Tacit Verification of Determinate and Indeterminate Text Ideas

Murray Singer
University of Manitoba

Singer (2006) presented evidence that reading time reflects, in part, processes of continuously verifying current clauses with reference to their text antecedents. This study extended that analysis to text ideas of indeterminate truth in their discourse context. For example, having read simply that Norm’s house was destroyed, one might later read that Norm’s cousin believed that Norm’s house was destroyed by a fire. Research concerning people’s reports of not knowing something suggested that the reading of clauses of indeterminate truth would be faster than for false or inconsistent clauses. In two experiments, target sentences varied in their truth, verb entailments, and use of negation with reference to their antecedents. Reading time for indeterminate targets was sometimes distinctly shorter and was never longer than for corresponding false targets. The effects were modulated by the entailments of factive and nonfactive main verbs and by negative expression. All of the conditions that were identical to ones of Singer (2006) replicated the former findings. It was concluded that encountering text ideas of indeterminate truth does not initiate protracted memory searches for comparable concepts.

Keywords: comprehension: text, metamemory, memory-based text processing, pragmatics

Thorough comprehension during reading requires the continual evaluation of text ideas. The reader’s sensitivity to text accuracy is reflected by the inconsistency effect: Reading time is greater for constituents that are either superficially (Klin, 1995; Long & Chong, 2001) or situationally (Albrecht & Myers, 1995; O’Brien & Albrecht, 1992; Rinck, Hahnel, & Becker, 2001) inconsistent with their text antecedents than for consistent ones. Singer (2006) presented further evidence of the ongoing verification of text ideas and specified several principles concerning the contributing processes. First, consistent with the memory-based text processing analysis (e.g., O’Brien, Lorch, & Myers, 1998), the current clause provides cues for the passive retrieval of text antecedents and relevant knowledge. Second, successful retrieval permits the verification of the current clause in the context of its antecedents. Third, parsimony suggests that tacit verification during reading might resemble the processes of intentional verification. Suppose one reads, Norm’s house had been destroyed by a tornado. In intentional verification, one might encounter the test item, Was Norm’s house destroyed by a fire? (“no”). In ordinary reading, one might encounter the subsequent sentence, His cousin believed that Norm’s house had been destroyed by a fire. Fully understanding that sentence entails detecting the fire-tornado discrepancy with its antecedent. This parallel between verification and ordinary reading provides cues for the passive retrieval of text antecedents and relevant knowledge. Second, successful retrieval permits the verification of the current clause in the context of its antecedents. (Klin, Guzman, & Levine, 1997; Long, Oppy, & Seely, 1997).

In this regard, reading time for affirmative and negative targets such as the cousin sentence indeed varied systematically with their contextual truth (Singer, 2006). The data suggested that reading time partly reflected the execution of elementary comparison operations posited according to well-known verification models (Carpenter & Just, 1975; Clark & Chase, 1972). However, the data also indicated that reading time was modulated by the pragmatic felicity of the verb-complement constructions (e.g., His cousin believed . . .). These results were consistent with the contention that analyses of discourse comprehension and question answering can mutually inform one another (Carpenter & Just, 1975; Lehnert, 1977).

Verifying Indeterminate Text Ideas

Following the approach of Singer (2006), consider reading that Norm’s house had been destroyed and then having to answer, Was Norm’s house destroyed by a fire? A reasonable reply would be “don’t know.” Metacognitive studies have suggested that answering “don’t know” is frequently relatively fast (Glucksberg & McCloskey, 1981; Kolers & Palef, 1976; Singer, 1981, 1984). Thus, don’t know answer time is fast for (a) the verification item, Bill has a pencil, after learning that Bill has a rifle (he could have a pencil, too; Glucksberg & McCloskey, 1981); and (b) The pilot painted a fence, with reference to the pilot painted with the brush (Singer, 1981). The explanation in both studies was that a “don’t know” response could be registered as soon as it was determined that there was no information available on the queried dimension.

