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Drawing Inferences from the Presuppositions and Implications of Affirmative and Negative Sentences[1]

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This study examined the effects of negation on how people make use of information in the presuppositions and implications of sentences. Subjects were timed as they made true–false judgments of sentences like *If John forgot to let the dog out, then the dog is supposed to be in.* The verbs were either positive (for example, *remember*) or inherently negative (*forget*); the conclusions interrogated either presuppositions (*the dog is supposed to be out*) or implications (*the dog is out*). Subjects found it easier to verify positive components as true, but negative components as false. This happened regardless of the polarity (positive or negative) of the parent sentence. Also, subjects took longer on negative verbs, but by an equal amount on both components, even though such negation does not logically affect presuppositions. This suggests that people may examine implications before presuppositions regardless of which component is interrogated.

Recent linguistic investigations (Fillmore, 1971; Karttunen, 1971; Lakoff, 1970) have distinguished between presuppositions and implications, two types of components contained in the meaning of sentences. As illustration of this distinction, sentence (1a) is said to presuppose proposition (1b), but to imply proposition (1c):

(1) a. John managed to find his hat.
 b. Presupposition: John tried to find his hat.
 c. Implication: John found his hat.

Obviously, if the listener has fully comprehended (1a), then he should be able to answer questions about the presupposition and implication separately; for example, *Did John try to find his hat? Did John find his hat?* The aim of the present study was to discover the process by which he is able to do this. In particular, we wished to examine the role of negation in answering questions and drawing inferences about the separate components of a sentence. To do this, we asked subjects to answer questions or verify statements about the positive or negative components of a sentence they had just read, and we measured the latencies of their responses.

As linguistic entities, the presuppositions and implications of a sentence are both legitimate inferences that can be drawn from the sentence; nevertheless, they are distinguishable by several linguistic criteria (Kiparsky & Kiparsky, 1970; Fillmore & Langendoen, 1971; Karttunen, 1971). Of most interest here is the criterion that when a sentence is negated, all its implications become negative too, while its presuppositions remain unchanged. Consider, for example, sentence (2a), which is the negative of (1a):

(2) a. John didn't manage to find his hat.
 b. Presupposition: John tried to find his hat.
 c. Implication: John didn't find his hat.

Implication (2c) is the negative of the previous implication (1c), but presupposition (2b) is

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identical to presupposition (1b). Thus, a sentence and its negative have the same presuppositions, but different implications, a property that will be valuable for testing how subjects access presuppositions and implications.

In the present experiments, we made use of the predicates *remember to* and *thoughtful* and their inherently negative counterparts *forget to* and *thoughtless*, since these words have exceptionally nice properties for the study of positive and negative components. As Karttunen (1971) has pointed out, sentences (3a) and (4a) have identical presuppositions (3b) and (4b), but implication (4c) is the negative of implication (3c):

(3) a. John remembered to let the dog out.
 b. Presupposition: John was supposed to let the dog out.
 c. Implication: John let the dog out.

(4) a. John forgot to let the dog out.
 b. Presupposition: John was supposed to let the dog out.
 c. Implication: John didn't let the dog out.

In this respect, *forgot to* behaves just like the explicit negative *didn't remember to*, since an explicit negation of sentence (3a) would have the same presupposition and implication as sentence (4a). Experimentally, the advantage of the word *forget* over *not remember* is that *forget* is no longer than the word *remember*—it is even shorter—and should not take any longer to read. Furthermore, we were interested in the inherent negativity of *forget*. The properties of *thoughtful* and *thoughtless* are shown in (5) and (6):

(5) a. It was thoughtful of John to let the dog out.
 b. Presupposition: John let the dog out.
 c. Implication: John was supposed to let the dog out.

(6) a. It was thoughtless of John to let the dog out.
 b. Presupposition: John let the dog out.
 c. Implication: John wasn't supposed to let the dog out.

