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# The Influence of Conceptual Context on the Reading of Prose Passages

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# ABSTRACT

The Influence of Conceptual Context
on the Reading of Prose Passages

Terence J. Cooper
Concordia University, 1995

The present research investigated the effects of information presented earlier in a text, referred to as conceptual context, on word reading times of target words in prose texts. In the first experiment, it was shown that conceptual context facilitated the reading of expected target words compared to a neutral condition in which the text engendered no expectations for the target words. In the second experiment, it was shown that conceptual context typically did not exert its effect on prelexical processes such as word identification, but on postlexical processes occurring during sentence integration. In the third experiment, it was shown that conceptual context will facilitate prelexical processing if such processing is rendered inefficient by making the reading material more difficult to encode. Overall, the data pattern indicated that the effects of conceptual context occurred through automatic spreading-activation, but compensatory processing was engaged when the reading material was difficult to encode. The implications of these findings for current theories of context effects in reading are discussed.

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# The Influence of Conceptual Context On the Reading of Prose Passages

One of the challenges facing researchers studying the reading process has been to understand the component processes involved in reading, such as lexical access and sentence integration. Then, an understanding of how these processes interact may clarify the manner by which a printed word comes to represent something meaningful to a reader. Although there is a general consensus that a series of increasingly complex processes are involved in transforming a printed word into a meaningful concept, there has been much disagreement as to whether readers can use information other than what is on the printed page to help in this process. For example, can a reader's expectations influence reading? If so, under what conditions can this occur? Do expectations tend to increase reading efficiency, or do they sometimes interfere with the reading process?

The present research describes three studies which attempt to clarify the role of some of these influences, such as expectations, on reading. These influences are generally referred to as "context effects" and are often described as being "higher-level processes", since they make use of information that has already undergone considerable processing. The first experiment investigates whether context provided by a paragraph of text can influence in a

measurable way the time it takes to read a particular word. The second experiment attempts to clarify at which stage of the reading process the effects of context occur. For example, does context influence the identification of a word, or does it influence its interpretation? The third experiment is concerned with the conditions under which context can influence reading. Are contextual influences constantly influencing the reading process, or do people use contextual information only at certain times, for example, when the material is difficult to read?

In order to place the current research in the framework of the existing literature on reading, a few general models of the reading process will first be described. Then, different types of context which are postulated to influence reading will be described, and the type of context under investigation in the present research will be defined. This will be followed by a selective review of the research on context effects. This will include how single word and sentence contexts can influence word recognition, a component of the reading process. Also, research on the effects of context in the form of short paragraphs on eye movements in reading will be briefly summarized. Finally, an attempt will be made to understand these research findings within the theoretical framework proposed by Posner and Snyder (1975), as well as Fodor (1983).

Models of Reading

Models of reading have traditionally emphasized either bottom-up or top-down processes. Bottom-up models such as the one presented by Gough (1972) assumed sequential processing of textual information. The reading process started with an iconic representation of the visual stimulus. Each letter and word was decoded and processed sequentially from left to right, going through a number of stages until the meaning of the text was understood. Higher-level processes such as general world knowledge or specific knowledge that could lead to expectancies of upcoming textual material was postulated to have little influence on the processing of the visual stimulus.

Top-down models acknowledged the role of bottom-up processes, but placed more emphasis on using knowledge in long-term memory to facilitate the processing of text even at the level of letter perception. This facilitation resulting from the influence of higher-level processes is generally referred to as a context effect. An example of a top-down model is the one proposed by Hochberg (1970), in which he postulated readers made use of two mechanisms which influenced their perception of the visual stimulus. Cognitive search guidance (CSG) was the mechanism by which readers used their knowledge of the meaning of the text, as well as knowledge of spelling and grammar to generate hypotheses about the upcoming text. Peripheral search

guidance (PSG) enabled the reader to make predictions about the text based on cues in peripheral vision. Together, these mechanisms enabled readers to skip areas of high predictability and lead the eyes to the more informative areas of the text. This presumably resulted in rapid and efficient reading.

Over the years, research findings initiated a move away from strict bottom-up and top-down models in favour of interactive models (Rumelhart, 1977; Just & Carpenter, 1980; Rayner & Pollatsek, 1989). McClelland (1979) showed that later stages in the reading process may begin their computations before earlier stages have completed their processing, thus violating the assumption of sequential processing in strong versions of bottom-up models. With regards to top-down processing, several researchers argued that such processes seem to be able to influence reading only once lexical access has occurred (Rayner & Pollatsek, 1989; Stanovich & West, 1983).

An example of an interactive model is the one proposed by Just and Carpenter (1980). According to this model, physical features are extracted from the visual stimulus and deposited into working memory. These features are used to activate the representation of the word, whereupon its corresponding concept is placed into working memory. This concept is linked to a more complete representation of the meaning of the word stored in long-term memory in the form

of a semantic network. The nodes of this network refer to the different meanings the word may have, as well as its orthographic and syntactic properties and the contexts in which the word is most likely to occur. These nodes are described as a set of *productions* that act to facilitate the understanding of a word.

According to Just and Carpenter (1980), the lexicon is accessed when a word's semantic representation is activated above its base level. There are three ways in which such activation can occur: (1) through perceptual encoding; (2) through the productions that carry out computations in a serial manner at each stage of processing; (3) through productions occurring in parallel that produce spreading activation through the semantic network. When a word's semantic representation is activated in one of these ways, a pointer to its meaning is inserted in working memory. Productions then come into play to determine relations among the words in a clause, and then to integrate clauses in a meaningful way. At the end of a sentence, processing time is spent integrating the different parts of the sentence and dealing with any inconsistencies that could not be resolved within the sentence. This extra processing is referred to as sentence wrap-up. Sentences are integrated with previous information acquired from the text or with knowledge retrieved from long-term memory.

It is clear that this model violates the assumption of

sequential processing characteristic of a strong bottom-up model, since productions in long-term memory operate in parallel on information contained in working memory. Also, it is noteworthy that the set of productions in long-term memory which act to assign case roles as well as integrate clauses and sentences do so beyond the lexical access stage, once a pointer to the word's meaning has been deposited in working memory. Hence, this model restricts the influence of higher-level processes to the postlexical stages. In doing so, it does not fully conform to strong versions of the top-down models which state that higher-level processes, in theory, can influence any stage of the reading process.

## Levels of Contextual Constraint

Higher-level processes in the form of context effects are often described in the literature without reference to the type of context referred to. Shebilske and Fisher (1983) identified three types of context which they labelled situational context, linguistic context, and conceptual context. Situational context refers to the sum total of nonlinguistic external stimuli that act upon a reader. These include the purposes for which the person is reading the text (e.g., studying for an exam vs. reading for enjoyment) and the manner in which the text is presented (e.g., in book form vs. on a computer screen). This type of context is usually controlled during experiments and as such

would not differentially affect different conditions.

Linguistic context refers to the influence that a reader's prior knowledge has on the expectancy of regularities in orthographic, lexical, syntactic, and semantic information as the text is being read. Studies which use single words to facilitate the perception of target words (Becker, 1980; Meyer, Schvaneveldt, & Ruddy, 1975; Neely, 1976; Neely, Keefe, & Ross, 1989) as well as those using single sentences to achieve similar facilitation (Fischler & Bloom, 1979; O'Regan, 1979, 1980; Stanovich & West, 1983; Tulving & Gold, 1963) are manipulating the influence of linguistic context.

The third type of context is referred to as conceptual context. This is the type of context under investigation in the present research, and consists of the reader's background knowledge at the moment of reading. It includes concepts presented in earlier portions of a text, the reader's prior knowledge about the topic under discussion, and the reader's general knowledge of the world. It is evident that the need to integrate a current sentence into the structure of a more conceptual context is absent in single sentence studies of context effects. The question arises as to whether readers use the conceptual context to place further constraints on the range of possible target words and hence increase the predictability of such words. Ehrlich and Rayner (1981) and Ehrlich (1983) argue that this

type of context builds up over time so that its constraining effects on the processing of words may not be observed if the person reads merely a sentence or two. Larger bodies of text are necessary for the reader to integrate what is currently being read with the other concepts that have appeared earlier in the text.

The following review of context effects on reading will first focus on the effects of linguistic context on word recognition. Then, research on the effects of conceptual context will be described.

## Effects of Linguistic Context on Word Recognition

Numerous studies indicate that the visual recognition of words can be facilitated by presenting a semantically related word (Meyer & Schvaneveldt, 1971; Meyer, Schvaneveldt, & Ruddy, 1975; Neely, 1976; Becker, 1979). For example, the word "butter" can be recognized faster when it is preceded by the word "bread" than by the word "doctor" (Meyer, Schvaneveldt, & Ruddy, 1975).

Although a few general models of reading (e.g., Just and Carpenter, 1980; Rayner and Pollatsek, 1989) have been described earlier as consistent with the view that context influences primarily postlexical processes, this is not at all clear when one considers semantic priming effects on visual word recognition. Neely, Keefe, and Ross (1989) have presented some evidence that semantic priming is at least

partly influenced by the operation of a prelexical expectancy mechanism which influences the speed of lexical access.

The typical paradigm used in single word priming studies involves presenting the target word either very briefly or in a degraded manner. Such a procedure, however, may lead readers to rely on contextual cues to an extent that is not comparable to normal reading conditions (Gough, 1983). Not only is the visual stimulus usually clear and continually present in normal reading situations, but the reader also relies on the extraction of meaning through integration of previous semantic information with new visual input (Spoehr & Schuberth, 1981), a situation usually not present in single-word priming studies. For these reasons, it has been suggested that results obtained in single-word studies should not be generalized to the reading of normal text (Gough, 1983; Stanovich, 1991). According to Stanovich (1991), the large context effects obtained in word recognition studies result from using unusually predictable material. Studies that have used material more representative of ordinary text report small context effects of a few milliseconds (Forster, 1981; Gough, Alford, & Holley-Wilcox, 1981; Mitchell & Green, 1978).

Research on sentence context effects have shown that context in the form of incomplete sentences can affect the recognition of a subsequently presented word (Briggs,

Austin, & Underwood, 1984; Morton, 1969; Schwanenflugel & Shoben, 1985; Tulving & Gold, 1963; Tulving, Mandler, & Baumal, 1964). For example, the word "tree" is recognized faster when preceded by the sentence frame "The apple fell from the _____". Schuberth and Eimas (1977) have found that such sentence frames facilitate lexical decision times for congruous words which are likely to follow a given context (e.g., The puppy chewed the *bone*), and interferes with or inhibits the decision process for incongruous words which do not conserve the overall meaning of the sentence (e.g., The puppy chewed the *hour*). Thus, linguistic context in the form of sentence frames can either facilitate or inhibit the recognition of a subsequently presented word. We shall now examine research which shows different patterns of facilitation and inhibition.

## Facilitation and Inhibition Dominance

The "cloze" method introduced by Taylor (1953) to measure readability of text has been adapted in reading experiments to measure a reader's expectation of a specific word occurring given a particular context (Bloom & Fischler, 1980; Ehrlich & Rayner, 1981; Zola, 1984). Readers are presented with a sentence or a prose passage in which a word is replaced by a blank space, and they must fill in the blank with the word which they think is most appropriate. One can then compute the probability of a word being

selected given a particular context.

Bloom and Fischler (1980) compiled cloze probabilities for 329 sentence contexts. In several studies using a lexical decision task, they found both facilitation for appropriate words and inhibition for inappropriate words, with the amount of inhibition larger than that of facilitation (i.e., inhibition dominance). With regard to facilitation, they found that when a target word is congruous with the sentence frame, there is no decrease in latency as the cloze probability is increased until the probability is .90 or greater. In other words, facilitation seems to occur in situations where the context strongly suggests a particular word, and that word is actually presented (Fischler & Bloom, 1979).

These findings are consistent with Gough's (1983) argument that words are not very predictable in ordinary reading material. He reported that for 100 sentences taken from successive articles in the Reader's Digest, the ninth word of the sentence (when that word was a content word) was accurately predicted only 10% of the time. This finding corroborates Aborn, Rubenstein, and Sterling's (1959) research which showed that although the syntactic class of a final missing word was almost totally redundant (98% agreement), the actual word that had been used in the original sentence was guessed only 25% of the time.

In contrast with Fischler and Bloom's findings of

inhibition dominance, the prevailing data pattern in research by Stanovich and West (1981, 1983) is one of facilitation dominance. They reported significant facilitation effects for difficult congruous words, (e.g., The accountant balanced the *ledger*), in which the difficult target words were predicted only 11% as the first guess in a cloze task (compared to 43% for easy words). Although they originally used a word naming task in which subjects read the sentence frames out loud, they obtained the same results when subjects read the sentence frames silently (Stanovich & West, 1983, Exp. 1).

The main reason for the discrepant patterns of facilitation and inhibition in these experiments seems to be task differences. This was shown by Stanovich and West (1983, Exp. 9) when they used 95 sentences of Bloom and Fischler (1980) in their oral reading naming task and failed to find substantial inhibition. Predictable target words (mean cloze probability of .61 and mean frequency of 157) had faster response times than unpredictable words (mean cloze probability of .07 and mean frequency of 85.9). When task type was manipulated directly (Stanovich & West, 1983, Exp. 11), it was found that the lexical decision task displayed facilitation to the same extent as the naming task, but significant inhibition effects were only found with the lexical decision task.

According to Stanovich and West (1983), the difference

in inhibition effects may be due to postlexical message-level processes. This can be better understood with reference to Forster's (1979) model of language processing. In this model, lexical, syntactic, and message-level processes are arranged in a serial structure, each simultaneously sending information to a decision-making general problem solver that determines the appropriate response based on task demands. The unfamiliar binary response required by the lexical decision task (i.e., one seldom encounters non-words in normal reading material) may allow information from the message level to influence the response choice made by the decision-maker. When message-level processes detect an unpredictable word, it may bias the decision-maker toward a "no" response. Overcoming this bias may lengthen response time in the unpredictable condition. Stanovich and West argue that their naming task, which involves a more direct and compatible connection between lexicon and response, may be less likely to be influenced by such postlexical message-level processes. It may be argued, then, that findings of inhibition dominance are associated with the use of the lexical decision task, and occur as a result of processes which are typically not activated in normal reading situations where the reader implicitly assumes that each string of characters is indeed a word.