These findings suggest that text constituents presenting ideas of indeterminate truth might likewise be read relatively quickly. Consider that one reads Norm’s house had been destroyed and later encounters the sentence, His cousin believed that Norm’s house was destroyed by a fire. The supposition of the fire will fail to access corresponding causal information. The reader might react to this in different ways. (a) A lengthy but ultimately futile search for the pertinent information could be initiated. (b) The assertion
could be used to update the text representation to include the novel element either unequivocally (Albrecht & O’Brien, 1993; Levine & Klin, 2001; O’Brien, Rizzella, Albrecht, & Halleran, 1998) or hypothetically (Campion, 2004). (c) Alternatively, the reader could suspend judgement about the novel element and proceed to the next sentence (van den Broek, Risden, Fletcher, & Thurlow, 1996). In the absence of a protracted memory search (alternatives b and c), don’t know reading times are likely to be quick.

Weighing against the possibility of short don’t know reading times, however, are observations that “don’t know” verification responses are sometimes relatively time-consuming. Don’t know judgements about Bill has a pencil are relatively slow after one has learnt that It is unknown whether Bill has a pencil (Glucksberg & McCloskey, 1981). Those authors attributed this outcome to people’s need to scrutinize the link between these two related concepts. Furthermore, judgement time about such “explicit don’t know” items increases as (a) their relatedness to a discourse context increases and (b) their degree of elaboration in the context decreases (Klin et al., 1997).

Likewise, Singer (1986) measured relatively long don’t know answer times to intermixed wh- and yes-no questions, and attributed this outcome to lengthy memory searches initiated in the context of a complicated task. Metacognitive analyses reveal that don’t know answer times increase systematically with people’s feeling of knowing the queried fact (Costermans, Lories, & Ansas, 1992; Koriat & Levy-Sadot, 2001; Nelson & Narens, 1980; Singer & Tiede, 2008). Influences of this sort could result in lengthy reading times for indeterminate (don’t know) sentences in a discourse context.

Overview and Predictions

This study compared readers’ processing of text ideas that were true, false, or indeterminate with reference to their message antecedents. In six-sentence passages illustrated in Table 1, they alternatively read at sentence 2 that Norm’s house was destroyed by a fire, a tornado, or an unspecified cause. At sentence 5, they encountered His cousin believed that Norm’s house was destroyed by a fire. Thus, the complement of believed was true, false, or indeterminate with reference to antecedent sentence 2. Reading time for sentence 5 was predicted to be shorter in the don’t know than the false condition. In the false condition, the resonance of sentence 2 to the ideas of sentence 5 would require the comparison of fire and tornado followed, perhaps, by an attempt to reconcile their inconsistency (Bolce & Gerrig, 2005; Rapp & Kendoue, 2005; Wiley, Mason, & Myers, 2001). In contrast, comprehending sentence 5 accesses no information relevant to the accuracy of fire in the context of Norm’s house had been destroyed, so the reader might quickly proceed to the next sentence. In the true condition, the extra common content word (fire) might also result in shorter sentence-5 reading time than in the false condition (Singer, 1981, 1984). Whether reading time would be yet shorter in the don’t know than the true condition was viewed as an empirical issue.

A complementary investigation of these issues was presented by Cook, Myers, and O’Brien (2005). In lengthy texts, their participants read one of alternatives (1a), (1b), or (1c), and subsequently encountered “demand sentence” (2):

(1) a. Terry saw a cherry stained cello . . . . She decided to purchase it that afternoon. (exemplar-present)