Here again, the presuppositions are the same, but the implication of *thoughtless* is the negative of the implication of *thoughtful*. In the first experiment, the presuppositions and implications of sentences (3) through (6) were interrogated with the questions *Where is the dog?* and *Where is the dog supposed to be?* One property of these questions is that *Where is the dog?* interrogates the implications of the *remember–forget* sentences, but the presuppositions of the *thoughtful–thoughtless* sentences; *Where is the dog supposed to be?* does just the reverse. This counterbalancing of question and component interrogated eliminates certain short cuts subjects could take if the questions were correlated with the component they interrogated.

To examine the role of negation in accessing presuppositions and implications, we proposed two hypotheses, the independence hypothesis and the components hypothesis. The independence hypothesis is a natural first conjecture about how these components might be accessed. It states simply that the subject is able to access and make use of the presuppositions and implications of a sentence independently of each other. Previous studies have shown that negative sentences take longer to verify or complete than positive sentences (Clark, 1970; Clark & Chase, 1972; Just & Carpenter, 1971; Trabasso, Rollins, & Shaughnessy, 1971; Wason, 1961). If, as the independence hypothesis states, the presuppositions and implications of a sentence can be accessed independently, then the presence of a negative component should make inferences harder to draw only if that component is interrogated. For example, consider *Where is the dog?* and *Where is the dog supposed to be?* asked of sentences (3a) and (4a). The implication of (4a) is the negative of the implication of (3a). The presence of this negative should make the subject take longer to answer *Where is the dog?* for (4a) than for (3a), since he has to carry out an extra time-consuming step in making the inference that if the dog is not out, as (4a) implies, then it must be in. By contrast, the presuppositions of both sentences are positive, so the independence hypothesis predicts that *Where is the dog supposed to be?* should not be affected by the presence of the additional negative component in (4a). Thus, it should take longer to access the implication of (4a) than of (3a), but not to access their presuppositions. This hypothesis was examined in both Experiments I and II.

The second hypothesis of interest is the components hypothesis. It assumes that negative components are verified differently from positive components regardless of the sentence they are contained in. Roughly speaking, previous studies of negation have shown that positive sentences are easier to verify as true than false, but negative sentences are easier to verify as false than true (Clark, 1970, 1973; Trabasso, Rollins, & Shaughnessy, 1971). None of the previous studies, however, has tried to separate out the verification of the separate components (presuppositions, implications) of the sentences. According to the present hypothesis, it is the polarity of the component that is relevant to the verification process and not the polarity of the sentence itself. Thus, positive *components* should be easier to verify as true than false, and negative *components*, easier to verify as false than true, and this pattern should hold regardless of whether the sentence containing these components is itself positive or negative. This hypothesis makes the following exemplary prediction. Given sentence (4a), subjects should find it easier to judge that the conclusion *The dog is supposed to be out* is true than that *The dog is supposed to be in* is false, since these conclusions must be verified against a positive component (the presupposition). Conversely, subjects should find it more difficult to judge that *The dog is in* is true than that *The dog is out* is false, since these conclusions must be verified against a negative component (the implication). This hypothesis was examined in Experiment II.

Experiment I was designed to test the independence hypothesis alone. It utilized the problems shown in Table 1. In it we expected the following results for the *remember–forget* sentences. First, *forget* should take more time to encode or register initially than *remember*, since *forget* is inherently negative and *remember* is not. This pattern would be consistent with a number of previous studies on implicit negatives (Clark, 1970, 1971; Just & Carpenter, 1971). Second, *Where is the dog supposed to be?* might well take more time to encode or read initially than *Where is the dog?*, since the former question contains extra words (*supposed to be*) which in turn indicate a more complex modality that could take more time to comprehend. The critical prediction of the independence hypothesis, however, is that *Where is the dog?* should take more time on *forget* than on *remember* over and above these other main effects; that is, there should be a particular *remember–forget* by question interaction in Experiment I. The analogous expectations hold for *thoughtful* and *thoughtless*.