Another cautionary note regarding task demands in

reading experiments in which the dependent measures are speed or accuracy of recognition has been expressed by Ehrlich (1983). She differentiates between word identification, which refers to the singling out of an element within the lexicon, and word interpretation, which refers to the integration of the word with other concepts that have appeared earlier in the text. These two processes are potentially independent, so that word identification may occur without word interpretation (Ehrlich, 1983). Because the goal presented to subjects in studies using speed or accuracy of recognition as dependent variables is accurate word *identification*, the processes that play a role in the interpretation of words may not be engaged. This is an important point, because if higher-level processes are not activated in the first place, they cannot be expected to influence prelexical word perception. Experiments using the lexical decision task or the word naming task could be subject to such criticism.

## Amount of Constraint in Experimental Texts

Bloom and Fischler (1980) point out that sentence frames differ with respect to the degree with which they constrain a primary response (i.e., the most likely word given the sentence frame), as well as the degree to which they constrain the number of meaningful responses possible given the sentence frame. A sentence frame which highly

constrains a primary response and for which there are little alternative meaningful responses should produce the strongest expectancy for one specific word (e.g., The movie was so jammed they couldn't find a single _____). These are the types of sentence frames that are typically used in experiments studying context effects, because they do produce high probabilities of selecting one target word in a cloze task.

One must keep in mind, however, that such highly constraining sentence frames may not be characteristic of ordinary reading material. Rather, ordinary text may be characterized by sentence frames suggesting a large number of possible alternate words, and for which a primary response may be only a little more probable than a competing response. If this is the case, it is possible that the presence of mostly highly constraining sentence frames in an experimental situation will lead readers to adopt particular strategies in dealing with this unusually predictable material.

One strategy which may be used when presented with highly constraining sentence frames in an experiment would be to generate expectancies about the target word in order to facilitate word recognition. The use of this strategy would be worthwhile as long as the predictions about the target words are accurate. With ordinary reading material, however, readers may not typically generate particular

expectancies because they will not be correct often enough for such a strategy to be worthwhile. An inaccurate prediction would slow down reading.

According to Stanovich (1991), across a variety of subject populations and texts, a reader's probability of predicting the next word in a passage is usually between .20 and .35. As Gough (1983) has shown, this figure is highest for function words and quite low for the very words in the passage that carry the most information. In experiments such as those by Ehrlich and Rayner (1981), which look at context effects in the reading of prose passages, the target words all have cloze probabilities over .90. Even though both Fischler and Bloom's (1979) and Stanovich and West's (1983) data do not suggest readers can control the strategies they use, it is important to keep in mind that experimental texts may differ from normal text with regard to the amount of contextual constraint provided by sentence frames.

## Effects of Conceptual Context on Eye Movements in Reading

There have been fewer studies reported in the literature of the effects of conceptual context on reading. Most of these studies involve recording a reader's eye movements as short paragraphs are read, and measuring the probability of fixating a target word, or the duration of fixation of a target word.

In one such experiment, Scinto (1978) reported shorter fixation durations when subjects read portions of text in which the information presented had already been presented earlier in the passage. Ehrlich and Rayner (1981) reported shorter fixation durations on target words as well as lower probabilities of fixating these target words which were highly constrained by a short paragraph. Constraint was determined by a cloze task in a pilot study in which the target word was correctly selected 93% of the time for the high constraint paragraphs and less than 15% for the low constraint paragraphs. Hence, the target words in the highly constrained paragraphs have cloze probabilities similar to those with which Fischler and Bloom (1979) obtained facilitation effects in their lexical decision task. It is again worth noting that such constraint is probably not typical of normal reading material and may lead readers to adopt particular strategies when reading these paragraphs. As both Gough (1983) and Stanovich (1991) have pointed out, experiments that have used constraints of a magnitude more typically found in normal texts have produced only small context effects of a few milliseconds.

## Automaticity and Modularity

Although it is possible to argue from Fischler and Bloom's (1979) data that readers will only generate expectancies for sentence frames which highly predict a

given word (i.e., target words with cloze probabilities greater than .90), the facilitation observed for such contexts does not seem to have the characteristics of an attentional process. Using the theoretical framework of Posner and Snyder (1975), context in the form of expectancies can affect word recognition in one of two ways, either through automatic spreading-activation or through a conscious-attention mechanism. These two mechanisms operate independently and have different properties. Automatic spreading-activation occurs when the stimulus activates a memory location and spreads this activation to nearby semantically related memory locations. This process is fast and does not use attentional capacity. It does not affect the retrieval of information from memory locations unrelated to those activated by the context. Hence, this results in facilitation of congruous words but no inhibition of incongruous words. In contrast, the conscious-attention mechanism directs the processor to the memory location of the expected stimulus and in so doing, inhibits information from unexpected locations. Because the semantic network in long-term memory is large, this process takes considerably more time to execute. Contextual inhibition is an indicator that the conscious-attention mechanism has been activated.

If attentional processes were implicated in Fischler and Bloom's (1979) finding that readers formed expectancies only for highly predictable sentence frames, target words that

are less likely but acceptable should have been inhibited if they followed such sentence frames. However, these sentence frames did not produce corresponding inhibition of less likely words. Furthermore, giving the readers more time to generate expectancies did not increase facilitation, and readers were not able to avoid the facilitation effect when asked to ignore the relationship between sentence frame and target word (Fischler & Bloom, 1979). This implies the context effect observed was due to automatic spreading-activation.

Stanovich and West (1979, 1981, 1983) also interpret their findings in terms of the Posner-Snyder theory, and like Fischler and Bloom, conclude that automatic spreading-activation processes are heavily implicated in sentence context effects. They could find no evidence that manipulations designed to affect a reader's strategies altered the pattern or magnitude of the context effects in a manner which would indicate the operation of attentional processes (Stanovich & West, 1983, Exps. 3,4,5).

Both Fischler and Bloom(1979), and Stanovich and West (1983) therefore suggest that sentence context effects result from automatic spreading-activation processes. Such automatic processes have been assumed to be fast, unconscious (i.e., requiring no conscious attention), and obligatory (i.e., cannot be influenced once triggered) (LaBerge & Samuels, 1974). The unconscious triggering and

ballistic execution of automatic processes have been interpreted as implying that such processes need not utilize much cognitive resources. While automatic processing is occurring, the conscious attention of the subject can be directed elsewhere. In contrast, attentional processes are assumed to make much use of cognitive resources and hence operate much more slowly (LaBerge & Samuels, 1974). Stanovich (1991), however, has pointed out that automatic processing is not synonymous with resource-free processing. Processes which are obligatory may still utilize cognitive resources.

In an attempt to differentiate the components of automaticity and move away from viewing resource allocation as its most important dimension, Stanovich (1991) has advocated replacing the resource-based concept of automaticity by Fodor's (1983) information-based concept of modularity. Fodor (1983) makes a distinction between central and modular processes. Central processes are directed by expectancies based on information stored in long-term memory. These processes are slow acting, domain general, and operate under strategic control. In contrast, modular processes are not influenced by information stored in long-term memory. As a result, these processes are fast acting, domain specific, and obligatory in execution.

Since modular processes are independent of information stored in long-term memory, they are not influenced by

higher-level processes and hence are isolated from background knowledge. This accounts for the greater speed with which these processes can execute, since no time is spent searching through the vast networks of long-term memory. Also, the subject is more apt to encode features of the environment without distortion brought about by perceptual or cognitive sets. Modular processes are said to be informationally encapsulated, since hypotheses are generated based on much less information than the subject potentially has. In contrast, central processes are described as informationally unencapsulated, since they can make use of any information stored in long-term memory.

As was pointed out earlier, the text is usually clear in normal reading situations and the reader can fixate a word for as long as he or she pleases. The visual system can therefore deliver an accurate representation of the stimulus to higher-level cognitive systems. In the prelexical decoding of reading material, modular processes would be best suited to rapidly deliver accurate information in a bottom-up manner, free from the influence of expectancies which may distort the visual data. Recalling Just and Carpenter's (1980) model, once lexical access had occurred, a pointer to the word's meaning would then be deposited in working memory. Information from long-term memory could then be used to integrate clauses and then sentences with previous information from the text or with knowledge in

long-term memory. This would imply that context effects as central processes would occur postlexically, and would have the potential to influence integrative processes such as sentence wrap-up effects.

## The Present Research

The present research investigated the effects of conceptual context (i.e., information presented earlier in the text) on word reading times of target words embedded within prose texts. Conceptual context was provided in the form of short paragraphs. Because there is strong evidence in the literature that sentence frames can facilitate or inhibit the identification of a word (Stanovich & West, 1983), experiments had to be designed which separated the effects of a particular sentence frame from the effects of a much larger body of text on a target word. In order to do this, the sentences containing the target words were taken from Bloom and Fischler's (1980) completion norms, which provide probabilities of occurrence for different words given a particular sentence frame. These probabilities served as an independent variable in the current experiments. Each sentence frame was followed by a target word which either had a high probability of occurrence or a low probability of occurrence given the preceding sentence frame.

Prose paragraphs were written such that each paragraph contained two sentences from Bloom and Fischler's (1980)

norms. All paragraphs were self-contained and focused on a different topic. A second independent variable was the extent with which a paragraph constrained the target words. One version of the paragraph did not lead to any expectation of the target word, whereas the alternate version strongly constrained the low-probability target word. The rationale for having conceptual context constrain only the low-probability target word was to ensure that any facilitation of that target word would clearly be due to conceptual context and not to the sentence frame.

To recapitulate, the experiments employed 2 x 2 repeated measures designs. One factor was the probability of occurrence of a target word (high or low probability) given a particular sentence frame as determined by Bloom and Fischler's (1980) completion norms. The second factor was the level of conceptual constraint (neutral vs. constrained) as determined by the extent to which the body of the text led to an expectation of the low-probability target word. If conceptual context exerts no influence on the low-probability target words, then we should observe facilitation for the high-probability target words relative to the low-probability target words irrespective of the type of paragraph. This would be consistent with Bloom and Fischler's (1980) published norms and would reflect the effects of sentence context as reported by Fischler and Bloom (1979) and Stanovich and West (1983).

If the conceptual context does influence reading of the target word, we should observe an interaction between the probability of occurrence of a target word and the level of conceptual constraint. Facilitation should be observed for the high-probability target words relative to the low-probability target words in the neutral condition, reflecting the effects of sentence context. Facilitation should be observed for the low-probability target words in the constrained condition relative to the low-probability target words in the neutral condition, reflecting the effects of conceptual context.

Because the neutral condition cannot be considered a true replication of the sentence context experiments given that the sentences are embedded within prose passages, a third condition was included consisting of high- and low-probability words given a particular sentence frame embedded in text which did not consist of prose but of unrelated sentences. It was felt that this condition more closely reflected the sentence context experiments and should result in facilitation of the high-probability target words. Because readers may use different strategies when reading unrelated sentences than when reading connected prose, this condition was analyzed separately using a t-test.

To ensure that each subject read the paragraphs in their entirety under the same conditions, the moving window paradigm was used to display the texts on a CRT. In this

paradigm, each text appears as a series of dashes which replaces each word of the text. Each dash corresponds to a letter, hence preserving word length information. Proper spacing and punctuation is also preserved. When the subject presses a button on the mouse, the first set of dashes is replaced by the first word of the text. A subsequent button press returns the first word to a set of dashes, and the second word of the text is revealed. The subject thus reads the text seeing only one word at a time, and controls the amount of time each word is displayed. There was no provision for looking back at a previously read word. With this paradigm, problems associated with subjects skipping or re-reading portions of text were avoided. Word reading times, defined as the interval between successive button presses, were recorded.

The first experiment, therefore, was designed to measure the effects of conceptual context on the word reading times of target words. Because there is some debate as to whether context can influence prelexical processes (Neely, 1990), the second experiment was designed to determine whether the effects of conceptual context occurred at word identification, which would suggest a prelexical effect, or at word interpretation, which would suggest a postlexical effect. Because some researchers (Gough, 1983; Stanovich, 1991) have argued that large context effects arise from textual constraints not typical of normal reading material,

the third experiment was designed to determine whether interference with bottom-up processing by making the text more difficult to read would produce large effects of conceptual context, or change the locus of such effects (e.g., from a postlexical to a prelexical locus).

## Experiment 1

Experiment 1 was designed to determine whether the perception of the target word occurred primarily as a bottom-up process or whether higher-level processes in the form of conceptual context could facilitate the reading of this word. Contextual facilitation would be reflected in an interaction between the probability of occurrence of the target word given a particular sentence frame and conceptual constraint provided by the text.

Target words having a low probability of occurrence given a particular sentence frame should show longer word reading times than target words having a high probability of occurrence given a particular sentence frame in the neutral text condition, but not in the constrained text condition. This is because the conceptual constraints were designed to lead readers to expect only those target words having a low probability of occurrence given a particular sentence frame. Hence, these low-probability target words should show shorter word reading times in the constrained text condition

than in the neutral text condition. Because the conceptual context in the constrained text condition is designed to lead to the expectation of only the low-probability target words, it is also expected that this condition may result in longer word reading times for the target words having a high probability of occurrence given a particular sentence frame relative to the target words having a low probability of occurrence given a particular sentence frame. In the unrelated sentences condition, word reading times should be shorter for the target words having a high probability of occurrence given a particular sentence frame, since there is no conceptual constraint.

If conceptual context does not decrease word reading times for target words that have a low probability of occurrence given a particular sentence frame in the constrained text condition relative to the neutral text condition, this would suggest that bottom-up processes are playing a major role in the reading of these passages and that the influence of top-down processes may be negligible.

## Method

### Subjects

Subjects consisted of 32 paid participants, 20 females and 12 males ranging in age from 19 to 41 years (mean age of 23 years). English was their mother tongue and they had either obtained at minimum a Bachelor's degree or were in the process of obtaining such a degree at an English-

speaking university. All subjects were doing most of their day-to-day reading in English at the time they participated in the experiment. All subjects had good corrected or uncorrected vision (equivalent to Snellen acuity of 20/20), which was determined by administration of the Keystone School Vision Screening Test, developed by the Keystone View Company. Subjects were naive with respect to the purpose of the experiment.