Table 1

<table>
<thead>
<tr>
<th>Sample Materials of Experiments 1 and 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experiment 1</strong></td>
</tr>
<tr>
<td>After a long afternoon of driving, Norm was shocked when he turned his street corner. (Sentence 1)</td>
</tr>
<tr>
<td>His house had been destroyed (true: by a fire/false: by a tornado/ don’t know: 0) (Sentence 2 – Antecedent)</td>
</tr>
<tr>
<td>Norm didn’t know what to do so he got back in his car. (Sentence 3)</td>
</tr>
<tr>
<td>He drove to his cousin’s to spend the night. (Sentence 4)</td>
</tr>
<tr>
<td>His cousin (factive: showed/nonfactive: believed) that Norm’s house was destroyed by a fire. (Sentence 5 – Target)</td>
</tr>
<tr>
<td>At that moment, all Norm really wanted was to go to sleep. (Sentence 6)</td>
</tr>
<tr>
<td>Was Norm driving most of the afternoon? (Comprehension question)</td>
</tr>
<tr>
<td><strong>Experiment 2</strong></td>
</tr>
<tr>
<td>Chris and Randy had decided to spend the afternoon investigating an old abandoned house in their neighbourhood. (Sentence 1)</td>
</tr>
<tr>
<td>As Randy started up the front stairs in front of Chris, he was startled (true: by a roach/false: by a centipede/ don’t know: 0). (Sentence 2 – Antecedent)</td>
</tr>
<tr>
<td>The front door creaked as they slowly pushed it open and stepped inside. (Sentence 3)</td>
</tr>
<tr>
<td>They were both so scared they turned and ran out of the house and all the way home. (Sentence 4)</td>
</tr>
<tr>
<td>Their mother established that Randy (affirmative: was/negative: was not) startled by a roach. (Sentence 5 – Target)</td>
</tr>
<tr>
<td>They were seen occasionally but didn’t thrive in this climate. (Sentence 6)</td>
</tr>
<tr>
<td>Was the house abandoned? (Comprehension question)</td>
</tr>
</tbody>
</table>

**Note.** Experiment 1 targets were all affirmative, and Experiment 2 targets all used factive verbs.

b. Terry saw a cherry stained cello . . . . She decided to wait a while before she purchased it. (exemplar-negated)  

b. Terry saw a cherry stained cello . . . . She decided to wait a while before she purchased it. (exemplar-absent)  

(2) Jill asked what instrument she bought. (demand sentence)  

The exemplar (cello) of the category “instrument” is situationally present in (1a); and situationally negated in (1b), by virtue of the decision not to buy it. In (1c), in contrast, the exemplar is absent, because the text does not identify what instrument Terry was considering. Reading time for demand sentence (2) was shorter in the absent condition than in exemplar-negated condition. Sentence (2) reading time was also shorter in the absent condition than in the exemplar-present condition, when averaged over five experiments.

Cook et al.’s (2005) exemplar-present and exemplar-absent conditions correspond respectively with the aforementioned true and indeterminate versions of the “Norm’s house” materials. Furthermore, both Cook et al.’s exemplar-negated condition and the false condition of “Norm’s house” both involve conspicuous inconsistencies between the target sentence and its antecedent. Cook et al. interpreted their data to favour a two-stage analysis of sentence processing. First, a fast, automatic, and global resonance process accesses information about the interrogated semantic category, such as a musical instrument or the cause of destruction of a house. Second, if the first stage yields relevant information, whether matching or inconsistent, time-consuming additional processing is required. However, when no relevant information is retrieved, memory search is abridged and processing may quickly proceed to
the next sentence. Cook et al. rejected the alternative that retrieving no relevant information is followed by a protracted memory search.\footnote{Cook et al. (2005) treated the abridged-search alternative as a one-stage process, but I propose that both abridged and protracted memory search require an initial stage of automatic retrieval (Singer, 1981, 1984).}

Notwithstanding the similarities between the present design and that of Cook et al. (2005), this study extended their findings in numerous ways. Most importantly, these issues were examined in Singer’s (2006) text verification framework. Therefore, the emphasis was on the validation of text statements rather than readers’ tacit answering of the implicit questions raised by demand sentences. Second, the anaphoric devices scrutinized in the two studies were different: definite noun phrases that were embedded in clause complements here, as compared to demand sentences by Cook et al. Third, as discussed earlier, the present false condition and Cook et al.’s exemplar-negated condition presented different types of inconsistencies. Therefore, this study contrasted the main hypotheses in informatively novel ways.