EXPERIMENT I

Method

In this experiment, subjects were timed while they read and answered premise–question pairs of the following form: *If John remembered to let the dog out, then where is the dog?* There were 16 different problems, 8 of which are given in Table 1; the other 8 were identical, but with the word *in* in place of the word *out*. Each premise–question pair was typed in elite type and viewed in a tachistoscope at a distance of 41 centimeters.

On each trial, the subject began the sequence by pushing a "ready" button, and 500 milliseconds later he was presented with the stimulus card. He then read the problem and answered it as quickly and as accurately as possible. He indicated his answer by pushing an "in" or "out" button on either side of the ready button with his left or right thumb; this response turned off the display. Assignment of the in and out buttons to the two hands was balanced across subjects with respect to their hand dominance. The subject was timed in hundredths of a second from the onset of the display to the first push of a response button. There was a practice session, consisting of 10 of the problems chosen at random. The test session consisted of the 16 problems presented in random order within each of 10 blocks. There was a short rest period between blocks, and the entire session lasted about 45 minutes.

The subjects were 10 introductory psychology students at Stanford University.

Results

Of most interest are the mean latencies shown in Table 1. They were obtained as follows. Each subject was given a mean latency for each of the 16 problems based on his 10 or fewer correct responses to each problem; (the error rate was only 3.1 percent). These means, collapsed over *in* and *out*, were averaged across subjects to produce the means in Table 1. They were also submitted to two analyses of variance, one for *remember–forget* and one for *thoughtful–thoughtless*.

The analysis of the *remember–forget* problems was not consistent with the critical independence prediction, although it did confirm the other expectations. First, *forget* took 438 milliseconds longer than *remember* [$F(1, 9) = 9.86$, $p < .025$], and the question *Where is the dog supposed to be?* took 178 milliseconds longer than the question *Where is the dog?* [$F(1, 9) = 20.63$, $p < .01$]. But, in contradiction to the independence prediction, the interaction between *remember–forget* and the question was not significant [$F(1, 9) < 1$]. In fact, the direction of the interaction was slightly (67 milliseconds) in the wrong direction.

The *thoughtful–thoughtless* latencies yielded almost the same pattern. First, as expected, *thoughtless* took 347 milliseconds longer than *thoughtful* [$F(1, 9) = 11.39$, $p < .01$], and *Where is the dog supposed to be?* took 64 milliseconds longer than *Where is the dog?* [$F(1, 9) < 1$]. But again in contradiction to the independence prediction, the interaction between *thoughtful–thoughtless* and the question was not significant [$F(1, 9) = 2.65$]. Indeed, the magnitude of this F ratio is due to a slight (158 milliseconds) interaction in the wrong direction.

TABLE 1

EXEMPLARY PROBLEMS AND THEIR MEAN LATENCIES (IN MILLISECONDS) FOR EXPERIMENT I

Premise and question	Component interrogated	Mean latency
John remembered to let the dog out.		
Where is the dog?	Implication	1795
Where is the dog supposed to be?	Presupposition	1939
John forgot to let the dog out.		
Where is the dog?	Implication	2199
Where is the dog supposed to be?	Presupposition	2410
It was thoughtful of John to let the dog out.		
Where is the dog?	Presupposition	2015
Where is the dog supposed to be?	Implication	2158
It was thoughtless of John to let the dog out.		
Where is the dog?	Presupposition	2441
Where is the dog supposed to be?	Implication	2426

The question arises here as to whether the differences among the means could be attributed to differences in skewness of the latency distributions in the various conditions. Since latency distributions are often skewed in a positive direction, the means of some conditions could conceivably have been inflated by a small number of very long latencies. To check for this possibility, we calculated the within-subject skewness measure g_1 (see Snedecor & Cochran, 1967, p. 86) for the latency distribution of each condition. The mean g_1s were positive for all eight conditions, as expected, but they showed only a negligible correlation ($r = -.13$, n.s.) with mean latencies. This result indicates that differential skewness cannot account for differences among the mean latencies.