Materials and Apparatus

To make up the experimental texts, 80 sentences were taken from Bloom and Fischler's (1980) completion norms, for which cloze probabilities are available for the target words occurring at the end of sentence frames. The following are two examples of sentence frames without the target words:

1) At night they often took a short

2) In the distance they heard the

For the first sentence frame, 68% of the people tested chose the word "walk" as best completing the sentence, and 2% chose the word "swim". Thus, "walk" can be considered a high-probability target word for that sentence frame and "swim" can be considered a low-probability target word. Likewise, for the second sentence, 15% chose the word "thunder" and 4% chose the word "screams" (Bloom & Fischler, 1980).

Each of the 80 sentence frames selected had associated

with them both a high-probability target word and a low-probability target word. Cloze probabilities for high-probability target words ranged from 0.15 to 1.00, with a mean of 0.68, median of 0.70, and standard deviation of 0.22. Cloze probabilities for low-probability target words ranged from 0.00 to 0.34, with a mean of 0.06, median of 0.04, and standard deviation of 0.06.

After selecting these 80 sentence frames and target words, 40 narrative texts of 12 sentences long were created which incorporated two sentence frames per text. Although the length of the sentence frames and hence of the texts vary, the sentence frames with their corresponding target words always appeared as the sixth and tenth sentences in each text. The following is an example of one text, in which the target words are underlined (the high-probability target word precedes the low-probability target word).

> It was a warm evening. Both John and Suzie were at a loss for words. They had a lot to talk about which made them both uncomfortable. Suzie had been accepted to graduate school in Vancouver. She was also convinced that she loved John very much. At night they often took a short walk/swim. Suzie tried to guess what John was thinking. She remembered how they had often discussed the future they would have together. The wind whistled through the branches. In the distance they heard the thunder/screams. One of them would have to begin talking. Suzie decided she would be the one.

In the above text, the high- and low-probability target words are of the same length. Although this was not always the case for each text, the mean word length of high-probability words (n = 80) was 4.86 (s = 1.06), and the mean

word length of low-probability words (n = 80) was 4.77 (s = 1.20).

Word frequencies for the high-probability words (n = 79), based on Kucera and Francis' (1967) estimates, ranged from 3 to 1961, with a mean of 181.02, median of 67, and a standard deviation of 311.50. Word frequencies for the low-probability words (n = 79) ranged from 1 to 2619, with a mean of 145.52, median of 75, and standard deviation of 316.96. Word frequency estimates are based on a sample of 79 because both the high- and low-probability conditions contained a word which was not listed in Kucera and Francis' (1970) monograph. This was the word "signs" in the high-probability condition, and the word "nose" in the low-probability condition.

Three types of text were constructed which incorporated the sentence frames with their target words: "Neutral", "Constrained", and "Sentence" texts. In the "Neutral" text, of which the above text is an example, the narrative was written to provide little conceptual constraint of the target words. This means that prior to seeing the word "walk", for example, there should be no information in the text leading the reader to expect this word as opposed to other words such as "drive", "swim", "break", or "nap".

In the "Constrained" text, the narrative was written to conceptually constrain the low-probability target word, so that readers would be more likely to expect the occurrence

of this word prior to its perception. In other words, the narrative text was designed to transform what is essentially a low-probability word given a particular sentence frame into a high-probability word for the textual context. The following is the Constrained text for the two sentence frames discussed above.

> It was a warm evening. John and Suzie headed out towards the ocean. They had to be careful because sharks were common in this region. They both had their bathing suits underneath their clothes. It was almost midnight when they reached the edge of the sea. At night they often took a short walk/swim. Back on the shore, they listened to the waves. Over the waves came the sound of a person shouting for help. Someone was being attacked by a shark. In the distance they heard the thunder/screams. They were completely helpless to do anything. It was a horrible experience.

In this version, the narrative was written to bias the reader to expect the low-probability target words (relative to their sentence frames) "swim" and "screams" rather than the high-probability words "walk" and "thunder". To ensure that the texts in the Constrained condition were effective in biasing readers to expect the low-probability words, they were given to 128 undergraduate students to read in a pilot study. In each text, the target words were replaced by a blank, and the students were instructed to fill in the blanks with the one word they thought was most appropriate. The proportion of readers selecting the two target words for each sentence frame was computed. Only those texts for which the difference in proportions between low- and high-probability words given a particular sentence frame was zero

or higher for at least one of the two sentence frames were kept for use in the experiment. This criteria ensured that the low-probability word was selected at least as often as the high-probability word by these readers. For those texts in which data for one of the sentence frames did not meet this criteria, the text was changed and another pilot study was done. After three pilot studies, seven target words did not meet these criteria and hence were not included in data analysis. Three additional target words were also excluded from data analysis after discovering that these words occurred earlier in the text. All analyses were therefore based on 70 target words. Across the 40 Constrained texts, the low-probability words given a particular sentence frame had a mean cloze probability of .62, whereas the high-probability words had a mean cloze probability of .09. Hence, the Constrained version of the texts did bias the reader to expect the low-probability word with respect to a particular sentence frame over the high-probability word.

In addition to the Neutral and Constrained texts, the third type of text created incorporating Bloom and Fischler's (1980) sentence contexts is called the "Sentence" condition. In this condition, the narrative text was replaced with unrelated sentences, preserving text length (i.e., number of sentences) but providing no opportunity for conceptual constraints to develop. Since the only constraints in these texts came from linguistic context, it

was possible to include more sentences from the Bloom and Fischler (1980) norms. In addition to the two sentence frames containing the target words (which are identical in all three conditions), six additional sentences from Bloom and Fischler's (1980) norms were included in most texts (there were not enough sentences to make 40 texts). Therefore, texts in the Sentence condition had either 2 or 8 target words per text. All experimental texts can be found in Appendix 1. An IBM-compatible Olivetti (Model M24) personal computer was used to present the texts and record subjects' data.

For each experimental text, two statements were created to be used as a measure of text comprehension. This was primarily to ensure that readers actually read the material and did not skip large sections of text by simply pressing the button on the mouse. For the "Neutral" and "Constrained" conditions, these statements either stated something true about the text or stated something false about the text. Whether the statements created for a particular text were true or false wa. determined at random, so that for some texts both statements were true, both statements were false, or one statement was true and the other false. Since the texts in the "Sentence" condition did not consist of connected prose but of unrelated sentences, the two statements consisted of sentences which might have appeared in the text. The reader answered "true"

if they remembered seeing the sentence and "false" if they believed the sentence had not appeared. The distribution of "true" and "false" sentences were random.

Procedure

Subjects were tested individually in a session which lasted approximately one hour, with the experimenter being present throughout this time. Subjects were presented with a consent form describing the procedure, and a verbal description of the procedure was also given. After signing the consent form they were given a vision test. They were then seated in front of the computer and two practice texts were presented, one comprised of unrelated sentences and one of a narrative text. The texts were presented one at a time using the moving window paradigm described earlier, which forced subjects to read one word at a time. Subjects controlled the speed with which each word appeared by pressing a button on a mouse.

After each practice text, subjects were presented with two statements to which they answered "true" or "false". For the Sentence text, they answered "true" if they remembered seeing the sentence in the text. For the Narrative text, they answered "true" if the statement was true in relation to the narrative. The answers were reviewed immediately so that subjects received feedback regarding their performance. If their answers were correct, the experiment was begun. If they made errors, they were

instructed to pay more attention to the texts.

During the experiment, subjects were presented with 40 texts blocked in groups of four. Eight texts consisted of unrelated sentences, and these were always presented as the first and last four texts. Readers were informed of this as well as reminded of the difference in the comprehension task. The remaining 32 texts were narratives. For the unrelated sentences condition, texts containing high-probability target words given a particular sentence frame alternated with texts containing low-probability target words given a particular sentence frame. Each block of four texts was counterbalanced so that each text could be represented in the unrelated sentences condition. However, with 32 subjects each reading 8 texts in this condition, this left 8 texts that could not be represented. These were texts 13 to 16 and texts 33 to 36.

The narrative texts were also blocked in groups of four, so that each condition (probability of occurrence of a target word given its sentence frame, and conceptual context) was represented in a block. These blocks were then counterbalanced, so that all texts were represented in each of the narrative conditions.

After reading each block of four texts, subjects were given the four pairs of true/false statements which corresponded to the four texts just read. Their answers were checked immediately. If they obtained more than two

mistakes out of eight (or if they got both statements for one text wrong), they were eliminated from the experiment and replaced.

## Results

For each subject, word reading times on the target word were averaged for each experimental condition. There were 16 replications serving as the data for each condition involving narrative texts, and 20 to 32 replications serving as the data for the two Sentence conditions. There were 10 data points eliminated per subject corresponding to the target words which failed to meet the criteria established in the pilot studies, and those for which a target word occurred earlier in the text. Word reading times on target words for the Sentence condition were analyzed separately, since it was felt that the reading material was qualitatively different (i.e., unrelated sentences as opposed to prose) and that subjects might use a different reading strategy given the different type of comprehension test administered (i.e., tapping memory for the sentence as opposed to memory for meaning).

For the Sentence condition, a t-test yielded a significant difference between high-probability ($M$ = 1358 ms) and low-probability ($M$ = 1476 ms) words, $t(31) = 2.12$, $p < .05$. The high-probability words showed faster word reading times, which is consistent with Bloom and Fischler's (1980) completion norms.

For the narrative texts, a 2 x 2 (Word probability given a particular sentence frame x Conceptual context) repeated measures ANOVA was performed on these means, and only a significant interaction effect was obtained, $\underline{F}(1,31) = 9.65$, $\underline{p} < .05$. A graph of this interaction can be seen in Figure 1. Post hoc Tukey tests using a significance level of .05 yielded a significant difference between means for high- and low-probability words in the Neutral condition, the high-probability words having faster word reading times. There was also a significant difference between the means of low-probability words in the Constrained compared to the Neutral condition. Low-probability words in the Constrained condition showed faster word reading times than low-probability words in the Neutral condition. ANOVA source tables are found in Appendix 2.

## Discussion

Results of Experiment 1 show no effect of conceptual context on word reading times for high-probability target words. This is not surprising since the textual constraints were designed to affect primarily the low-probability target words. However, one might have expected slower reading times for high-probability words in the Constrained condition compared to the Neutral condition, because the high-probability words were often unexpected in this condition. Although there was no neutral target word to serve as a baseline in order to evaluate facilitation and

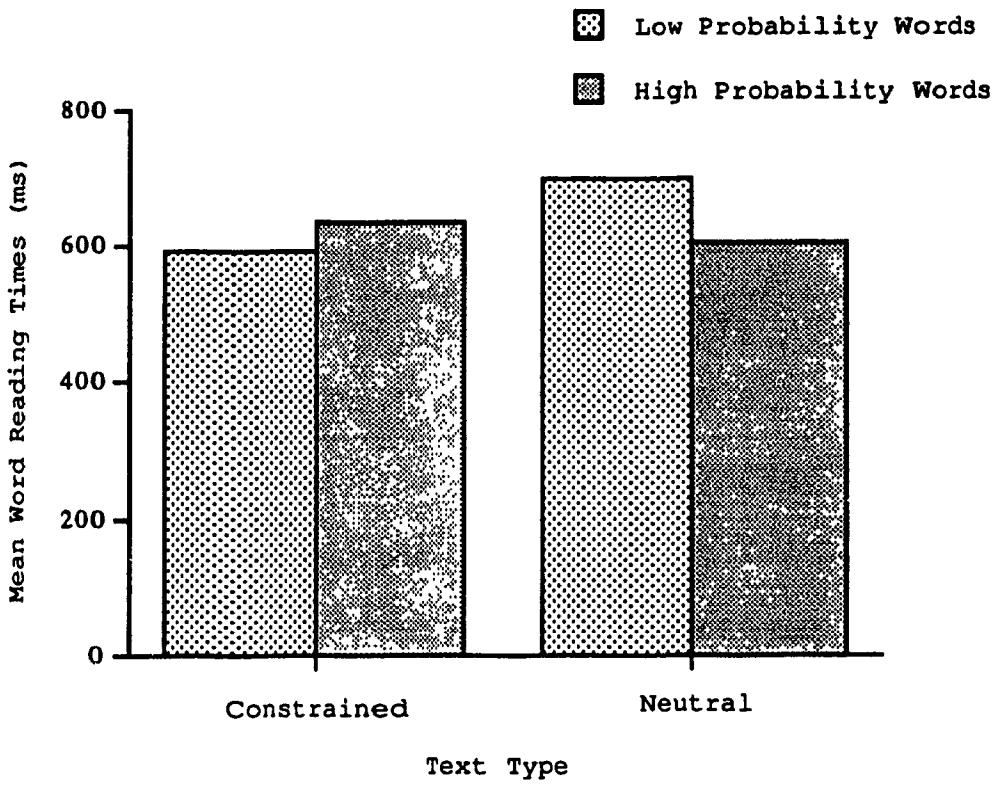


Figure 1. Mean word reading times (ms) as a function of word probability and type of text (Exp. 1)

inhibition effects, it seems that the Constrained condition facilitated processing of the low-probability words which were expected without inhibiting the high-probability words which were unexpected but not anomalous given either the sentence frame or the global text.

In the Neutral condition, in which the target words were not constrained by conceptual context, the high-probability target words showed significantly faster word reading times than the low-probability target words. This is consistent with Bloom and Fischler's (1980) completion norms and probably reflect the effects of constraints imposed by the sentence frames. The constraining effects of the sentence frames are also reflected in the faster reading times for high-probability words relative to low-probability words in the unrelated sentences condition. The much larger overall word reading times in this condition compared to either of the narrative conditions is probably reflective of the lack of flow in the reading material and the lack of continuity in meaning from one sentence to the next.

In contrast, conceptual context did affect the word reading times for the low-probability words. These were read significantly faster in the Constrained condition compared to the Neutral condition, reflecting contextual facilitation for these words. No significant differences were found between reading times for the low-probability words in the Constrained condition and the high-probability

words in either condition. Conceptual context in the Constrained condition seems to have facilitated the processing of the low-probability words by having them processed as quickly as the high-probability words, rather than by processing these words significantly faster than the high-probability words. In essence, the conceptual context seems to have provided the low-probability words with the same advantage in terms of processing speed that the high-probability words get from a highly constraining sentence frame.