This study was also distinct in the consideration of interactions between truth relation and discourse pragmatics. Pragmatics refers to the impact of linguistic context on subtleties of entailment and appropriate expression (e.g., Gibbs, 2003; Grice, 1975). Experiment 1 scrutinized the pragmatic impact of verb factivity (Lyons, 1977, pp. 599, 793) on text verification. Factive verbs, such as show, entail the truth of their complements whereas nonfactive verbs, such as believe, do not. Therefore, it is apt to indicate that someone believed something that is not true but not that they showed it. Verb factivity was manipulated in sentence 5 of the Experiment 1 passages (see Table 1). Because factive assertions commit the communicator to the truth of a complement statement, it is possible that factive verbs might more strongly constrain readers to verify text statements than nonfactive verbs. Singer’s (2006, Experiment 1b) reading time data for affirmative sentences, shown in Table 2, bear on this hypothesis: Reading time was greater for false than true affirmative target sentences that used factive main verbs but not for those with nonfactive main verbs. Those results suggested that false reading times would likely exceed don’t know reading times with factive verbs but were more equivocal with regard to nonfactive verbs.

Experiment 1

Method

Participants. The participants were 101 female and male native-English speaking students of introductory psychology at the University of Manitoba. They received credit toward a course requirement for their participation.

Materials. Experiment 1 scrutinized 30 6-sentence experimental passages (see Table 1) previously used in similar research (O’Brien, Plewes, & Albrecht, 1990, Experiment 1; Singer, 2006). Alternative versions of sentence 2 formed the antecedents of the true, false, and don’t know passages. For each passage, one factive and one nonfactive verb was randomly selected from lists of over 30 of each to function as the main verb.

In the first of six counterbalanced lists, the 30 passages were randomly assigned in equal numbers to one of the six Relation (true, false, don’t know) × Factivity conditions. Each passage was assigned to a random list position, subject to the restrictions that each half of the list include (a) exactly half of all experimental items, and (b) a minimum of two of the five items in each condition.

Simple yes-no questions (50% “yes”) were composed for each passage. They were intended to ensure that the participants were reading conscientiously. The questions did not query the crucial text idea, such as what destroyed Norm’s house. Randomly interspersed amongst the experimental passages were twelve 4-sentence filler passages plus corresponding comprehension questions. The fillers were intended to distract the readers from any regularities of the experimental passages. The list commenced with an additional four practice passages, similar in form to the filler passages.

The other five lists were constructed by cycling the experimental materials of list 1 across the experimental conditions in a Latin square fashion.

Procedure. The participants were tested in groups of up to four individuals at enclosed stations comprising a personal computer, a monitor, and a keyboard. The participants were randomly assigned in approximately equal numbers to view one of the six lists.

On each trial, upon the presentation of a “Ready” signal, the participant used the keyboard space bar to signal understanding of the successive sentences of the passage. The first character of each sentence appeared at row 10, column 1 of the monitor. If no response was made within 10 s, the current sentence was replaced by its successor. After a 2.5-s post-passage interval, a fixation “x” was displayed for 500 ms, followed by the comprehension question. The participant had a limit of 6 s to reply “yes” or “no” to answer the question, using keys “x” and “.”, respectively. The intertrial interval was 3 sec.

The key presses that initiated and terminated a sentence defined reading time. There was a 40-s rest period halfway through the nonpractice portion of the list.

Results

The measure of interest was reading time for sentence 5 of the experimental passages. Analysis of variance (ANOVA) alternately treated participants (F1) and items (F2) as the random effect. With participants-random, both relation and factivity were within-

\begin{table}[h]
\centering
\caption{Mean Target Reading Times (in Milliseconds; SE in Parentheses) in Experiment 1b of Singer (2006) as a Function of Factivity, Truth, and Negation}
\begin{tabular}{|l|l|l|l|}
\hline
 & Truth & & \\
\hline
 & Negation & Factivity & True & False \\
\hline
Affirmative & Factive & 3,742 (215) & 4,043 (170) & \\
 & Nonfactive & 3,431 (135) & 3,518 (232) & \\
Negative & Factive & 4,179 (203) & 4,190 (154) & \\
 & Nonfactive & 3,802 (194) & 3,575 (155) & \\
\hline
\end{tabular}
\end{table}

Note. Adapted from Table 2 (Singer, 2006). Copyright Elsevier Science. Adapted by permission.
participants variables and list was a between-participants variable. With items-random, relation and factivity were within-items variables and verbal set (the randomly designated sets of five passages each) was a between-items variable. Effects are not reported for the counterbalancing list and verbal set variables. The statistical criterion $\alpha = .05$ is used unless otherwise noted.