Discussion

According to Experiment I, the independence hypothesis is incorrect. If it had been correct, then the questions that interrogated the negative components of the experimental sentences—that is, the implications of *forget* and *thoughtless*—should have taken relatively longer to answer than the questions that interrogated the positive components. But this increase failed to appear, thus providing negative evidence for the hypothesis.

There are two alternative psychological models we could propose to account for this pattern: (*a*) the conversion model, which assumes that subjects always convert negative implications into positive form before answering any questions; and (*b*) the ordered model, which assumes that for any question, the subject always looks for the answer in the implication first and, if this fails, he then looks in the presupposition. These two models will be described and tested in more detail in Experiment II.

Experiment II

The purpose of Experiment II was to test the components hypothesis and, in so doing, test whether the conversion model or the ordered model is correct. For this purpose, we required subjects to make true–false judgments of premise–conclusion pairs like *If John forgot to let the dog out, then the dog is in.* Again, we measured the latency of the correct responses.

If the components hypothesis is correct, then true conclusions should be faster than false conclusions when the component being interrogated is positive, but true conclusions should be slower than false conclusions when the component being interrogated is negative. Taken at face value this statement is easy to apply to the problems containing *remember, forget, thoughtful,* and *thoughtless.* True should be faster than false for any conclusion that makes reference to the presupposition component of any of these verbs as well as for any conclusion that makes reference to the implication component of *remember* and *thoughtful,* since all these components are positive. But true should be slower than false for conclusions interrogating the implications of *forget* and *thoughtless,* since these components are negative. These predictions, however, rely on the assumption that the components of these four words are coded in the positive and negative forms shown in (3) through (6). The first model to be examined, the conversion model, does not make this assumption, and so its predictions are slightly different.

According to the conversion model, the implications of *forget* and *thoughtless* are not ultimately encoded as negative propositions at all, but rather they are each invariably converted into a positive form. Given *John forgot to let the dog out,* for example, the subject would automatically convert its underlying implication *The dog isn't out* into *The dog is in* before attempting to answer the question in Experiment I or verify the conclusion in Experiment II. These conversions are assumed to occur no matter what the question or conclusion is. Similar conversions have been noted in previous verification experiments, but only with sentences containing the explicit negative *not* (see Wason, 1961; Trabasso, Rollins, & Shaughnessy, 1971; Young & Chase, 1971); for example, some of Wason's subjects reported spontaneously converting expressions like *Six is not odd* into *Six is even.* In the present study, the extra conversion would occur on all problems containing *forget* and *thoughtless,* adding an extra increment of time (Young & Chase, 1971) to *forget* and *thoughtless* every time these terms were encountered. As applied to Experiment I, this model predicts a large *remember–forget* and *thoughtful–thoughtless* difference, but no interaction between these factors and the question. These predictions, of course, are quite consistent with the results of Experiment I.

Under the additional assumption that the components hypothesis is true, the conversion model can be directly tested in a verification task like Experiment II. This model assumes that all of the component propositions of *remember*, *forget*, *thoughtful*, and *thoughtless* are ultimately stored in a positive form. It predicts, therefore, that true conclusions should be verified more quickly than false conclusions for these premises no matter what component is being referred to in the conclusion. In all other respects, the results of Experiment II should be similar to those of Experiment I.