## Experiment 2

In an experiment looking at the eye movements of readers engaged in reading prose passages, Ehrlich and Rayner (1981) found evidence that high levels of conceptual constraint led readers to be less sensitive to visual features (i.e., they were less likely to detect letter substitutions in target words). Since the high-constraint passages also resulted in lower probabilities of fixating the target words and shorter fixations on the words that were fixated, they argued that conceptual context may facilitate reading by decreasing a reader's reliance on visual information. In other words, conceptual context may facilitate word identification (Ehrlich, 1983). The implication is that this would lead to more rapid singling out of an element within the lexicon. Any influence of conceptual context on the speed of lexical access would provide evidence that conceptual context can

influence prelexical processing.

Conceptual context may also facilitate word interpretation, a postlexical process. In this scenario, contextual constraints serve to decrease the time needed to integrate the word that is accessed in the lexicon with previously read material (Ehrlich, 1983). Proponents of this view argue that all the component processes of reading up to and including lexical access occur via fast and efficient bottom-up processing, free of contextual influences. Once a word has been identified, contextual constraints may facilitate its integration with other parts of the text (Just & Carpenter, 1980; Rayner & Pollatsek, 1989).

According to Just and Carpenter (1980), much of this integration occurs while a reader is fixating the last word of the sentence in a process called sentence wrap-up. It is possible that the context effect obtained in Experiment 1 (i.e., decreased word reading time on a target word) was a result of more efficient word interpretation during sentence wrap-up as opposed to faster word identification. Since the target word was also the last word of the sentence, word identification and word interpretation could not be differentiated. Experiment 2 was designed to address this problem.

In order to determine whether conceptual context affects word identification (a prelexical influence) or word

interpretation (a postlexical influence), all sentences containing the target word were extended by three words. For example, the sentence "At night they often took a short swim" became "At night they often took a short swim under the stars". In this way, word reading times could be examined for the target word "swim" as well as for the last word "stars". If conceptual context decreases word reading times for the low-probability target words in the constrained condition (i.e., a replication of Experiment 1), this would suggest such effects may be occurring at the word identification level, assuming very little word interpretation occurs when the word is being fixated. If conceptual context decreases word reading times for the last words rather than the target words, this would suggest such effects are occurring at the word interpretation level.

## Method

### Subjects

Subjects consisted of 32 paid participants, 20 females and 12 males ranging in age from 18 to 30 years (mean age of 26), who did not participate in Experiment 1. English was their mother tongue and they had either obtained at minimum a Bachelor's degree or were in the process of obtaining such a degree at an English-speaking university. All subjects were doing most of their day-to-day reading in English at the time they participated in the experiment. All subjects had good corrected or uncorrected vision (equivalent to

Snellen acuity of 20/20), which was determined by administration of the Keystone School Vision Screening Test, developed by the Keystone View Company. Subjects were naive with respect to the purpose of the experiment.

## Materials and Apparatus

All 80 sentences used in Experiment 1 which were taken from Bloom and Fischler's (1980) sentence contexts were extended by three words. In each of these sentence contexts, the same three-word extension was used following the high-probability and low-probability target words. In the Sentence condition, the additional sentences taken from Bloom & Fischler's (1980) norms which were included in the data analysis for Experiment 1 were not extended by three words. Hence, they were not included in the data analysis for Experiment 2. This means that all texts in the Sentence condition had only 2 target words per text instead of 8 as was the case for some texts in Experiment 1. This reduced to 8 the number of replications serving as the datum for both Sentence conditions. Apart from these two changes, the texts were otherwise identical to those used in Experiment 1. An IBM-compatible Olivetti (Model M24) personal computer was used to present the texts and record subjects' data.

## Procedure

The procedure was identical to that of Experiment 1.

Subjects were tested individually in a session which lasted approximately one hour, with the experimenter being present throughout this time. Subjects were presented with a consent form describing the procedure, and a verbal description of the procedure was also given. After signing the consent form they were given a vision test. They were then seated in front of the computer and two practice texts were presented, one comprised of unrelated sentences and one of a narrative text. The texts were presented one at a time using the moving window paradigm described earlier, which forced subjects to read one word at a time. Subjects controlled the speed with which each word appeared by pressing a button on a mouse.

After each practice text, subjects were presented with two statements to which they answered "true" or "false". For the Sentence text, they answered "true" if they remembered seeing the sentence in the text. For the Narrative text, they answered "true" if the statement was true in relation to the narrative. The answers were reviewed immediately so that subjects received feedback regarding their performance. If their answers were correct, the experiment was begun. If they made errors, they were instructed to pay more attention to the texts.

During the experiment, subjects were presented with 40 texts blocked in groups of four. Eight texts consisted of unrelated sentences, and these were always presented as the

first four and the last four texts. Readers were informed of this as well as reminded of the difference in the comprehension task. The remaining 32 texts were narratives. For the unrelated sentences condition, texts containing high-probability target words given a particular sentence frame alternated with texts containing low-probability target words given a particular sentence frame. Each block of four texts was counterbalanced so that each text could be represented in the unrelated sentences condition. However, with 32 subjects each reading 8 texts in this condition, this left 8 texts that could not be represented. These were texts 13 to 16 and texts 33 to 36.

The narrative texts were also blocked in groups of four, so that each condition (probability of occurrence of a target word given its sentence frame, and conceptual context) was represented in a block. These blocks were then counterbalanced, so that all texts were represented in each of the narrative conditions.

After reading each block of four texts, subjects were given the four pairs of true/false statements which corresponded to the four texts just read. Their answers were checked immediately. If they obtained more than two mistakes out of eight (or if they got both statements for one text wrong), they were eliminated from the experiment and replaced.

## Results

### Analysis of sentence wrap-up

In order to determine that readers did in fact show sentence wrap-up effects for the narrative texts, word reading times on the last word of the sentences containing the target words were compared with the mean word reading times of all the other words in these sentences (except for the first word). For each subject, word reading times for the last word was averaged across the four prose conditions (data from the Sentence conditions were not included in the analysis), yielding 64 replications serving as a data point. Mean word reading times for the remaining words (except for the first word) was also averaged across the four prose conditions, yielding 64 replications serving as a second data point. A t-test showed a significant difference between word reading times on the last word ($M = 629$ ms, $s = 297$) and the other words of the sentence ($M = 359$ ms, $s = 102$), $t(31) = -6.29$, $p < .001$. Readers did spend a significantly longer time fixating the last word of these sentences.

### Analysis of the target word

For each subject, word reading times on the target word were averaged for each experimental condition. There were 16 replications serving as the data for each condition involving narrative texts, and 8 replications serving as the data for the two Sentence conditions. As in Experiment 1,

there were 10 data points eliminated per subject corresponding to the target words which failed to meet the criteria established in the pilot studies, and those for which a target word occurred earlier in the text. The results for the word reading times on target words are presented in Table 1. Word reading times on target words for the Sentence condition were analyzed separately, since it was felt that the reading material was qualitatively different (i.e., unrelated sentences as opposed to prose) and the subjects might use a different reading strategy given the different type of comprehension test administered (i.e., tapping memory for the sentence as opposed to memory for meaning).

For the narrative texts, a 2 x 2 (Word probability given a particular sentence frame x Conceptual context) repeated measures ANOVA was performed on these means, and no significant effects were obtained. ANOVA source tables are found in Appendix 2. For the Sentence condition, a t-test yielded no significant difference between high- and low-probability words given a particular sentence frame, $t(31) = -.384$, $p = .67$.

Analysis of the target word and next word

Because of the possibility that some interpretation of the target word may begin prior to reaching the end of the sentence, statistical analysis was carried out on the sum of word reading times of the target word and the word

Table 1

Mean Word Reading Times (ms) on Target Words as a Function of Word Probability and Type of Text (Exp. 2).

| | Low Probability | | High Probability | |
|---|---|---|---|---|
| Constrained | 386 | (107) | 390 | (111) |
| Neutral | 391 | (126) | 380 | ( 85) |
| Sentence | 450 | (126) | 458 | (159) |

Note. Values in parentheses indicate the standard deviation.

Table 2

Mean Word Reading Times (ms) on Sum of Target and Target + 1 Words as a Function of Word Probability and Type of Text

| | Low Probability | | High Probability | |
|---|---|---|---|---|
| Constrained | 764 | (177) | 796 | (210) |
| Neutral | 783 | (224) | 767 | (177) |
| Sentence | 945 | (355) | 872 | (235) |

Note. Values in parentheses indicate the standard deviation.

immediately following the target word. This was to allow for the possibility that interpretation of the target word may lag behind the actual fixation on the word. It is important to note that the same word followed the high- and low-probability words given a particular sentence frame.

For each subject, the sums of word reading times on the target word and the word immediately following the target word were averaged for each experimental condition. There were 16 replications serving as the data for each condition involving narrative texts. As in Experiment 1, there were 10 data points eliminated per subject corresponding to the target words which failed to meet the criteria established in the pilot studies, and those for which a target word occurred earlier in the text. The results for the summed word reading times are presented in Table 2.

A 2 x 2 (Word probability given a particular sentence frame x Conceptual context) repeated measures ANOVA was performed on these means, and no significant effects were obtained. ANOVA source tables are found in Appendix 2. For the sentence condition, a t-test yielded no significant difference between high- and low-probability words given a particular sentence frame, $t(31) = 1.763$ $p = .08$.

Analysis of the last word

For each subject, word reading times on the last word of the sentences containing the target words were averaged for

each experimental condition. There were 16 replications serving as the data for each condition involving narrative texts, and 8 replications serving as the data for the two Sentence conditions. There were 10 data points eliminated per subject corresponding to the target words which failed to meet the criteria established in the pilot studies, and those for which a target word occurred earlier in the text. Word reading times on the last words for the Sentence condition were analyzed separately, since it was felt that the reading material was qualitatively different (i.e., unrelated sentences as opposed to prose) and that subjects might use a different reading strategy given the different type of comprehension test administered (i.e., tapping memory for the sentence as opposed to memory for meaning).

For the narrative texts, a 2 x 2 (Word probability given a particular sentence frame x Conceptual context) repeated measures ANOVA was performed on these means, and only a significant interaction effect was obtained, $F(1,31) = 9.13$, $p < .05$. A graph of this interaction can be seen in Figure 2. Post hoc Tukey tests using a significance level of .05 yielded a significant difference only between means for the Low-probability Constrained condition and the Low-probability Neutral condition. The last word in the Low-probability Constrained condition was read faster than the last word in the Low-probability Neutral condition. ANOVA source tables are found in Appendix 2.

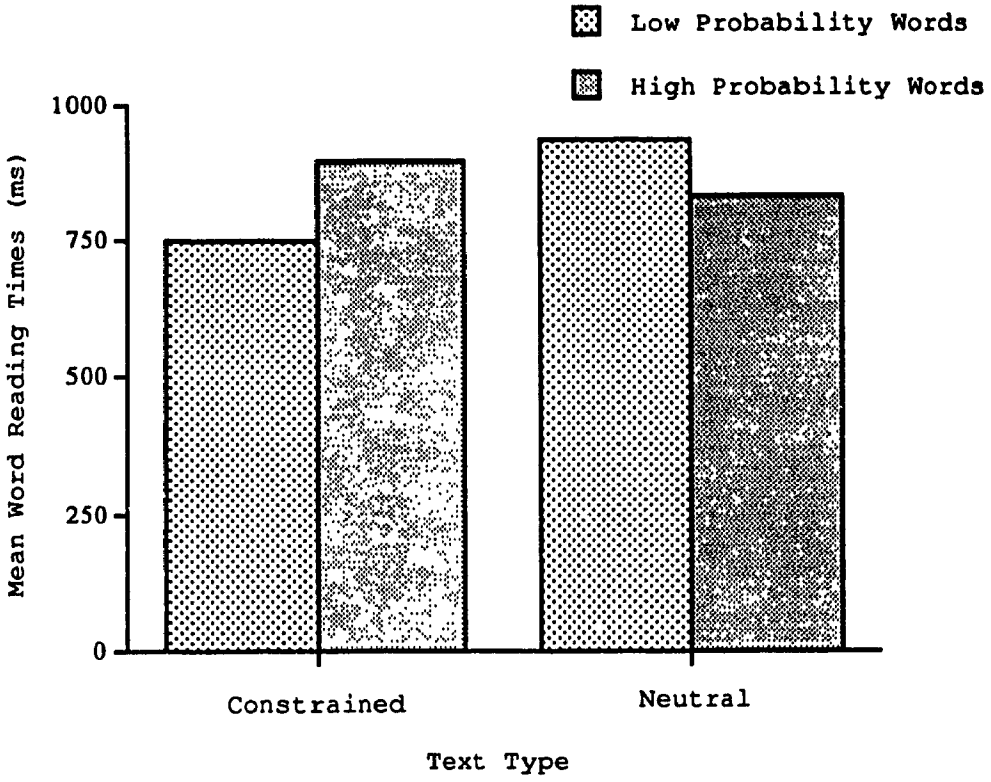


Figure 2. Mean word reading times (ms) on last words as a function of word probability and type of text (Exp. 2)

For the Sentence condition, a t-test yielded no significant difference between the last words in the High-probability word condition (M = 1625 ms) and the last words in the Low-probability word condition (M = 1432 ms), $t(31) = -1.23$, $p = .22$.

## Discussion

The lack of contextual effects on the word reading times of target words suggests that conceptual context did not influence lower-level processes such as word identification. However, conceptual context did influence reading of the last word of sentences containing the target word, which might suggest an influence on higher-level processes such as word interpretation. The data pattern, however, is different than what was found in Experiment 1.

As in Experiment 1, the results of Experiment 2 show no effect of conceptual context on word reading times for the last words following high-probability words in the Neutral vs. Constrained conditions. It is worth recalling that the conceptual context was designed to affect primarily the low-probability target words, so this finding is not surprising.

A more surprising finding is that in the Neutral condition, the last words following high-probability words were not read significantly faster than the last words following low-probability words, although there was a trend in this direction. Furthermore, the difference between high- and low-probability word conditions was also not

significant in the Unrelated Sentences condition. The discrepancy with the results obtained in Experiment 1 challenges the explanation that the differences between high- and low-probability words in the neutral and unrelated sentence conditions in Experiment 1 occurred as a result of contextual effects provided by the sentence frame, because such effects should also be present in Experiment 2.