Each list was viewed by either 16 or 17 participants. Data were excluded for one participant who exceeded the reading time limit for the targets of 20 of the 30 experimental passages. The sentence-5 reading times appear in Table 3.

ANOVA revealed a main effect of relation, $F(1, 188) = 8.59$, mean square error ($MSE$) = 337,058, $F(2, 48) = 7.06$, $MSE = 120, 909$: True and don’t know reading times were approximately equal but were shorter than the false reading times. In addition, the Relation x Factuality interaction was significant, $F(1, 188) = 9.13$, $MSE = 289,823$, $F(2, 48) = 9.17$, $MSE = 91,698$. Tests of simple main effects revealed a significant relation effect in the factive condition, $F(1, 188) = 14.38$, $MSE = 381,299$, $F(2, 48) = 11.73$, $MSE = 143,221$; but not in the nonfactive condition, $Fs \leq 1$. Furthermore, planned comparisons indicated that false reading times exceeded don’t know reading times in the factive condition, $F(1, 93) = 20.69$, $MSE = 319,082$, $F(2, 24) = 10.22$, $MSE = 179,150$, but not the nonfactive condition, $Fs \leq 1$. However, comparing yes versus don’t know reading times yielded significant differences neither in the factive condition, $F(1, 93) = 2.04$, $MSE = 227,758$, $F(2, 24) = 1.66$, $MSE = 93,557$, nor the nonfactive condition, $Fs < 1$.

The factivity main effect was significant by participants but only marginally so by items, $F(1, 94) = 11.65$, $MSE = 261,128$, $F(2, 24) = 2.86$, $MSE = 272,515$, $p = .10$. Finally, the accuracy rate for the comprehension questions that accompanied the experimental passages was 85.8%.

**Discussion**

Experiment 1 revealed a main effect of relation. Specifically, higher sentence-5 reading times were detected in the false condition than the other conditions. This main effect was qualified by an interaction between relation and factivity, such that the relation effect was significant only in the factive condition. Planned comparisons confirmed greater false than don’t know reading times in the factive condition but not in the nonfactive condition.

Reading times did not differ significantly between the don’t know and true conditions. The discussion of this comparison will be deferred to the General Discussion section.

The absence of the relation effect in the nonfactive condition is clarified by the data of the comparable conditions of Experiment 1b of Singer (2006), shown here in Table 2. Singer reported that, for affirmative sentences governed by a nonfactive main verb, reading times were similar in the true and false conditions. This was attributed to the inflation of nonfactive true affirmative reading times by the slight pragmatic peculiarity of statements analogous to *Jill believed that the world is round* (why does Jill only “believe” this familiar fact?).

In conclusion, shorter don’t know than false reading times in Experiment 1 supported abridged as opposed to protracted memory search for indeterminate information in ordinary reading. However, the contributing processes were modulated by pragmatic effects. Experiment 2 was designed to offer an additional test of the present hypotheses.

**Experiment 2**

Experiment 2 inspected the effect of a different pragmatic variable: Specifically, target sentence 5 varied in affirmative versus negative expression (but always used a factive main verb; see second passage of Table 1). Negation was scrutinized because it interacts in informative ways with truth. Judgement time for true negatives (*two is not odd*) often exceeds, perhaps counterintuitively, that for false negatives (*two is not even*; Clark & Chase, 1972; Wason & Jones, 1963). However, Table 2 shows that Singer (2006, Experiment 1b) measured approximately equal true negative and false negative reading times for target sentences governed by factive verbs. This was attributed to the inflation of reading time for false negative complements of factive verbs. This inflation results from the infelicity, in the discourse context, of such sentences (e.g., *Norm’s cousin showed that Norm’s house was not destroyed by a fire.*)

