative implicative predicates that influence their comprehension.

The present results also suggest that the scope-of-negation hypothesis applies to SEM-NEGn sentences but not to SEM-NEGp sentences, since only SEM-NEG sentences with forget had shorter inference latencies than SYN-NEG sentences with remember as predicted by the scope-of-negation hypthesis.

Another interesting finding was that syntactic negation time (the difference of AFF from SYN-NEG sentences) was very short in the case of not bother (98 msec) as compared to not remember (366 msec). It is possible that the short negation time for not bother is related to the fact that not bother is a very commonly used negative form. If so, this finding should be restricted to not bother and a few verbs in the same category. Further study of syntactic negation is required to determine this. Variability in negation time is not, however, a phenomenon unique to this study. Carpenter and Just (1975), in a comparison of negation times obtained in studies of syntactic and semantic negation, have concluded that negation time can vary from 200 to 600 msec even in the same study. Within the framework of their "Constituent Comparison Model" for the processing of

negative sentences, Carpenter and Just (1975) have accounted for this finding by proposing that negative sentences are sometimes represented in terms of two embedded propositions and sometimes in terms of three embedded propositions. These different representations are assumed to capture the different suppositional nature of negative sentences.

Similarly, within the framework of the present study, the short negation time for not bother could be accounted for if it is assumed that representations for not bother consist of two embedded propositions and that representations for not remember consist of three embedded propositions (see the Carpenter & Just, 1975, model for more details). This asumption could be justified if it is hypothesized that the suppositional nature of syntactic negation varies as a function of the presence or absence of a semantically negative counterpart to it. Namely, granted that a distinction can be drawn in sentences with semantically negative implicative predicates between those that have a semantically positive counterpart (SEM-NEGp), as in the case of forget, and those that do not have a positive counterpart (SEM-NEGn), as in the case of neglect, it can be said that SYN-NEG sentences are represented in terms of three embedded propositions, that is, as (false(AFF(.....))) in the presence of a SEM-NEGp sentence and in terms of two embedded propositions, that is, as (false(.....)) in the absence of a SEM-NEGp sentence. This hypothesis could be investigated empirically. Further study of semantic negation is required to determine the generality of this finding.

Context Effects

It was predicted that all context conditions would decrease inference latencies for all sentence types. This prediction was based on the assumption that the inferential process would be facilitated when occurring in a context that met some of the presuppositions of the sentences. All context conditions met some of the general presuppositions of all sentences by positing the existence of the object denoted by the complement noun of the implicative verb. The main effect of context and the appropriate pairwise comparisons confirmed this prediction, indicating that contexts meeting the presuppositions of sentences facilitate not only comprehension but also reasoning.

The decrease in inference latencies for all sentence types under the context conditions in this study is consistent with previous findings that comprehension time for sentences with a definite noun phrase presupposing existence is shorter when these sentences are preceded by a context sentence positing the existence of the referent of the definite noun (Haviland & Clark, 1974; Juppet & Le Bouedec, 1977). Haviland and Clark have discussed this finding in the context of a broader theory of language comprehension known as the "given-new contract" theory. The present study extends those findings by showing that the given-new contract theory applies also to an inference-drawing task.

A second context effect that applies equally to remember/forget and to bother/neglect is the finding that all context conditions affected semantic negation time more than syntactic negation time. More specifically, both

in the case of bother/neglect and in the case of remember/forget syntactic negation time (the difference of AFF from SYN-NEG sentences) was not affected by context, while semantic negation time (the differences of AFF from SEM-NEG sentences) decreased significantly under the context conditions. The latter effect resulted in a statistically reliable interaction between context and semantic negation.

The context X semantic positiveness/negativeness interaction is consistent with the more general finding that semantic negation is more sensitive to the meaning fluctuations of the different sentence types than syntactic negation. Namely, semantic negation (but not syntactic negation) entered into statistically significant interactions in addition to context, with complement type and implicative verb type.

These results indicate that there is a real psychological difference between syntactic negation and semantic negation in the way these two types of negation are processed during language comprehension and reasoning. While both SYN-NEG and SEM-NEG sentences require the performance of additional operations, in comparison to affirmative sentences, these operations are affected more by meaning variation in the case of semantic negation than in the case of syntactic negation. This holds equally well for SEM-NEGp and SEM-NEGn sentences.