On the other hand, the ordered model assumes that the subject invariably checks the question, or conclusion, against the implication of the premise first; if he cannot find the answer there, he then checks it against the presupposition. For example, for the question *Where is the dog supposed to be?* asked of the premise *John forgot to let the dog out*, the subject would compare the question first against the implication *The dog isn't out*; because the latter is negative, this comparison would add an extra increment of time. But the subject would find that the modality of the question (where the dog is *supposed* to be) does not match the modality of the implication (where the dog *is*), and so he would go on to the presupposition (here, *The dog is supposed to be out*) and find the answer. For Experiment I, this model predicts that presuppositions should take longer to interrogate than implications, since implications are always scanned first. It also predicts that the added increment in the interrogation of negative implications should be found every time *forget* and *thoughtless* occur, since these implications are invariably scanned first. But again, this model predicts no interaction between *remember-forget* (or *thoughtful-thoughtless*) and the question. Thus, this model is also quite consistent with the results of Experiment I.

Under the assumption that the components hypothesis is true, the ordered model can also be tested in Experiment II. This model assumes that the negative implications of *forget* and *thoughtless* remain negative throughout the process. It predicts, therefore, that whereas true conclusions should be verified more quickly than false conclusions in every other case, false conclusions should be verified more quickly than true conclusions whenever they make reference to the implications of *forget* and *thoughtless*. In all other respects, the results of Experiment II should look like those of Experiment I.

To summarize, both the conversion and ordered models predict (a) that *forget* should take longer than *remember* (and *thoughtless* longer than *thoughtful*), (b) that *Where is the dog supposed to be?* should take longer than *Where is the dog?*, and (c) that there should be no interaction between (a) and (b). In addition, both models predict that true conclusions should be faster than false conclusions for the following three components: the presuppositions of *remember* and *thoughtful*, the presuppositions of *forget* and *thoughtless*, and the implications of *remember* and *thoughtful*. The critical difference between the models is that the conversion model predicts that true conclusions should also be faster than false conclusions for the implications of *forget* and *thoughtless*, whereas the ordered model predicts the opposite. Finally, the ordered model predicts that presuppositions should take an independent increment longer to access than implications (since implications are invariably scanned first), whereas the conversion model makes no such prediction.

Method

In this experiment, subjects were timed while they made true–false judgments of premise–conclusions pairs (for example, *If John forgot to let the dog out, then the dog is supposed to be in*). There were 32 such problems, 16 of which are shown in Table 2; the remaining 16 were identical to these except that *in* was replaced

TABLE 2

EXEMPLARY PROBLEMS AND THEIR MEAN LATENCIES (IN MILLISECONDS) FOR EXPERIMENT II

Premise and conclusion	Component interrogated	Mean latency
John remembered to let the dog out.		
The dog is out. [true]	Implication	2814
The dog is in. [false]	Implication	3252
The dog is supposed to be out. [true]	Presupposition	3564
The dog is supposed to be in. [false]	Presupposition	4100
John forgot to let the dog out.		
The dog is in. [true]	Implication	3670
The dog is out. [false]	Implication	3536
The dog is supposed to be out. [true]	Presupposition	4183
The dog is supposed to be in. [false]	Presupposition	4664
It was thoughtful of John to let the dog out.		
The dog is out. [true]	Presupposition	3647
The dog is in. [false]	Presupposition	3964
The dog is supposed to be out. [true]	Implication	4162
The dog is supposed to be in. [false]	Implication	4539
It was thoughtless of John to let the dog out.		
The dog is out. [true]	Presupposition	3939
The dog is in. [false]	Presupposition	4527
The dog is supposed to be in. [true]	Implication	4657
The dog is supposed to be out. [false]	Implication	4673

by *out*, and vice versa, in each problem. The procedure was identical to that in Experiment I, except that each subject went through five blocks of 32 trials, each block consisting of the 32 premise–conclusion pairs. The subjects were 12 paid Stanford University undergraduates. The true and false buttons were balanced with respect to hand dominance across subjects.