The affirmative condition of Experiment 2 was identical to the factive condition of Experiment 1 so false reading times were again predicted to exceed don’t know and possibly true reading times. For don’t know negatives, however, several alternatives seemed plausible. Don’t know reading processes might be relatively fast, like in some analogous verification conditions; or slow, like when people execute lengthy memory searches for unknown information. Another possibly contributing factor is illustrated by the don’t know negative sequence, *As Randy started up the front stairs in front of Chris, he was startled.* Their mother established that Randy was not startled by a roach (see Table 1). The reader might find the negation of roach to be incongruous, because the antecedent text does not mention the involvement of a roach (Wason, 1965). Therefore, no firm prediction was offered concerning the outcome in the negative condition.

**Method**

The participants were 99 naive individuals from the same population as before. The materials were derived from those of Experiment 1. In particular, the nonfactive passages of Experiment 1 were converted to the negative condition: First, the nonfactive verbs of Experiment 1 were replaced with their factive counterparts. Second, sentence 5 in this condition was a negative rather than an affirmative. In all other respects, the materials were identical to those of Experiment 1. Finally, the procedure of Experiment 2 was identical to that of Experiment 1.

<table>
<thead>
<tr>
<th>Factivity</th>
<th>Truth</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>True</td>
<td>False</td>
<td>Don’t know</td>
</tr>
<tr>
<td>Factive</td>
<td>3,538 (120)</td>
<td>3,990 (134)</td>
<td>3,640 (135)</td>
</tr>
<tr>
<td>Nonfactive</td>
<td>3,609 (159)</td>
<td>3,598 (112)</td>
<td>3,568 (141)</td>
</tr>
</tbody>
</table>
Results

No list was viewed by fewer than 15 participants. Data were excluded for three participants who signalled the understanding of 17 or fewer of the 30 experimental target sentences within the time limit. The mean sentence-5 reading times appear in Table 4. The relation main effect was significant, $F(2, 180) = 11.56, MSE = 229,937, F(2, 48) = 7.19, MSE = 116,892$. Like in Experiment 1, true and don’t know reading times were approximately equal but were shorter than the false reading times. The relation effect was qualified by a significant Relation $\times$ Negation interaction, $F(2, 180) = 4.90, MSE = 260,845, F(2, 48) = 4.00, MSE = 102,645$. There was a relation effect in the affirmative condition, $F(2, 180) = 16.72, MSE = 227,668, F(2, 48) = 9.14, MSE = 132,465$; but not in the negative condition, $F_s < 1$.

Within the affirmative condition only, reading time was greater in the false condition than the don’t know condition, $F(1, 90) = 28.74, MSE = 222,520, F(1,24) = 17.78, MSE = 115,257$. Yes and don’t know reading times differed significantly neither in the affirmative condition nor the negative condition, all $F_s < 1$.

Sentence-5 reading time was 291 ms longer in the negative condition than the affirmative condition, $F(1, 90) = 51.76, F(1, 24) = 17.36, MSE = 218,970$. Finally, the mean accuracy for the experimental-passage comprehension questions was 84.9%.

Discussion

The results were highly similar to those of Experiment 1. The main effect of relation diagnosed higher sentence-5 reading times in the false condition than the other conditions. This effect was qualified by a Relation $\times$ Negation interaction: The relation effect was significant for affirmative but not negative target sentences.

The similarity of the negative reading times across relations is likely due to two pragmatic influences. First, consider the true negative and false negative reading times. It was previously mentioned that verification time is frequently greater for true negatives (Two is not odd) than false negatives (Clark & Chase, 1972; Wason & Jones, 1963). However, Singer (2006) proposed that infelicities of factive negative complements, analogous to Jill knew that the world is not round, abolish the advantage of false over true statements (see also means of 4179 ms and 4190 ms, Table 2).