With regard to the differential effects of context on sentences with remember/forget and bother/neglect, there are mainly two results that need to be accounted for. First, syntactic negation time was much shorter in the case of not bother than in the case of not remember under all context

conditions. This finding also holds for the no-context condition and was discussed in the previous section. As such, this difference will not be further discussed here. The second difference was that the semantically negative context (the bad context) further facilitated the processing of sentences with neglect but not sentences with forget. This finding adds further support to the suggestion that forget loses some of its semantic negative identity and is treated as a negation of remember, whereas neglect is treated independently of bother. It is interesting to note that inference latencies for sentences with neglect and bother are almost equal under the bad-context condition, despite the greater complexity of the inference-drawing task in the negative situation. This result agrees with Wason's (1965) argument that the difficulty in the processing of affirmative/positive and negative sentences decreases when the negative sentences are presented in contexts which meet their presuppositions.

Summary

The results of the present study indicate that overall, differences in the presuppositions of implicative predicates affect the process of drawing their implications. Sentences with implicative predicates that involved semantic negation had inference latencies different from those of sentences involving syntactic negation, despite the fact that all sentences implied the falsity of the proposition contained in their complements. With respect to semantic negation, it was found that semantically negative implicative predicates cannot be characterized in a general way but that there are important differences among them, such as the presence or absence

of positive counterparts, which influence their representation and processing. In addition, the results of the context manipulations show that a linguistic context meeting the presuppositions of implicative sentences can facilitate the process of drawing the implications of these sentences. Inference latencies for implicative sentences were lower when these sentences were presented in contexts that met some of their general presuppositions than when these sentences were presented in contexts that did not. Context also facilitated the processing of semantically negative implicative sentences more than the processing of syntactically negative ones, indicating that a real psychological difference exists in the way these two types of negation are processed in language comprehension and reasoning tasks.

Reference Note

1. Clark, H. H. The chronometric study of meaning components. Paper presented at C.R.M.S. Colloque Internationale sur les Problems Actuals de Psycholinguistique, Paris, 1971.

References

Austin, J. L. How to do things with words. Cambridge, Mass.: Harvard University Press, 1962.

Carpenter, P. A., & Just, M. A. Sentence comprehension: A psycholinguistic processing model of verification. Psychological Review, 1975, 82, 45-73.

Chomsky, N. Deep structure, surface structure and semantic representation. In D. D. Steinberg & L. A. Jakobovits (Eds.), Semantics: An interdisciplinary reader in philosophy, linguistics and psychology. Cambridge: Cambridge University Press, 1971.

Clark, H. H. Semantics and comprehension. In T. A. Sebeok (Ed.), Current trends in linguistics (Vol. 12). The Hague: Mouton, 1974.

Clark, H. H., & Chase, W. B. On the process of comparing sentences against pictures. Cognitive Psychology, 1972, 3, 477-517.

Fillmore, C. T. Types of lexical information. In D. D. Steinberg & L. A. Jakobovits (Eds.), Semantics: An interdisciplinary reader in philosophy, linguistics and psychology. Cabridge: Cambridge University Press, 1971.

Gough, P. B. Grammatical transformations and the speed of understanding. Journal of Verbal Learning and Verbal Behavior, 1965, 5, 107-111.

Haviland, S. E., & Clark, H. H. What's new? Acquiring new information as a process in comprehension. Journal of Verbal Learning and Verbal Behavior, 1974, 13, 515-521.

Jones, S. Instructions, self-instructions and performance. Quarterly Journal of Experimental Psychology, 1968, 20, 74-78.

Jupet, M., & Le Bouedec, B. The given-new contract and the constructive aspect of memory for ideas. Journal of Verbal Learning and Verbal Behavior, 1977, 16, 69-75.

Just, M. A., & Carpenter, P. A. Comprehension of negation with quantification. Journal of Verbal Learning and Verbal Behavior, 1971, 10, 244-253.

Just, M. A., & Clark, H. H. Drawing inferences from the presuppositions and implications of affirmative and negative sentences. Journal of Verbal Learning and Verbal Behavior, 1973, 12, 21-31.

Karttunen, L. Implicative verbs. Language, 1971, 47, 340-358.

Klima, E. S. Negation in English. In J. H. Fodor & J. J. Katz (Eds.), The structure of language. Englewood Cliffs, N.J.: Prentice-Hall, 1964.

Lakoff, G. On generative semantics. In D. D. Steinberg & L. A. Jakobovits (Eds.), Semantics: An interdisciplinary reader in philosophy, linguistics and psychology. Cambridge: Cambridge University Press, 1971.

Olson, D. R., & Filby, N. On the comprehension of active and passive sentences. Cognitive Psychology, 1972, 3, 361-381.

Trabasso, T. Mental operations in language comprehension. In J. B. Carroll & R. O. Freedle (Eds.), Language comprehension and the acquisition of knowledge. Washington, D.C.: Winston, 1972.