Results

The latencies were analyzed as in Experiment I. Each subject was given a mean latency for the five or fewer correct responses for each of the 32 premise–conclusion pairs; (the error rate was 5.6%). These means, collapsed over *in* and *out*, were submitted to two analyses of variance, one for *remember–forget* and one for *thoughtful–thoughtless*. These means were also compared to the mean skewness measure g_1, just as in Experiment I, and were again shown to have a negligible correlation with skewness ($r = -.27$, n.s.), ruling out a possible confounding of these two measures. As listed in Table 2 and shown in Figures 1 and 2, these mean latencies confirm the conclusion of Experiment I that the independence model is incorrect, and they tend also to support the ordered model over the conversion model.

The *remember–forget* latencies fit a rather simple pattern. As before, *remember* was 581 milliseconds faster overall than *forget* [$F(1, 11) = 35.06$, $p < .01$]; and conclusions about where the dog is were verified 810 milliseconds faster overall than conclusions about where the dog is supposed to be [$F(1, 11) = 99.54$, $p < .01$]. But again, the *remember–forget* difference was no larger overall for implications (570 milliseconds) than for presuppositions (592 milliseconds) [$F(1, 11) < 1$]. Thus, like the results of Experiment I, this finding is inconsistent with the independence model, which predicts a larger difference for implications than for presuppositions. On the critical implications of *forget*, false was 134 milliseconds

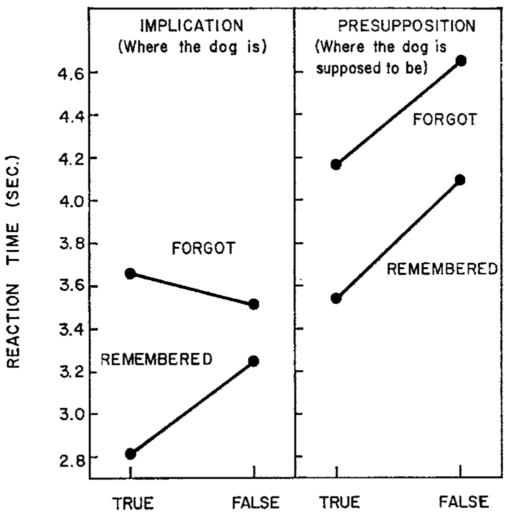

FIG. 1. Verification time as a function of truth value for *remember–forget*.

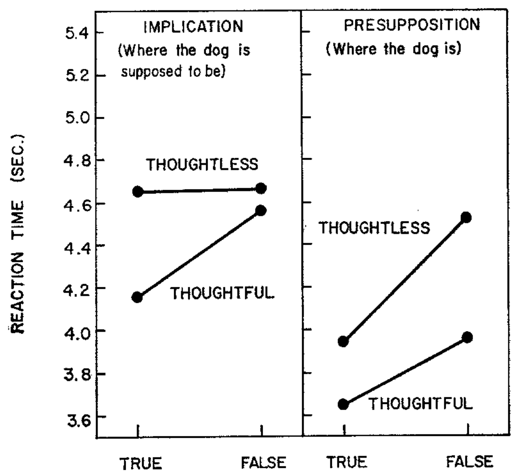

FIG. 2. Verification time as a function of truth value for *thoughtful–thoughtless*.

faster than true, thereby supporting the ordered model over the conversion model. Specifically, in a comparison of the implications of *remember* and *forget*, there was a significant *remember–forget* by true–false interaction [$F(1, 11) = 13.35$, $p < .01$], and no significant true–false difference [$F(1, 11) = 1.19$]. This is exactly the pattern predicted by the ordered model. In addition, true was faster than false for the presuppositions of both *remember* and *forget* [$F(1, 11) = 19.72$, $p < .01$], with no interaction, and this is also consistent with the ordered model.