It is possible, however, that contextual effects resulting from a sentence frame may produce facilitation in the interpretation of a word which may occur after the word is fixated but prior to the end of the sentence. This requires distinguishing between word interpretation, processes involved in establishing the meaning of a word, and sentence integration, the integration of this word with the rest of the sentence, and assuming that word interpretation may lag behind the actual fixation of a word. If this were the case, one would expect a significant difference between high- and low-probability conditions in the Neutral and Unrelated Sentences conditions to be evident not in word reading times of the target words, but primarily in word reading times of the words following the target words. However, analysis of the summed word reading times of target words and the first word following the target words yielded no significant differences.

In contrast, conceptual context did influence processing of the last word in the Constrained condition. For the

texts containing low-probability target words, last words were read significantly faster in the Constrained condition compared to the Neutral condition. This suggests that conceptual context influences reading by facilitating sentence integration.

## Experiment 3

The previous two experiments support the working assumption that word identification essentially occurs in a bottom-up manner and is free of contextual influences. It has some characteristics of an automatic process, in that it occurs rapidly and is unaffected by a reader's strategies. As long as bottom-up processing is efficient and occurs rapidly, the effects of conceptual context only become apparent at sentence wrap-up, where sentence integration is facilitated.

In Fodor's (1983) conceptualization, word identification is a modular process which is informationally encapsulated. This means it is independent of other information stored in long-term memory and is not influenced by higher-level processes. According to Stanovich (1991), contextual facilitation (a central process) can penetrate the word identification module if bottom-up processing is not particularly efficient at decoding the visual input. This situation is typical for novice readers, less skilled readers, and skilled readers for which the reading material is degraded or presented rapidly (Stanovich, West, & Feeman,

1981; Briggs, Austin, & Underwood, 1984; Meyer, Schvaneveldt, & Ruddy, 1975). According to Stanovich (1980), there is a strategic reliance on contextual information in this situation to compensate for the difficulties with bottom-up processing, and this usage of context has the characteristics of a conscious, attentional process (Stanovich, 1980; Stanovich, West, & Feeman, 1981).

In the third experiment, the use of conceptual context as a compensatory mechanism for inefficient bottom-up processing was investigated. Bottom-up processing was rendered more difficult by presenting the text backwards, hence reducing the efficiency of the word identification module. If readers compensate for this difficulty by using conceptual context to aid in word identification, then context effects should be seen on the target words as well as at sentence wrap-up. Faster word reading times should be seen for the low-probability target words in the Constrained condition compared to the Neutral condition. Also, the last word of the sentences containing the low-probability target words should be read faster than the last word of the sentences containing the high-probability target words in the Constrained condition compared to the Neutral condition. If conceptual context influences only sentence wrap-up and not the processing of the target words, this would indicate that the word identification module is relatively impenetrable irregardless of the integrity of bottom-up processes.

# Method

## Subjects

Subjects consisted of 32 paid participants, 27 females and 5 males ranging in age from 19 to 36 years (mean age of 22). These subjects participated in neither Experiment 1 nor 2. English was their mother tongue and they had either obtained at minimum a Bachelor's degree or were in the process of obtaining such a degree at an English-speaking university. All subjects were doing most of their day-to-day reading in English at the time they participated in the experiment. All subjects had good corrected or uncorrected vision (equivalent to Snellen acuity of 20/20), which was determined by administration of the Keystone School Vision Screening Test, developed by the Keystone View Company. Subjects were naive with respect to the purpose of the experiment.

## Materials and Apparatus

The texts used were identical to those used in Experiment 2. An IBM-compatible Olivetti (Model M24) personal computer was used to present the texts and record subjects' data.

## Procedure

Subjects were tested individually in a session which lasted approximately two hours, with a ten-minute rest period halfway through the experiment. The experimenter was

present throughout the session. Subjects were initially presented with a consent form describing the procedure, and a verbal description of the procedure was also given. After signing the consent form they were given a vision test. They were then seated in front of the computer and two practice texts were presented, one comprised of unrelated sentences and one of a narrative text. The texts were presented backwards, one at a time, using the moving window paradigm. Reading proceeded from right to left, with the words spelled backwards. For example, the phrase "it was difficult" would appear as "tluciffid saw ti". Subjects controlled the speed with which each word appeared by pressing a button on a mouse. There was no provision for looking back at a previously read word.

After each practice text, subjects were presented with two statements to which they answered "true" or "false". For the Sentence text, they answered "true" if they remembered seeing the sentence in the text. For the Narrative text, they answered "true" if the statement was true in relation to the narrative. The answers were reviewed immediately so that the subjects received immediate feedback regarding their performance. If their answers were correct, the experiment was begun. If they made errors, they were urged to pay more attention to the texts. The true/false statements assessing memory for sentences and comprehension of narratives were not presented backwards.

During the experiment, subjects were presented with 40 texts. Eight texts consisted of unrelated sentences blocked in groups of four, and the remaining 32 texts were narratives. The first four texts presented to the readers as well as the last four texts always consisted of the unrelated sentences. Readers were informed of this as well as reminded of the difference in the comprehension task. Texts containing high-probability target words given a particular sentence frame alternated with texts containing low-probability target words given a particular sentence frame. Each block of four texts was counterbalanced so that each text could be represented in the unrelated sentences condition. However, with 32 subjects each reading 8 texts in this condition, this left 8 texts that could not be represented. These were texts 13 to 16 and texts 33 to 36.

The narrative texts were also blocked in groups of four, so that each condition (probability of occurrence of a target word given its sentence frame and conceptual context) was represented in a block. These blocks were then counterbalanced, so that all texts were represented in each of the narrative conditions.

After every block of four texts, subjects were given four pairs of true/false statements which corresponded to the four texts just read. Their answers were checked immediately. If they obtained more than two mistakes out of eight (or if they got both statements for one text wrong),

they were eliminated from the experiment and replaced.

## Results

### Analysis of sentence wrap-up

Word reading times on the last word of the sentences containing the target words were compared with the mean word reading times of all the other words in these sentences (except for the first word). For each subject, word reading times for the last word was averaged across the four prose conditions (data from the Sentence conditions were not included in the analysis), yielding 64 replications serving as a data point. Mean word reading times for the remaining words (except for the first word) was also averaged across the four prose conditions, yielding 64 replications serving as a second data point. A t-test showed a significant difference between word reading times on the last word ($M$ = 1532 ms, $s$ = 397) and the other words of the sentence ($M$ = 1043 ms, $s$ = 188), $t(31) = -9.06$, $p < .001$. Readers did spend a significantly longer time fixating the last word of these sentences.

### Analysis of the target word

For each subject, word reading times on the target word were averaged for each experimental condition. There were 16 replications serving as the data for each condition involving narrative texts, and 8 replications serving as the datum for the two Sentence conditions. As in the previous experiments, there were 10 data points eliminated per

subject corresponding to the target words which failed to meet the criteria established in the pilot studies, and those for which a target word occurred earlier in the text. Word reading times on target words for the Sentence condition were analyzed separately, since it was felt that the reading material was qualitatively different (i.e., unrelated sentences as opposed to prose) and that subjects might use a different reading strategy given the different type of comprehension test administered (i.e., tapping memory for the sentence as opposed to memory for meaning).

For the prose texts, a 2 x 2 (Word probability x Context) repeated measures ANOVA was performed on these means, and a main effect of Word Probability was obtained, $\underline{F}(1.31) = 6.26$, $\underline{p} < .05$. High-probability words showed faster word reading times than Low-probability words across context conditions. The effect of context was not significant, $\underline{F}(1.31) = 3.62$, $\underline{p} = .063$. There was a significant interaction effect, $\underline{F}(1,31) = 20.46$, $\underline{p} < .05$. A graph of this interaction can be seen in Figure 3. Post hoc Tukey tests using a significance level of .05 yielded a significant difference between means for High- and Low-probability words in the Neutral condition, the High-probability words having faster word reading times. There was also a significant difference between the means of Low-probability words in the Constrained and Neutral conditions. Low-probability words in the Constrained condition showed

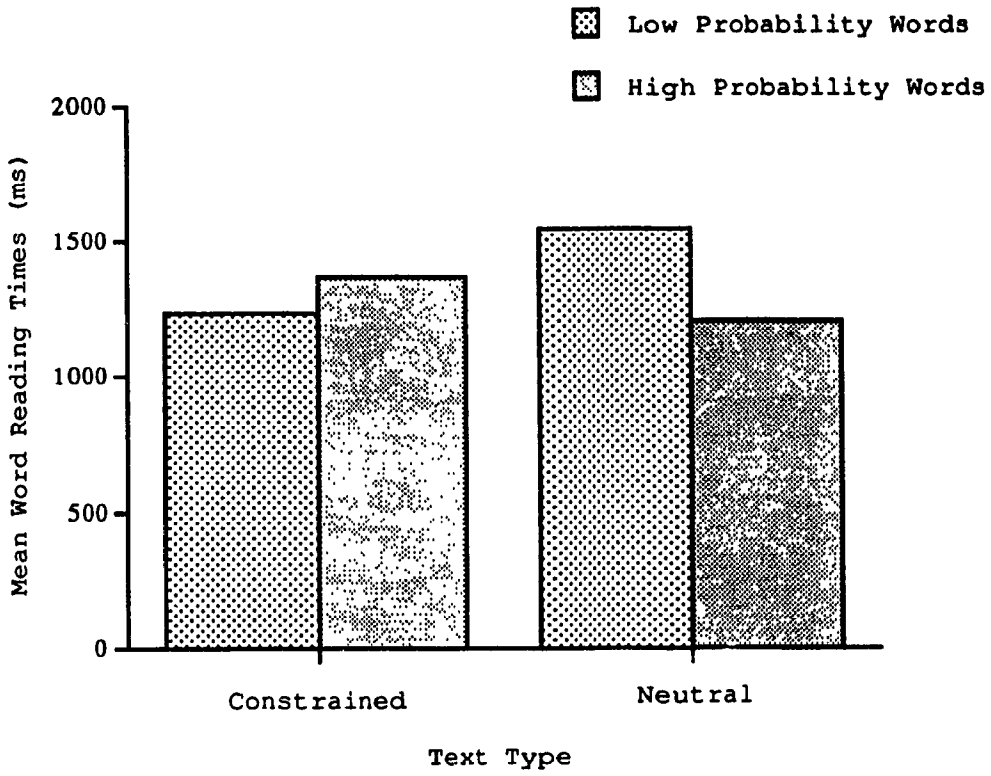


Figure 3. Mean word reading times (ms) on target words as a function of word probability and type of text (Exp. 3)

faster word reading times. Essentially, the interaction effects replicate those of Experiment 1. ANOVA source tables are found in Appendix 2.

For the Sentence condition, a t-test yielded a significant difference between high-probability words (M = 1310 ms) and low-probability words (M = 1754 ms), $t(31) = 5.15$, $p < .05$. The high-probability words showed faster word reading times.

Analysis of the last word

For each subject, word reading times on the last word of the sentences containing the target words were averaged for each experimental condition. There were 16 replications serving as the data for each condition involving narrative texts, and 8 replications serving as the data for the two Sentence conditions. There were 10 data points eliminated per subject corresponding to the target words which failed to meet the criteria established in the pilot studies, and those for which a target word occurred earlier in the text. The results for the word reading times on the last words are presented in Table 3. Word reading times on the last words for the Sentence condition were analyzed separately, since it was felt that the reading material was qualitatively different (i.e., unrelated sentences as opposed to prose) and that subjects might use a different reading strategy given the different type of comprehension test administered (i.e., tapping memory for the sentence as opposed to memory for meaning).

Table 3

Mean Word Reading Times (ms) on Last Words as a Function of Word Probability and Type of Text (Exp. 3).

| | Low Probability | | High Probability | |
|---|---|---|---|---|
| Constrained | 1479 | (496) | 1526 | (486) |
| Neutral | 1853 | (707) | 1751 | (1142) |
| Sentence | 2277 | (865) | 2217 | (879) |

Note. Values in parentheses indicate the standard deviation.

For the prose texts, a 2 x 2 (Word probability x Context) repeated measures ANOVA was performed on these means, and a main effect of Context was obtained, $F(1.31) = 4.56$, $p < .05$. Word reading times were faster in the Constrained condition (1503 ms) compared to the Neutral condition (1802 ms). No other significant effects were found.

For the Sentence condition, a t-test yielded no significant difference between the last words in the High-probability (M = 2217 ms) and Low-probability (M = 2277 ms) word conditions, $t(31) = 0.48$, $p = .62$.

## Discussion

Larger overall word reading times for Experiment 3 indicates that presenting the text backwards did make reading more difficult and rendered bottom-up processing less efficient. The finding of contextual facilitation for the processing of Low-probability target words in the Constrained condition suggests that readers were able to make use of the conceptual constraints in these texts to compensate for inefficient bottom-up processing.

The fact that contextual facilitation occurred during fixation of the target words suggests that context may have influenced word identification as well as word interpretation. A significant sentence wrap-up effect indicates that the usual integrative processes did occur at

sentence wrap-up, so contextual influences on the target word were not due to those integrative processes occurring prior to the end of the sentence.

As was the case in Experiment 1, there was no difference between word reading times for the High-probability target words and the Low-probability target words in the Constrained condition. The Low-probability target words in the Neutral condition, however, showed significantly slower reading times than Low-probability target words in the Constrained condition and High-probability target words in the Neutral condition. This would imply that low-probability words were processed more slowly than high-probability words, and the effects of conceptual context was to increase the efficiency of processing low-probability words in order to complete this processing in the same amount of time required to process high-probability words. This was also reflected in a main effect of word probability, High-probability target words having faster reading times than Low-probability target words. Faster reading times for the High-probability target words relative to the Low-probability target words was also evident in the Sentence condition.

There was a main effect of conceptual context for the last words of the sentences containing the target word. Word reading times for the last words in the Constrained condition were significantly faster than in the Neutral

condition. This likely reflects the fact that the sentence in which the target word occurs is constrained by the previous text, much more so than in the Neutral condition in which the sentence containing the target word is unrelated in terms of informational content to what has occurred in the text up to that point. In other words, the sentence containing the target word is new information which is expected in the Constrained texts, whereas it is simply new information in the Neutral texts, and this difference is reflected in more rapid sentence integration for the expected sentences.