Wason, P. C. The contexts of plausible denial. Journal of Verbal Learning and Verbal Behavior, 1965, 4, 7-11.

Wason, P. C. In real life negatives are false. Logique et Analyse, 1972, 17-38.

Wason, P. C., & Johnson-Laird, P. N. Psychology of reasoning: Structure and content. Cambridge, Mass.: Harvard University Press, 1972.

Footnote

The reseach reported herein is based on a portion of the author's doctoral dissertation submitted to Clark University. This paper was completed while the author was at the Center for the Study of Reading, University of Illinois, and its preparation was supported in part by the National Institute of Education under Contract No. HEW-NIE-C-400-76-0116. The author would like to thank Rachel Joffe-Falmagne for her support and advice throughout this project. Special thanks are also due to Lenny Cirillo, Joseph Schmuller, and Mort Wiener for their helpful comments on earlier drafts of this manuscript.

Table 1

Exemplar Sentences with Implicative Predicates

Semantically	Syntactically	
	Affirmative	Negative
Positive	Fred has remembered to open the safe (AFF)[a]	Fred hasn't remembered to open the safe (SYN-NEG)[b]
Negative	Fred has forgotten to open the safe (SEM-NEG)[b]	Fred hasn't forgotten to open the safe (SEM/SYN-NEG)[a]

[a]Implies the truth of the proposition contained in its complement (i.e., Fred opened the safe: true)

[b]Implies the falsity of the proposition contained in its complement (i.e., Fred opened the safe: false)