The *thoughtful–thoughtless* latencies also rule out the independence model, but they are equivocal between the ordered and conversion models. First, as expected, *thoughtful* was 371 milliseconds faster than *thoughtless* [$F(1, 11) = 25.33$, $p < .01$], and conclusions about where the dog is were verified 489 milliseconds faster than conclusions about where the dog is supposed to be [$F(1, 11) = 21.00$, $p < .01$]. But once again, the *thoughtful–thoughtless* difference was not larger for implications (315 milliseconds) than for presuppositions (428 milliseconds) [$F(1, 11) < 1$], a result which is inconsistent with the independence model. On the critical implications of *thoughtless*, true was a small 16 milliseconds faster than false. This pattern is almost exactly halfway between the ordered and conversion models. That is, on the implications of *thoughtful–thoughtless*, the ordered model predicts a *thoughtful–thoughtless* by true–false interaction, but no overall advantage of true over false; the conversion model predicts the reverse—no interaction, but an advantage of true over false. The latencies show both a partial, but nonsignificant interaction [$F(1, 11) = 2.27$], and a just-significant 196 milliseconds advantage of true over false [$F(1, 11) = 6.33$, $p < .05$].

There is one important difference between the *remember–forget* and *thoughtful–thoughtless* latencies. Both patterns showed that conclusions about where the dog is were faster than conclusions about where the dog is supposed to be. But this difference was much larger for *remember–forget* (810 milliseconds) than for *thoughtful–thoughtless* (489 milliseconds), although this discrepancy is not quite significant. This finding is at least consistent with the ordered model, which predicts that conclusions concerning presuppositions take longer than those concerning implications. This would make the modality difference larger for *remember–forget* than for *thoughtful–thoughtless*, just as the results showed.

Finally, there are two results that do not afford easy explanation. First, the difference between *remember* and *forget* was larger than the difference between *thoughtful* and *thoughtless*, both in Experiment I (438 to 347 milliseconds) and Experiment II (581 to 371 milliseconds). This occurred despite the fact that both pairs have approximately the same contrasting properties with respect to negativity. Second, the difference in modality (where the dog is *vs* where the dog is supposed to be) was very much larger in Experiment II (650 milliseconds) than in Experiment I (121 milliseconds). This disparity is surprising since the modals serve what appear to be identical functions in the two experiments.

Discussion

The present results bear on two issues concerning the comprehension of sentences: first, the specification of what it means to say that words like *remember* and *thoughtful* are positive and that words like *forget* and *thoughtless* are negative; and second, the elimination of several plausible models for the process of answering questions and verifying statements about presuppositions and implications, at least for the present tasks.

Linguistically, *remember–forget* and *thoughtful–thoughtless* are two positive–negative pairs. *Forget* and *thoughtful* are inherently negative because their implications are negative, just like the implications of the explicit negatives *didn't remember* and *wasn't thoughtful*, and because they evince certain other properties common to negatives (see Klima, 1964). Previously, it has been found that negatives take longer to comprehend on the average than their positive counterparts, no matter whether the negatives are explicit like *not* or *never* (Clark & Chase, 1972; Trabasso, Rollins, & Shaughnessy, 1971; Wason, 1961), inherent like *hardly*, *scarcely*, or *few* (Just & Carpenter, 1971), or even more implicit like *absent*, *different*, or *conflict* (Clark, 1971). In agreement with this generalization, the *remember–forget* and *thoughtful–thoughtless* differences ranged from 336 to 592 milliseconds in Experiments I and II, with the positive member always easier than the negative.

But Experiment II also provides evidence for the componential nature of *remember*, *forget*, *thoughtful*, and *thoughtless*. As pointed out above, it has previously been found that positive sentences are verified more quickly when true than when false, but negative sentences are verified more quickly when false than when true. The latter pattern occurs whenever the negative sentence is coded as a negative and is not converted into a positive form first. In the present paper, however, we have argued that it is the positive and negative *components* of sentences that should be viewed as positive and negative, respectively, not the sentences themselves. The present evidence supports this view. First, the implications and presuppositions of *remember* and *thoughtful* and the presuppositions of *forget* and *thoughtless* are all positive; therefore, a "true" response should be faster than a "false" response for each of these components. This was in fact the case. Second, the implications of *forget* and *thoughtless* are negative; therefore, false should be faster than true. This was so for *forget*. In the case of *thoughtless*, even though true was slightly faster than false for this negative implication, the difference (16 milliseconds) was clearly smaller than the true–false differences (317, 377, and 588 milliseconds) for the three positive components of *thoughtful–thoughtless* [$t(11) = 2.88, p < .025$]; therefore, this negative implication is treated by subjects more like a negative than the other three positive components are (see also below). In short, negatives like *forget* and *thoughtless* contain components that are negative, but they also contain components that are positive, and these two types of components are treated differently in verification tasks and hence in comprehension generally.