## General Discussion

It is clear from the present research that reading prose passages is different from reading unrelated sentences. Reading times for the last words in the sentences containing the target words were faster for the prose passages relative to the unrelated sentences. The mean difference was of a magnitude of 685 ms, averaged across all three experiments. This difference does suggest there is a global or general effect of conceptual context which makes the sentences containing the target words easier to process in prose than in isolation.

There is also a specific effect of conceptual context which facilitates the integration of expected words into the conceptual framework provided by the text. The present

research helps to clarify this specific effect, and builds on existing models of context effects in reading by providing information about processes which occur beyond the lexical access stage. It also examines the role of conceptual context in situations where reading is made more difficult and bottom-up processing is rendered less efficient.

In Experiment 1, it was found that conceptual context led to faster reading times for target words which had a low probability of occurrence given a sentence context but which were highly expected given the prior text, relative to a Neutral condition, in which the text did not constrain these words. The effects of conceptual context translated into a 104 ms advantage in processing the low-probability target words constrained by the texts. Conceptual context had no effect on the reading times of words which were highly constrained by a sentence context but which were not constrained by the overall text. In fact, there was a trend towards slower reading times for these target words in the Context condition relative to the Neutral condition. Although the trend is not statistically significant (target words were read more slowly by an average of 27 ms), it was expected that this difference might occur. This is because the Context texts constrained only those target words which had a low probability of occurrence in the sentence. In some cases, the high probability words were quite surprising

given the conceptual context of the passage as a whole.

In Experiment 2, all sentences containing the target words were extended by three words, so the target word no longer occupied the last position in the sentence. This was done to determine whether the effects of conceptual context occurred as the word was being read, or whether conceptual context influenced higher-level integrative processes such as sentence wrap-up. Results clearly showed that conceptual context did not influence processes such as word identification. Word reading times on target words were not influenced by conceptual context or by their probability of occurrence given the sentence context.

Word reading times on the last words of the sentences containing the target words, however, did show contextual effects. Conceptual context led to faster reading times for the last words of those sentences containing target words which had a low probability of occurrence given the sentence context, but which were highly expected given the prior text, relative to a Neutral condition in which the text did not constrain these words. The effects of conceptual context in Experiment 2 translated into a 184 ms advantage in processing the last words. Conceptual context had no effect on the reading times of the last words of those sentences containing target words which had a high probability of occurrence given the sentence context but which were not constrained by the overall text. The trend

was towards slower reading times for these words in the Context condition relative to the Neutral condition, which was likely a reflection of the fact that some high-probability target words were surprising given the conceptual context. The overall longer word reading times for the last words of the sentences in Experiment 2 relative to the last words of the sentences in Experiment 1 (i.e., mean difference of 219 ms) may be a reflection of the increased sentence length in Experiment 2 which would require more integration time at sentence wrap-up.

The results of Experiment 2 showed that the influence of conceptual context was not evident at the word identification level, but rather at the level of sentence integration. Word identification seemed to occur rapidly, free from the effects of prior knowledge. Conceptual context seemed to facilitate the interpretation of an expected word by facilitating its integration with other concepts that had appeared earlier in the text. Hence, the effects of conceptual context on the processing of the target word were noticeable only at sentence wrap-up, at which point higher-level integrative processes were occurring.

In Experiment 3, having the subjects read the text backwards increased overall word reading times for the prose passages by an average of 955 ms for the target words and 800 ms for the last words, relative to word reading times in

Experiment 2. Hence, backward reading did decrease the efficiency of both word identification and word interpretation. Given this situation, results indicated that readers were able to use the conceptual context to compensate for inefficient bottom-up processing.

For the target words, conceptual context led to faster reading times for those words which had a low probability of occurrence given the sentence context but which were highly expected given the prior text, relative to the Neutral condition, in which the text did not constrain these words. The effects of conceptual context translated into a 310 ms advantage in processing target words constrained by the texts. Conceptual context had no effect on the reading times of target words which were highly constrained by the sentence context but which were not constrained by the overall text. The trend was towards slower reading times for these target words in the Context condition relative to the Neutral condition. As has been mentioned previously, the most likely explanation for this is the fact that some high-probability words were surprising given the conceptual context, and this may have slowed down reading. However, this difference was not statistically significant.

An examination of word reading times for the last words of the sentences containing the target words yielded only a main effect of context. Words in the Context condition showed faster word reading times than words in the Neutral

condition (mean difference of 299 ms). This may indicate that it was easier to integrate the target words with the texts in the Context condition relative to the Neutral condition, regardless of whether the word was expected. This may be a reflection of greater redundancy in the texts in the Context condition. On the whole, these texts did have a greater cohesiveness since they lead to the expectation of both sentences containing the target words. These sentences therefore consisted of redundant information as well as new information, making integration of both these sentences relatively easy. In contrast, texts in the Neutral condition were designed not to lead to expectations of the target words. As a result, the two sentences in which the target words appear tend to be unrelated to the previous text to the extent that they provide largely new information to the reader. Hence, a sentence which provides redundant as well as new information would be easier to integrate with previous text than a sentence which provides largely new information. This could explain the faster word reading times in the Context condition for the last words, which reflects integrative processes.

## Implications for Current Models of Context Effects in Reading

The results of these experiments lend support to models of reading which view word identification in the normal

reading situation as largely determined by bottom-up processes which are informationally encapsulated and hence impervious to top-down influences (Rayner & Pollatsek, 1989; Stanovich, 1991). Most of these models state that once lexical access has occurred, a pointer to the meaning of a word is deposited into working memory. According to a model proposed by Just and Carpenter (1980, 1987), this pointer is linked to a more complete representation of the word's meaning in the form of a semantic network stored in long-term memory. The nodes of this network refer to the different meanings the word may have, its orthographic and syntactic properties, as well as the different contexts in which the word is likely to occur. These nodes are described as a set of productions, condition-action rules that come into play to determine relations among the words in a clause, and then to integrate clauses in a meaningful way. At the end of a sentence, processing time is spent integrating the different parts of a sentence, then integrating the sentence with previous information acquired from the text or with knowledge retrieved from long-term memory. The present research suggests that under situations approximating normal reading conditions, conceptual context seems to exert its influence on the integrative processes which occur at the end of a sentence.

Results from the present research can add to the existing body of knowledge regarding context effects in

reading, much of which has been based on the results of single-word priming studies and sentence context experiments (Neely, 1977; Fischler & Bloom, 1979; Neely, Keefe, & Ross, 1989; Stanovich & West, 1983). One must keep in mind that these experiments have manipulated and studied the effects of linguistic context on reading, which refers to the influence that a reader's prior knowledge has on the expectancy of regularities in orthographic, lexical, syntactic, and semantic information as the text is being read (Shebilske & Fisher, 1983). They could not, obviously, have examined influences from concepts presented earlier in a text. Even sentence wrap-up effects in single sentence studies would not provide information about the integration of the words in the current sentence to concepts presented earlier in the text, since each sentence is unrelated to the next.

Several researchers have argued that because conceptual context is absent from single-word and single sentence experiments, the obtained results cannot be easily generalized to normal reading situations (Gough, 1983; Stanovich & West, 1983), because of important differences in the reading situation, the readers' goals, and perhaps the readers' strategies, in comparison to natural reading situations. For example, in the lexical decision task, the reader's goal is the identification of a word. Once a string of letters has been identified as a viable word, the

task is completed, and there is no need for further processing. Hence, any effects of context on processing beyond this stage cannot be known using this procedure. Although these arguments have merit, it is worth noting that these studies have provided important and seemingly accurate information about some of the component processes involved in reading. For example, although findings of large context effects in single-word priming studies cannot be used to infer that these effects are present under normal reading situations, they do illustrate how context would be expected to influence reading if the reading conditions began to approximate these experimental conditions.

More importantly, research examining the component processes of reading have provided insight into the mechanisms by which these processes operate. For example, Neely (1977) was able to find evidence for both an automatic and an attentional mechanism underlying semantic priming effects which conformed to Posner and Snyder's (1975) distinction between these processes. Fischler and Bloom (1979), as well as Stanovich and West (1979, 1981, 1983), reported that automatic processes were heavily implicated in sentence context effects, and that findings of inhibition dominance seemed to have been an artifact of the lexical decision task. This led to the working assumption that sentence context effects resulted from automatic spreading-activation processes.

In the current research on conceptual context, all three experiments show statistically significant shorter word reading times for low-probability words given a particular sentence frame (but expected given the conceptual context) in the Constrained relative to the Neutral condition (this effect occurs for the last word in the sentence containing the low-probability word in Experiment 2). However, these experiments also showed no significant differences between high-probability words given a particular sentence frame (but not expected given the conceptual context) in the Constrained relative to the Neutral condition. This suggests that the effects of conceptual context produced facilitation of the reading of low-probability words in the Constrained condition with no corresponding inhibition of high-probability words in this condition. These findings are consistent with those reported by Stanovich and West (1983) for sentence context effects, and suggest that effects of conceptual context may also be attributable to automatic as opposed to attentional processes.

An apparently problematic finding in this respect is that the lack of a significant difference between high-probability words given a particular sentence frame (but not expected given the conceptual context) in the Constrained relative to the Neutral condition was also obtained for Experiment 3. If this finding does indeed suggest a lack of inhibition for high-probability target words in the

Constrained condition, implying that the effects of conceptual context are automatic as opposed to attentional, then the compensatory process postulated to be occurring as a result of inefficient bottom-up processing cannot be under the reader's strategic control.

In experiments examining the relationship between sentence context and stimulus quality, Stanovich and West (1983, Exps. 6,7,8) also found evidence of compensatory processing in which the data pattern displayed facilitation and inhibition when contrast reduction was used to degrade the target word (implying attentional processes were at work), but facilitation without inhibition when degradation was achieved by inserting asterisks between each letter of the target word (implying automatic processes were at work). Stanovich and West argued that a conscious expectancy strategy may be used only if readers are in doubt as to whether bottom-up processes can sufficiently specify the stimulus. Because contrast reduction slows the initial stages of encoding, executive processing systems may be alerted that extra resources are necessary. Since the asterisk manipulation may slow later stages of feature comparison and visual scanning, they may never leave the system in doubt as to whether the stimulus will be resolved, even though reading is slowed. Degradation of the texts in Experiment 3 by presenting them backwards is similar to the asterisk manipulation, since the letters themselves remain

quite clear and distinct. This implies that just as the effects of conceptual context in Experiments 1 and 2 seem to have the characteristics of an automatic process, the compensatory mechanism in Experiment 3 also seems to share these characteristics, and may not have been under the readers' strategic control, unless there are other reasons why inhibition of high-probability words in the Constrained condition would not have been expected to occur.

It is worth noting that inhibition effects typically associated with linguistic context, in which a sentence frame slows the recognition of a subsequently presented word, are obtained by using target words which do not preserve the overall meaning of the sentence (Schberth & Eimas, 1977; Fischler & Bloom, 1979, 1980). Although the high-probability words in the current experiments were often surprising in the Constrained condition, they were not incongruous with the sentence frames in which they appeared, and the sentences in turn were not anomalous with respect to the preceding text. The fact that the high-probability words did not compromise the integrity of the sentences or paragraphs in which they occurred may have resulted in a lower likelihood that inhibition effects would be observed.

It is conceivable that compensatory processing in Experiment 3 may have been possible without corresponding inhibition of high-probability words in the Constrained condition if the readers were using the sentence frames to

more easily process the high-probability words. The fact that the conceptual context provided by the paragraph did not lead to the expectation of the high-probability words in the Constrained condition would not have prevented readers from using contextual cues provided by the sentence frames. In fact, Schwanenflugel and White (1991) have shown that the contextual effects of local information provided by a sentence frame do not disappear even when contradicted by paragraph information.

In the Neutral condition, readers were not provided with information in the paragraph to facilitate the processing of the low-probability words, but they could still use contextual cues provided by the sentence frames to more easily process the high-probability words, leading to word reading times which were not significantly different from those in the Constrained condition. In Experiment 3, subjects had to work harder to identify the words which were presented backwards, and conceptual context seemed to facilitate the identification of the target words.

Another problematic finding in the current research was that the high-probability target words given a particular sentence frame were not read significantly faster than the low-probability target words in either the Neutral or the Unrelated Sentences condition in Experiment 2, whereas such a difference was obtained in Experiment 1. The finding of such a difference would certainly be consistent with Bloom

and Fischler's (1980) completion norms, and would suggest contextual facilitation resulting from the sentence frames. In fact, the Unrelated Sentences condition was specifically included in the design of these experiments in order to facilitate the replication of the findings from sentence context experiments reported by Fischler and Bloom (1979) and Stanovich and West (1983).

It is difficult to interpret the discrepancy between the findings for the Neutral and Unrelated Sentences conditions in Experiments 1 and 2. It is possible that the differences in Experiment 1 do reflect contextual effects of the sentence frames. Fischler and Bloom (1979) and Stanovich and West (1983) have provided evidence that sentence context effects have the characteristics of an automatic process, but it is possible there are multiple mechanisms at work to produce a context effect resulting from sentence frames.

Neely, Keefe, and Ross (1989) have shown that this seems to be true for semantic priming effects. They provided evidence that semantic priming in the lexical decision task is affected by both prelexical and postlexical processes. Prelexical processes involve generating an expectancy for a candidate set of target words that are likely to follow a prime. If the target word is a member of this expectancy set, lexical access is facilitated relative to a neutral condition that provides no semantic information. If the target word is not a member of this expectancy set, lexical

access is inhibited. The generation of this expectancy set is assumed to be under the reader's strategic control.

When the stimulus onset asynchrony (SOA) between the prime and target word is very short, readers will not have enough time to generate an expectancy set from the prime. Therefore, the semantic priming effects occurring at these short prime-target SOAs result from an automatic spreading-activation process that is not under the reader's strategic control. In this situation, readers check whether the target word is related or unrelated to its preceding prime, and this facilitates their lexical decision. This semantic matching is obviously a postlexical process.

Neely, Keefe, and Ross (1989) have also shown that the prelexical prime-generated expectancy is modulated by the relatedness proportion (i.e., the proportion of related word-prime/word-target trials), whereas the semantic matching process is modulated by the non-word ratio, which is the probability of a target's being a non-word, given that it is unrelated to the prime that precedes it.