Second, one might ask, in turn, why the don’t know negative reading times were not even faster than the others. As discussed earlier, there is a violation of the context of plausible denial (Wason, 1965) in sequences such as As Randy started up the front stairs in front of Chris, he was startled. Their mother established that Randy was not startled by a roach. I speculate that this factor inflated the don’t know reading times.

The affirmative condition replicated the (identical) factive condition of Experiment 1. The advantage of don’t know versus false reading times distinctly favours an abridged search of memory search for absent antecedent text information over the alternative of protracted memory search.

Text comprehension research has addressed whether negation effects stem from surface, textbase, or situational representations. In one study, statements completely crossed whether (a) a concept or entity participated in the text situation and (b) whether the concept was linguistically negated (Kaup & Zwaan, 2003). For example, pink is not situationally present in the wished-was version of Sam (was relieved/wished) that Laura (was/was not) wearing her pink dress. When the recognition probe pink appeared 500 ms after the sentence, response was faster for present than absent concepts in the affirmative condition but not the negative condition. However, with a probe delay of 1500 ms, recognition was faster for present than absent concepts for both affirmatives and negatives. Kaup and Zwaan concluded that, immediately after reading, both situational presence and the focal mechanisms of a propositional discourse representation influenced recognition. After just 1000 ms more, however, the situation model predominated in regulating the response.

To be most relevant to the latter issues, it would have been necessary to apply negation in the antecedent sentences (sentence 2; e.g., On the way to the cabin, they decided not to hunt deer) rather than in the target sentences (sentence 5) of Experiment 2. Nevertheless, the bearing of these experiments on multilevel text representations will be addressed in the General Discussion.

General Discussion

Singer (2006) presented evidence that readers routinely and continually verify the assertions of text. He invoked the memory-based text processing principle that each successive text constituent passively cues the retrieval of antecedent ideas from memory. His reading time data indicated that tacit verification processes of reading resemble those of intentional verification, but that they are regulated by pragmatic influences and negative expression.

This study extended that analysis to the scrutiny of indeterminate text constituents—that is, ones without relevant antecedents. The central novel question was whether the absence of an antecedent results either in abridged or protracted memory search for the missing information. Experiments 1 and 2 distinctly favoured abridged search: Reading time was shorter in the don’t know condition than the false condition.

### Table 4 Mean Target Reading Times (in Milliseconds; SE in Parentheses) in Experiment 2 as a Function of Truth and Negation

<table>
<thead>
<tr>
<th>Negation</th>
<th>Truth</th>
<th>False</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affirmative</td>
<td>3,402 (127)</td>
<td>3,723 (133)</td>
<td>3,353 (137)</td>
</tr>
<tr>
<td>Negative</td>
<td>3,778 (135)</td>
<td>3,823 (129)</td>
<td>3,751 (144)</td>
</tr>
</tbody>
</table>

2 The slight difference in length between the affirmative sentences ($M = 14.6$ syllables) and negative sentences ($M = 15.8$ syllables) was not of great concern because the comparisons of interest were within levels of the negation variable. Nevertheless, analysis of covariance was applied to the data, treating syllable-length as the covariate and items as the random effect. The negation main effect did not reach significance, $F < 1$. Of course, covarying syllable length had no impact on effects involving relation because there were no syllable-length differences across levels of the relation variable.
Abridged search might additionally have resulted in shorter don’t know than true reading times. However, averaged over the two experiments, those variables had almost identical means of 3582 ms and 3578 ms, respectively. Likewise, Cook et al. (2005) had to average the reading times of their analogous exemplar-present and exemplar-absent conditions over five experiments for the latter to emerge as significantly shorter. Unlike in Cook et al.’s experiments, the true targets here had the confounding advantage of repeating a critical content word (e.g., fire; see Table 1). The fact that reading time was nevertheless no greater in the don’t know than the true condition is interpreted as further denying a protracted memory search.