Table 2

Mean Inference Latencies

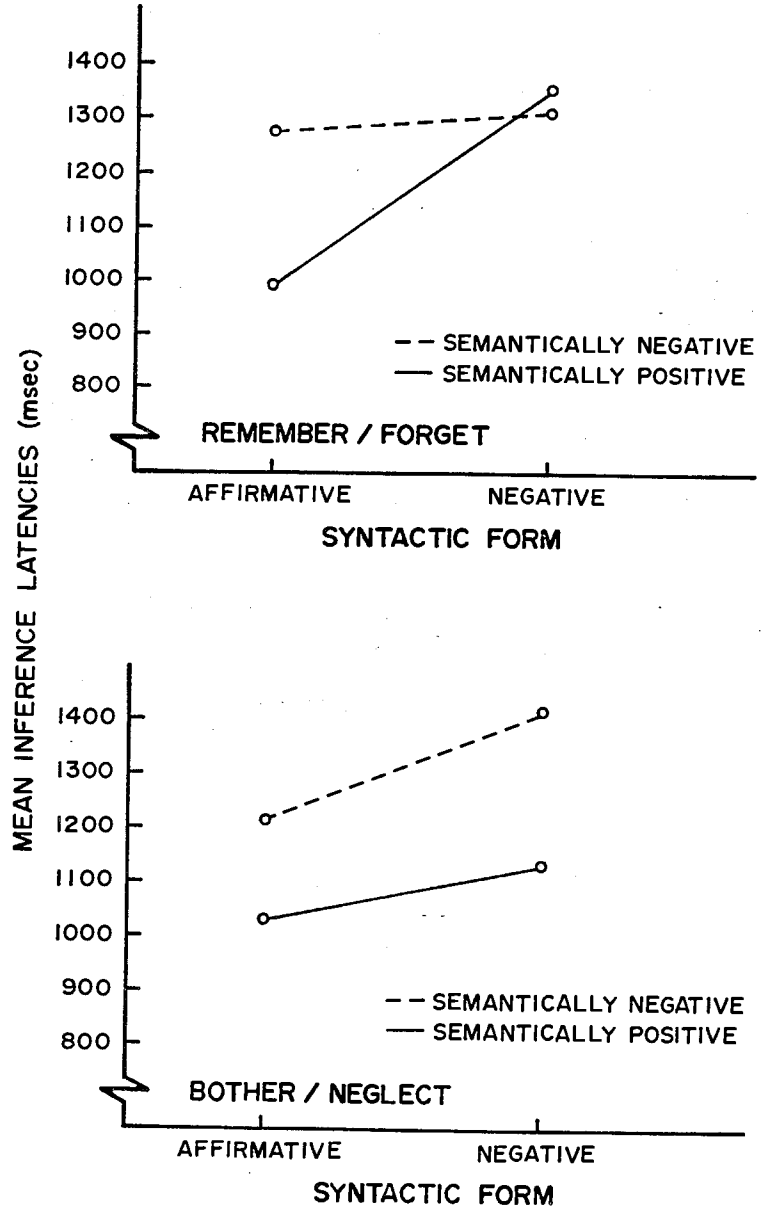
for the Main Effect of Context

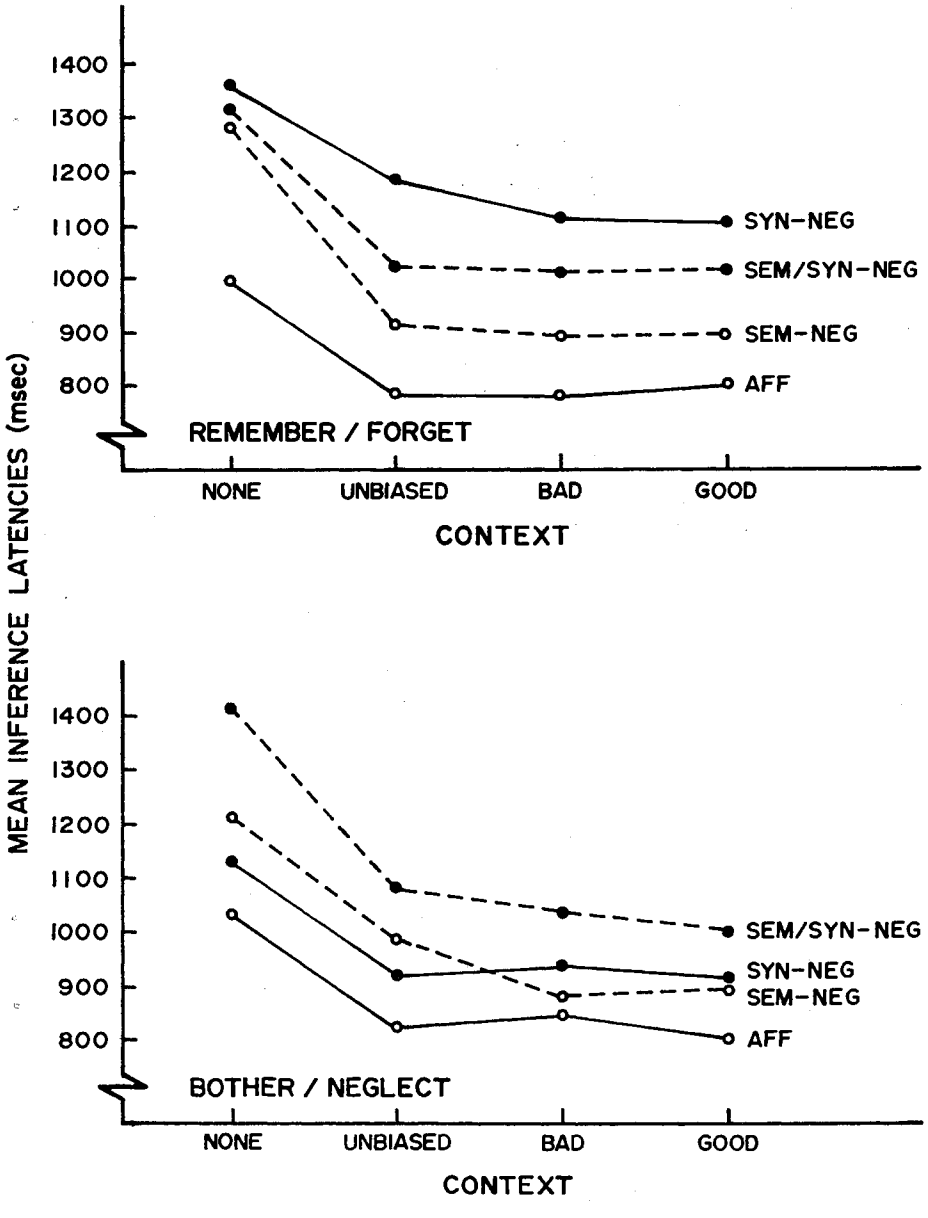
Context	Mean Latencies (in msec)
No context	1213
Unbiased context	959
Bad context	933
Good context	918

Figure Captions

Figure 1. Mean inference latencies as a function of implicative verb type, syntactic affirmation/negation, and semantic positiveness/negativeness.

Figure 2. Mean inference latencies for the two implicative verb types as a function of context, syntactic affirmation/negation, and semantic positiveness/negativeness.




MEAN INFERENCE LATENCIES (msec)
1400
1300
1200
1100
1000
900
800
SYN-NEG
SEM/SYN-NEG
SEM-NEG
AFF
REMEMBER / FORGET
NONE
UNBIASED
BAD
GOOD
CONTEXT
1400
1300
1200
1100
1000
900
800
SEM/SYN-NEG
SYN-NEG
SEM-NEG
AFF
BOTHER / NEGLECT
NONE
UNBIASED
BAD
GOOD
CONTEXT

This page is intentionally blank.