The sentence context experiments reported by Fischler and Bloom (1979) and Stanovich and West (1983) have always involved target words occurring at the end of sentences. It is possible that the contextual effects of sentence frames may be dependent on the target word being the last word in the sentence. A context effect may occur as a result of a prelexical expectancy mechanism facilitating the

identification of the target word which in turn facilitates sentence wrap-up. In Experiment 2, since the last words of the sentences containing the target words were not themselves constrained by the sentence frames, more rapid wrap-up in the high-probability word condition may not have been triggered. It is also possible that because sentence integration was not occurring during fixation of the target words, the effects of the sentence frames on the processing of the target words may have been attenuated. Admittedly, little is known about the likelihood that multiple mechanisms are responsible for sentence context effects. It is also possible that the significant differences between high- and low-probability target words obtained in Experiment 1 for the Neutral and Unrelated Sentence conditions may not reflect sentence context effects. It is likely, however, that such effects would be as complex as those operating to produce semantic priming.

As a conclusion, the present research suggests that conceptual context plays an important role in skilled reading in a situation approximating natural reading conditions. Conceptual context has a general effect on reading, which results in faster processing of sentences in prose text relative to sentences in isolation, as well as a specific effect, which facilitates the integration of expected words into the conceptual framework provided by the text. The effects of conceptual context occur at sentence

wrap-up and involve more rapid sentence integration. The effects of conceptual context are therefore postlexical in origin, and they have the characteristics of an automatic as opposed to an attentional process. Furthermore, the influence of conceptual context can penetrate the word identification module in order to facilitate word identification when bottom-up processing becomes inefficient, a process which does not seem to be under a reader's strategic control.

Future research may investigate more closely the locus of sentence context effects to determine their dependence on sentence wrap-up. This may help clarify the discrepant results obtained in Experiments 1 and 2 with respect to the difference between the high- and low-probability word conditions in the Neutral and Unrelated Sentences conditions. Also, further study of compensatory processing might compare text degradation such as contrast reduction which slows the initial stages of encoding, with backward reading which slows later stages, and see whether there is evidence that compensatory processing can operate under strategic control. With respect to compensatory processing, it would also be interesting to compare skilled and less skilled readers to investigate the activation of compensatory processing and whether it operates differentially as an automatic or attentional process in these groups.

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# Appendix 1

## Experimental Texts

The 40 experimental texts are presented on the following pages. There were six versions of each text: (1) Neutral, High-probability, (2) Neutral, Low-probability, (3) Constrained, High-probability, (4) Constrained, Low-probability, (5) Sentence, High-probability, and (6) Sentence, Low-probability. Because only the target words differ in the High-probability vs. Low-probability texts, these texts are only printed once, with the High-probability target word appearing in boldface followed by the Low-probability target word (e.g., **noise/crash**).

The texts are printed as they appeared in Experiments 2 and 3, with the target appearing prior to the end of the sentence. In Experiment 1, the texts differed only in that the three words following the target words did not appear. The target words were the last words of the sentence.

The seven target words which did not meet the probability criteria in the pilot studies were raise/bonus in text number 4, think/talk in text number 10, mother/bottle in text number 13, plate/vest in text number 16, letter/song in text number 22, signs/letters in text number 23, and help/him in text number 34. The three target words which occurred earlier in the text were "work" in text number 8, "time" in text number 22, and "looked" in text 37. The data for these ten words were not included in the analyses.

## Text No. 1

### Neutral Condition

The four friends loved dangerous water sports. Yesterday they canoed down the rapids. Today they set out in their boat. They had brought sandwiches. They could practically live on peanut butter and banana sandwiches. They were startled by the sudden **noise/crash** as they stopped. It seemed to be coming from the far bank. They did not bother to investigate but concentrated on finishing their lunch instead. They spent the afternoon on the water. The boat passed easily under the **bridge/house** with no trouble. Then the boys went home. They would get together again next weekend.

### Constrained Condition

The four friends loved dangerous water sports. Yesterday they canoed down the rapids. Today they set out in their boat. The wind was very strong. In their zeal, they did not notice the boulder until they rammed into it. They were startled by the sudden **noise/crash** as they stopped. Mr. Martin had built his home on the water. At low tide, you could steer a boat clear underneath the structure if you were careful. Here was a challenge worth her trying. The boat passed easily under the **bridge/house** with no trouble. Then the boys went home. This was enough excitement for one weekend.

### Sentence Condition

Stella searched everywhere but could not find the diamond ring. There isn't anything good on television tonight. The hungry bear found some stale bread. Don't touch the wet paint. Three people were killed in a major highway accident. The were startled by the sudden **noise/crash** as they stopped. The soldier complained that his portion was too small. George had been fired, but he couldn't tell his wife. Billy hit his sister on the head. The boat passed easily under the **bridge/house** with no trouble. The little boy searched for his parents everywhere. Susan wanted to disguise herself for the party.

## Text No. 2

### Neutral Condition

It was a warm evening. Both John and Suzie were at a loss for words. They had a lot to talk about which made them both uncomfortable. Suzie had been accepted in graduate school in Vancouver. She was also convinced that she loved John very much. At night they often took a short **walk/swim** under the stars. Suzie tried to guess what John was thinking. She remembered how they had often discussed the future they would have together. The wind whistled through the branches. In the distance they heard the **thunder/screams** loud and clear. One of them would have to being talking. Suzie decided she would be the one.

### Constrained Condition

It was a warm evening. John and Suzie headed out towards the ocean. They had to be careful because sharks were common in this region. They both had their bathing suits underneath their clothes. It was almost midnight when they reached the edge of the sea. At night they often took a short **walk/swim** under the stars. Back on the shore, they listened to the waves. Over the waves came the sound of a person shouting for help. Someone was being attacked by a shark. In the distance they heard the **thunder/screams** loud and clear. They were completely helpless to do anything. It was a horrible experience.

### Sentence Condition

He could not find a job for the summer. The raccoon washed the apple before eating it. Mrs. Martin told the bad student to stand in the corner. We sprayed the yard to keep away the bugs. Jean hurriedly shoved her way through the crowd. At night they often took a short **walk/swim** under the stars. If the crowd quiets down the band will play. He went to the factory where the toys were made. He crept into the room without a sound. In the distance they heard the **thunder/screams** loud and clear. He wanted to work as a stunt man. Jane could hear the birds but could not see them.

## Text No. 3

### Neutral Condition

This would no doubt be bad day for Steve. Some people seem to be born just to make trouble. Steve always managed to do something that angered the people around him. It was difficult to know whether he was aware of this pattern. Trouble resulted even when his intentions seemed to be good. The bad boy was sent to his **room/home** right after lunch. But Steve would never change. His father worked as an accountant for an engineering firm. His mother worked at a department store. George could not believe his son stole a **car/watch** from another person. He had received a very nice one just a few months ago for his birthday. George decided he would have to punish him for what he did.

### Constrained Condition

This was going to be a bad day for Steve. The teacher seemed to be watching him all the time. He waited until he thought the teacher had her back turned to him. She watched him almost as closely as his mother did. The teacher caught Steve stealing from someone else's desk. The bad boy was sent to his **room/home** right after lunch. His father have him a spanking. His parents were upset at Steve for stealing a Timex at school. Their reaction was one of incredulity. George could not believe his son stole a **car/watch** from another person. From Steve's point of view he was mainly afraid of his mother's anger.

### Sentence Condition

She found life in the marines difficult but rewarding. Stan was always telling lies to his teacher. When the two met, one of them held out his hand. Seals can swim better then they can walk. The movers put the sofa on the bare floor. The bad boy was sent to his **room/home** right after lunch. The crime rate has gone up this year. The mole lived in a hole in the ground. The dispute was settled by a third party. George could not believe his son stole a **car/watch** from another person. Cindy looked forward to her ballet classes each week. No one could predict what he would do next.

## Text No. 4

### Neutral Condition

The court-appointed lawyer looked over his client's file briefly. The man was caught selling an illegal weapon. He worked at a glove factory, and was not a good worker. The pay was certainly not very good. He felt that he could supplement his income by engaging in criminal activity. His boss refused to give him a **raise/bonus** despite his complaints. He complained only a little, knowing he could make money on the side. He was a strong man and he was very tall, yet people tended to walk all over him. It was probably his willingness to please that attracted the wrong sort of people. The lawyer feared that his client was **guilty/crazy** given the facts. He would discuss the options with him tomorrow. This might not be an easy client work with.

### Constrained Condition

The court-appointed lawyer looked over the man who traded in arms. The man was caught selling an illegal weapon. He worked at a good company, where employees usually obtained rewards at Christmas. He knew a reward was out of the question. He approached his boss, complaining he could use some extra money like everybody else. His boos refused to give him a **raise/bonus** despite his complaints. He went completely mad, accusing everyone of turning against him. The lawyer learned that he had a history of paranoid thoughts which often led to violence. He wondered if he would be better off in a psychiatric hospital as opposed to jail. The lawyer feared that his client was **guilty/crazy** given the facts. He would discuss the options with him tomorrow. This might not be an easy client to work with.

### Sentence Condition

The veterinarian did not like that dog. Florida was their preferred vacation spot. Captain Sheir wanted to stay with the sinking ship. We sometimes forget that golf is just a game. His leaving home amazed all his friend. His boos refused to give him a **raise/bonus** despite his complaints. Next year my little son will be going to school. He was afraid to work the night shift. The girl knew a lot for her age. The lawyer feared that his client was **guilty/crazy** given the facts. John ate the entire cake within twenty minutes. The old television set would not work properly.

## Text No. 5

### Neutral Condition

Everyone in town seemed to have a healthy respect for Matt. Matt was a farmer's son who was well educated. He had obtained a degree in agricultural science. At present he was helping his father on the farm. He was better trained to handle all of the new machinery. No one wanted to accuse him of **stealing/cheating** at this time. Anyone who did that would be in a lot of trouble. The town was small and generally peaceful. Everyone knew all about everything that went on. Matt was wild when he was **young/angry** and it showed. Yet the rest of his family were generally very restrained. His parents were well liked by everyone.

### Constrained Condition

Matt the gambler was a person you wouldn't want to meet. He was a foul-mouthed man with a lot of muscle. Most guys who played cards with him were afraid of him. They knew he was unfair but they didn't say a word. It was a little odd that Matt won ten games of poker in a row. No one wanted to accuse him of **stealing/cheating** at this time. Anyone who did that would end up in the hospital. When Matt go mad, he was extremely dangerous. Everyone knew what he could do under those circumstances. Matt was wild when he was **young/angry** and it showed. Eventually, everyone avoided him wherever he would go. A man like Matt does not have any friends.

### Sentence Condition

The poet had not written anything in over a year. She stood to lose a lost of money with that investment. Brian poured some sauce on his rare steak. The pits wallowed in the mud. Her job was easy most of the time. No one wanted to accuse him of **stealing/cheating** at this time. He shouted at the top of his lungs. The sun had turned his hair blond. She was named after her mother. Matt was wild when he was **young/angry** and it showed. The horses were beautiful as they galloped down the meadow. The astronomer peered into the telescope.

## Text No. 6

### Neutral Condition

Dan was an intern in a large city hospital. Every day he would take time out at lunch to play ball with other interns. The rest of the time was spent on different surgical rounds. The internship program was tough and the work load was heavy. Playing ball was a way to get away from the pressure. Playing ball was a way his **hands/teeth** but nearly fell. They would have just enough time to grab something to eat in the cafeteria. Dan decided on a ham and cheese sandwich. He brought the sandwich and a cup of tea to his office. The cup of tea felt very **warm/cold** in his hands. He was due in surgery in forty minutes. Dan though he was finally beginning to enjoy the hospital routine.

### Constrained Condition

Dan was an intern in a large city hospital. Every day he would take time out at lunch to play ball with other interns. They played for about half an hour in the hospital parking lot. Dan could do a neat trick with the ball that amazed everyone. He braced himself and opened his mouth wide. Dan caught the ball with his **hands/teeth** but nearly fell. He always joked that the ball tasted as good as the food in the cafeteria. Nothing was every hot in the hospital cafeteria. He grabbed a tray and a cup of tea. The cup of tea felt very **warm/cold** in his hands. The food was so bad nobody wanted to eat it. That's why they spent so much time outside playing ball.

### Sentence Condition

Nothing he could say would change things between them. Butterflies are easy to catch with a net. The fertilizer enriched the soil. The mail should get here soon. Pete won the cross-country race. Dan caught the ball with his **hands/teeth** but nearly fell. You'll never achieve anything if you don't try. The ship disappeared into the thick fog. She called her husband at his office. The cup of tea felt very **warm/cold** in his hands. There was no time to go to the beach. Andrew could not figure out how to solve the math problem.

Text No. 7

Neutral Condition

There wasn't much left to do before he went to bed. John poured himself a glass of wine. He was an agent for a few aspiring writers of general fiction. There were a lot of such people. He glanced at Vic's most recent manuscript. None of his books made any **sense/money** as it was. It was a good thing for Vic that his wife had a decent job. She worked very hard to make a living for both of them so they could enjoy some comfort. As soon as she got home, she would always give Vic a great big hug. Vic asked her to repeat what she had **said/heard** one more time. Apparently, some critic thought he was a promising writer. He was too depressed to feel good about the remark.

Constrained Condition

There wasn't much booze left in the liquor cabinet. John poured himself a glass of wine. As Vic's agent, he would have to tell him the bad news. Vic stood to lose a lot of cash with this contract. His recent book was not selling very well. None of his books made any **sense/money** as it was. It was a good thing for Vic that his wife had a decent job. She came back from work telling Vic she had been listening to the radio and noticed his name. This piqued his curiosity, since he knew his books were not very popular. Vic asked her to repeat what she had **said/heard** one more time. Apparently, some critic thought he was a promising writer. He was too depressed to feel good about the remark.

Sentence Condition

All the children wanted to go to the zoo. We took a tour of the city by helicopter. During the volley, Joe twisted his ankle. The front was clearly marked on the weather map. David's shirt was made of cotton. None of his books made any **sense/money** as it was. Phil put some drops in his eyes. Jill decided against the car when she learned the price. The student went home during the break. Vic asked her to repeat what she had **said/heard** one more time. The old car broke down on the way to the country fair. Sandra felt she could not win the competition.