A second central tenet of this analysis is that discourse pragmatics regulates ongoing text verification. Consistent with this proposal, the relation main effects were qualified by interactions between truth relation, one the one hand; and verb factivity (Experiment 1) or negation (Experiment 2), on the other. These interactions reflected the significance of the relation effect only for affirmative factive constructions (the factive condition of Experiment 1 and the affirmative condition of Experiment 2) and replicated the patterns of Singer (2006, Experiment 1b; see present Table 2). It was proposed in the discussions of Experiments 1 and 2 that the precise form of the reading profiles is attributable to pragmatic awkwardness such as those in assertions about knowing incorrect things, only believing obvious things, and denying uncontroversial things.

The present data convincingly replicated all of the equivalent conditions of Singer (2006; see Table 2). This was despite the fact that (a) factivity was varied within-items here but between-items by Singer; and (b) indeterminate items were intermixed with determinate ones only here. These replications are important in a relatively new research endeavour.

Reading time evidence for abridged memory search in the absence of text antecedents was likewise presented by Cook and colleagues. Their present study extends their findings in several ways. First, antecedent search was signalled by sentence-complement constructions here and by demand sentences by Cook et al. Second, Cook et al.’s indeterminacy was based on an “empty” category, such as musical instrument; whereas the present text antecedents made no mention of the category antecedent to the indeterminate entity (e.g., Randy was startled . . . Their mother established that Randy was startled by a ROACH). Third, this study extended Cook et al.’s findings by scrutinizing the impact of discourse pragmatics on the processes of access and search. As a corollary, this study embedded these issues in the theoretical framework of readers’ tacit validation of text assertions and implications (Singer, 2006; Singer & Halldorson, 1996).

Text Representations Underlying These Effects

As discussed earlier, the design of Experiments 1 and 2 could not identify surface versus situational representations as the basis of the observed negation main effect. Whether the Relation variable effects of Experiments 1 and 2 stem from surface or gist representations is a complex issue. The overlap of content words between the target sentences and their antecedents (e.g., house, destroy, fire; see Table 1) implicates surface representations, but differences between the exact phrasing of targets versus antecedents tends to deny surface influences. More generally, several observations converge on the contribution of situational representations to the present effects. First, memory-based analyses emphasise that semantic similarity is sufficient for the resonance of an antecedent, such as when odor and stripe are reminiscent of skunk (O’Brien & Albrecht, 1991). Second, many memory-based text inconsistency effects are clearly attributable to causal, temporal, and other situational representations (O’Brien, Rizzella, et al., 1998; Rinck et al., 2001). Third and furthermore, these effects emerge even when the degree of surface overlap between the target and its antecedent are held constant (Klin, 1995; Richards & Singer, 2001). Fourth, the rapid loss of the verbatim form of discourse (Clark & Sengul, 1979; Jarvella, 1971) likewise implicates propositional or situational representations in the present observations. However, more definitive conclusions will depend, in future research, on manipulating the verbatim and content-word overlap between the targets and antecedents of the present experimental materials.
cette analyse aux idées de vérité indéterminée contenue dans un texte, en fonction de leur contexte dans le discours. Par exemple, en ayant simplement lu que la maison de Norm a été détruite, quelqu’un pourrait par la suite lire que le cousin de Norm croyait que la maison de Norm avait été détruite par un feu. Les études portant sur les rapports d’individus qui ignorent des éléments suggèrent que la lecture d’énoncés de vérité indéterminée s’était plus rapide que celle des énoncés faux ou inconsistants. Dans deux expériences, les phrases cibles ont été variées quant à leur vérité, aux implications des verbes et à l’utilisation de la négation en rapport à leurs antécédents. Les temps de lecture pour les cibles indéterminées ont été distinctement plus courts et jamais plus longs que pour les cibles fausses. Les effets sont modulés par les implications des verbes principaux factifs et non factifs et par l’expression négative. Toutes les conditions similaires à celles de Signer (2006) ont permis de reproduire les mêmes résultats. Il fut conclut que le fait de rencontrer des idées de vérité indéterminée dans les textes n’initie pas de recherche approfondie pour des concepts comparables en mémoire.

Mots-clés : compréhension de texte, métabrotaire, traitement de texte fondé sur la mémoire, pragmatique

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