The results of Experiment II therefore rule out a type of response bias explanation for the previous results on negation. According to such an explanation, positive sentences make the response "true" more available (and hence faster) than "false," whereas certain types of negative sentences reverse this availability. In proposing this explanation, one could suppose that the negative element in negative sentences primes the response "false." Or one could suppose that people expect positive sentences to be true and negatives to be false, thereby decreasing the latencies for true positive and false negative sentences. Such an account would have to predict a fast "true" for positive sentences and a fast "false" for negatives no matter which conclusion was verified. But for *forget*, and partially for *thoughtless*, true was faster than false for presuppositions, but slower than false for implications. These findings contradict a response-bias account and suggest that it is also incorrect as an explanation for the previous studies of negation.

A second goal of the present study was to test the independence hypothesis, which assumes that the subject can access the presuppositions and implications of a sentence independently of each other. It predicts that since negation alters the polarity of the implications, but not the presuppositions, of a sentence, access to the implications of *remember* and *forget* (or *thoughtful* and *thoughtless*) should differ, whereas access to their presuppositions should not. Somewhat surprisingly, this prediction was disconfirmed in both experiments. Thus, we proposed two alternative models—the conversion model, where the negative component is invariably converted into a positive form before interrogation, and the ordered model, where the implication is invariably scanned before the presupposition. The *remember–forget* latencies were consistent only with the ordered model; however, the *thoughtful–thoughtless* latencies were equally inconsistent with both models. This suggests that subjects may have been using a mixture of strategies (as in Wason, 1961; see Clark, 1970, 1973, and Trabasso, Rollins, & Shaughnessy, 1971, for a discussion of Wason's results). If this is correct, the subjects solving the *remember–forget* problems performed most often according to the ordered model, whereas the subjects solving the more difficult *thoughtful–thoughtless* problems used a mixture of both the ordered and conversion models. Nevertheless, while predictions from the ordered model are generally more consistent with the data, the model clearly requires further, more detailed examination.

In addition to its empirical support, there is a certain linguistic plausibility to the ordered model. Pragmatically, presuppositions and implications are used for different communicative purposes. Presuppositions normally contain information that the speaker assumes he and the hearer can both take for granted at that point in the conversation. It is old information. Implications normally contain the new information the hearer does not yet know and the speaker wants to get across. This is why one cannot properly answer a question with information found in a presupposition of the answer: The presupposition is assumed to be known already. Thus, *Was John supposed to let the dog out?* cannot be properly answered by *Yes, he remembered to* or *Yes, he forgot to* since the information requested is found in the presuppositions of the answer. Although these answers provide the required information, they do so in the wrong component. (These two answers become sensible, of course, with a conjunction—*Yes, and he remembered to*, or *Yes, but he forgot to*—because *remember* and *forget* add new information in these instances and are not simply appositive to the answer "yes".) *Did John let the dog out?*, however, can be answered sensibly by *Yes, he remembered to*, or *No, he forgot to*, for these answers *imply* the information asked for in the question and thus are allowable replies. Thus, it is reasonable for people to assume that the question asked or the statement to be verified is concerned with the new information in the implication, not with the presumably shared information in the presupposition. In the present experiments, this assumption would lead the subject to scan the implication before the presupposition, a strategy incorporated in the ordered model.

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