## Text No. 8

### Neutral Condition

Ted's hobby since the time when he was in grade school was collecting butterflies. He had become an expert on butterflies. His collection included all of the butterflies found near his home. However, he did not have any rare specimens worth thousands of dollars. He would often go on camping trips looking for different species. Too many men are out of **work/shape** in these times. Ted was a person who devoted all his spare time to his hobby. The kids were quick to call him the butterfly man. We were surprised when Ted participated in the annual marathon. For a runner, Ted is rather **slow/fat** compared to others. Everyone took their places and the race was off. Poor Ted never made it to the finish line.

### Constrained Condition

We were surprised when Ted announced he was competing in a long-distance race. Ted is not the most athletic person around. Like many middle-aged workaholics, he has little time for exercise. It's hard to keep fit when you work all day behind a desk. For this reason, we were glad that Ted was in the race. Too many men are out of **work/shape** in these times. When the trumpet sounded, the runners stepped out on the track. Ted was far larger than any of the other runners. He looked out of breath although the race had not yet started. For a runner, Ted is rather **slow/fat** compared to others. They took their places and the race was off. Poor Ted never made it to the finish line.

### Sentence Condition

There was a steady breeze blowing through the cemetery. John took his sister to the show. They asked Dave to play tennis, but he was too tired. Sharon dried the bowls with a towel. He disappeared last year, and has not been seen. Too many men are out of **work/shape** in these times. Jack bet all he had on the last race. Starting a business takes a lot of money. Getting the shot didn't really hurt. For a runner, Ted is rather **slow/fat** compared to others. Gertie took the last piece of pie. Those kids watch five hours of television each day.

## Text No. 9

### Neutral Condition

She came into the kitchen to get the newspaper and saw her youngest daughter. Pam couldn't tell what she was eating. It was probably cereal and milk, which meant she would make a great big mess. She went over and kissed her. After checking that everything was all right, she went upstairs to her room. Pam did not have any clothes to **wear/wash** in the house. This was good because it meant she could concentrate on other things. She had a lot to do before Tom got home. She would resume work on the elegant dress she was making for herself. Her new shoes were the wrong **size/color** purely and simply. She would have to get them exchanged since they did not match the dress. She was able to exchange them before the day was done.

### Constrained Condition

She came into the kitchen and saw her daughter putting something in her mouth. Pam couldn't tell what she was eating. It was probably cereal, which meant she would certainly get it all over her clothes. Today was cleaning day. Pam went from room to room looking for dirty clothes, but couldn't find any. Pam did not have any clothes to **wear/wash** in the house. That afternoon, she went out to buy shoes to match her new dress. When she got home, she realized the shoes did not match her dress. She made up her mind too quickly. Her new shoes were the wrong **size/color** purely and simply. Yet in the department store light, they had looked fine. She was able to exchange them before the day was done.

### Sentence Condition

Her favourite subject was mathematics. Jim thought he saw a figure moving beyond the trees. At each table, I had to fill in another form. Don't believe everything you hear. At the track, the handicapper gave me a valuable tip. Pam did not have any clothes to **wear/wash** in the house. The cows moved from the sun in to the shade. The sun is just another star. Fred put the worm on a hook. Her new shoes were the wrong **size/color** purely and simply. Never did Joan feel so humiliated in all her life. The pilot brought the damaged airplane to a safe landing.

## Text No. 10

### Neutral Condition

Stanley had not really wanted to come to this party at all. He generally made it a point not to attend parties. He was not very skilled in social situations. The atmosphere made him nervous and uncomfortable. He stepped into the largest room where some people had begun to dance. The set was so loud he couldn't hear himself **think/talk** with this noise. He quickly found a room which was not so noisy. He finished his drink and decided it was time for him to leave. He began to make his way slowly to the front hall. When the power went out, the house became **dark/quiet** in an instant. Everyone was taken by surprise. Stanley could not find his coat.

### Constrained Condition

Stanley often thought his son John was a pain in the neck. He complained mostly about his television habits. John always put the television set on full blast. It seemed that any kind of noise disturbed him. Stanley was trying to explain binary numbers to his youngest daughter. The set was so loud he couldn't hear himself **think/talk** with this noise. Then, Stanley heard a tremendous clap of thunder. Everything suddenly became peaceful, then more thunder was heard. Abruptly, the television stopped playing altogether. When the power went out, the house became **dark/quiet** in an instant. Stanley could finally relax. He didn't mind the thunder at all.

### Sentence Condition

He could not play a single musical instrument. Phil and Brenda raised horses on their ranch. Dick wrote a chapter in the book. A future energy source is the sun. Our dog chased our cat up the tree. The set was so loud he couldn't hear himself **think/talk** with this noise. They wanted their parents to come home. Mary couldn't leave the parlour until her hair was dry. Her dress was made of very fine silk. When the power went out, the house became **dark/quiet** in an instant. The old man could not remember where he lived. The squirrels had made their nest in the attic.

## Text No. 11

### Neutral Condition

Ellen turned off the television set and put the potato chips away. It was after midnight and she had to get up early to go to work. In the past week, she had been going to bed at unreasonable hours. Because of this, she had always felt tired during the afternoons. She decided a warm glass of milk might help her get to sleep. She dropped the glass and woke up the **baby/cat** with the noise. Her husband George came down to the kitchen to see if she was all right. She picked up the broken pieces. Whiskers came into the room to check if there was any food in his dish. George must keep his pet on a **leash/diet** for his protection. It was two o'clock by the time Ellen got to bed. But she could not fall asleep.

### Constrained Condition

Whiskers would purr whenever Ellen stroked the underside of his chin. She left him lying on a pillow on a basket and turned off the lights. She went to the kitchen to get a glass of coke and a bowl of chips. she would watch television in her room before going to bed. She tiptoed in the darkness where Whiskers was sleeping. She dropped the glass and woke up the **baby/cat** with the noise. The next day, George took Whiskers to the vet while Ellen went to work. The vet examined the cat thoroughly. He told George that Whiskers should only eat certain foods from now on. George must keep his pet on a **leash/diet** for his protection. Ellen would have to stop feeding him table scraps. Whiskers was getting old.

### Sentence Condition

There was no coffee left in the machine. Susan was the best tennis player in the group. The kids fed the ducks some stale bread. Not even the cast liked the play. Some people have never had a square meal. She dropped the glass and woke up the **baby/cat** with the noise. The choir sang hymns while the people listened. The earth is shaped like a ball. In the park the hippie touched the flower. George must keep his pet on a **leash/diet** for his protection. He thought the woman was a shoplifter. Tina wanted to borrow the car for the weekend.

## Text No. 12

### Neutral Condition

It was a fine day and the weather was nice. All the guests had a very good dinner. There were several entrées followed by lamb chops with apple sauce. For dessert everyone had a small piece of cake. The club was just the right place for the townspeople to gather. The whole town came to hear their mayor **speak/sing** to the crowd. Everyone was talking loudly as they waited for him. When the major arrived, everyone began to clap furiously. It took a while before the noise stopped. He smiled and sat down at the **table/piano** with a grin. He sang about ten songs that night. He also managed to increase his popularity with the townspeople.

### Constrained Condition

The food tasted better than usual that day. All the guests had a very good dinner. The club was filled to capacity since the mayor would make an appearance. There were rumours he would perform several songs. The mayor wanted to get to know many of the townspeople better. The whole town came to hear their mayor **speak/sing** to the crowd. Everyone was talking loudly when the mayor appeared on stage. He walked over to the keyboard and tried out a few notes. Everyone in the room began clapping. He smiled and sat down at the **table/piano** with a grin. He sang about ten songs that night. He also managed to increase his popularity with the townspeople.

### Sentence Condition

He failed almost all his classes in high school. The tall woman waved at him from across the room. The pill contained a powerful drug. Few nations are now ruled by a king. The loaf was eaten except for a small piece. The whole town came to hear their mayor **speak/sing** to the crowd. Jill looked back through the open door. The hunter shot and killed a large deer. The birds in the yard ate every last crumb. He smiled and sat down at the **table/piano** with a grin. The large dog barked at everyone in sight. Barry wanted to computer for a his birthday.

## Text No. 13

### Neutral Condition

Nancy came into the kitchen and turned on the television. She heated a prepared dinner in the microwave oven. She was too exhausted to do anything else. She was under a tremendous amount of stress at work. She looked forward to the coming weekend. The baby cried and upset her **mother/bottle** then and there. Nancy wondered whether she should quit her job in order to look after Suzie. Her husband had a very decent salary. Their dog Rover came into the room. The puppy chewed on the **bone/rug** with obvious glee. Nancy let him out in the back yard. Staying home would eliminate the stress she felt.

### Constrained Condition

Nancy placed the baby in the high chair despite her protests. She was rapidly losing patience with her. Nancy gave her some milk to keep her quiet. It seemed that nothing would calm her at this point. Suzie lashed out at the milk in anger. The baby cried and upset her **mother/bottle** then and there. Nancy cleaned it up and shooed puppy away, who plopped himself down on the carpet. It was old and a bit frayed. He took a corner in his mouth and pulled. The puppy chewed on the **bone/rug** with obvious glee. Nancy finally put him outside. He was as bad as Suzie.

### Sentence Condition

The fortune teller was beginning to lose her powers. The billionaire bought a Lotus for his son. To find the body, they had to drain the lake. A direct attack failed, so they changed the strategy. They went as far as they could. The baby cried and upset her **mother/bottle** then and there. On their visit to England, they took a formal tour. He was miles off the main road. He used to get company every night. The puppy chewed on the **bone/rug** with obvious glee. Randy wanted to join a baseball club. Ted was aware that his business was losing money.

## Text No. 14

### Neutral Condition

Corinne and Jenny were best friends. As soon as the holidays started, they left together in Jenny's car. Corinne's parents had a cottage in the country. They would spend the week there. Jenny parked the car and they headed for the front door. As soon as they go in they turned on the **light/heat** in the house. They quickly checked to see if everything was in order. Jenny went on the back porch and disappeared. The porch had been heavily damaged and Jenny had fallen. The thick mud stuck to her **shoes/face** and she scowled. They concluded that someone must have deliberately damaged the porch. Corinne's parents would not be very happy.

### Constrained Condition

Corinne stepped on the gas. Both she and Jenny were cold because there was no heater in the car. But Corinne was to blame. She should have gotten the system fixed before winter arrived. They were freezing by the time they got home. As soon as they got in they turned on the **lights/heat** in the house. They had but two hours to put the make-up on. The cream was thick but would not give them the colour they wanted. Jenny looked at herself in the mirror. The thick mud stuck to her **shoes/face** and she scowled. She took her shoes off and sat back in the chair. She had another hour to wait.

### Sentence Condition

She did not wish to accompany him on his camping trip. The pilot was forced to make an emergency landing. I thought the sermon was very good. Bob thought she had such a friendly smile. They left the dirty dishes in the sink. As soon as they got in they turned on the **lights/heat** in the house. Without food a man would die in several days. Plants will not grow in dry soil. Jim had learned the special passage by heart. The thick mud stuck to her **shoes/face** and she scowled. His most enjoyable pastime was gardening. Nancy was lead guitarist in the school rock band.

## Text No. 15

### Neutral Condition

Ellen had a good job and a high salary. She lived alone in a plush condominium. She worked downtown in a large engineering firm. She had recently been promoted to head of the accounting department. After work, she liked to go out to Curly Joe's to eat. Ellen liked to season her food with **salt/garlic** all the time. She often found the evenings very long. Her life was a rather lonely one. One of her long-time friends had given her a dog as a gift. A dog has a good sense of **smell/hearing** and uses it. But Ellen did not keep him very long. She couldn't bear to have the dog locked up in her apartment alone for most of the week.

### Constrained Condition

Ellen did not like social gatherings. She was not a very talkative person. In general, many people tried to avoid her. They would try to stand as far away from her as possible. Everyone complained about Ellen's bad breath, but she didn't care. Ellen liked to season her food with **salt/garlic** all the time. She had a poodle she called Tutu. His ears were very sharp. All she had to do to call Tutu was click her tongue. A dog has a good sense of **smell/hearing** and uses it. Tutu was certainly no exception. Ellen liked her little poodle much more than she liked most of her friends.

### Sentence Condition

Lucy had a voracious appetite for such a skinny girl. He easily beat the rival team and won the tournament. The fire was small, and there was no reason to worry. Most cats see very well at night. Wally wanted to buy a beer, but he was too young. Ellen liked to season her food with **salt/garlic** all the time. Their money was divided by the bank. The elderly sometimes lose their mind. The child went ever higher on the swing. A dog was a good sense of **smell/hearing** and uses it. He very strongly believed in extrasensory perception. Laura decided she could not choose between the two of them.

## Text No. 16

### Neutral Condition

It was a clear evening and the weather was mild for March. My uncle gave my mother a big rose. Once seated at the table, it took a long time before the waiter took our order. There were lots of things to talk about since my uncle had been away for so long. My mother had missed him. He scraped the cold food from his **plate/clothes** as he spoke. His eating habits had always been quite sloppy and in a way this showed us he hadn't changed. He was the same jovial man that I remembered as a child. We had a good meal. The rude waiter was not given a **tip/chance** but a scolding. We then went to see a movie that had just been released. My uncle would come to visit often.

### Constrained Condition

My uncle was obviously hiding a flower behind his back. My uncle gave my mother a big rose. Once seated at the table, it took a long time before the waiter took our order. When he brought the food, the waiter spilled the coleslaw on my uncle's waistcoat and pants. My uncle was furious. He scraped the cold food from his **plate/clothes** as he spoke. The restaurant manager came to apologize since many people had complained about this waiter. There was no way the restaurant would keep him on. He was fired instantly. The rude waiter was not given a **tip/chance** but a scolding. Despite this mishap, the rest of the evening went well. We went to see a movie after dinner.

### Sentence Condition

We counted twelve birds perched on the telephone wire. It took him a whole day to clean up his room. The car stalled because the engine failed to start. The ruby was so big, it looked like a rock. Sometimes success is simply a matter of luck. He scraped the cold food from his **plate/clothes** as he spoke. His view was blocked by the music stand. Coming in he took off his coat. He drove the nail into the wood. The rude waiter was not given a **tip/chance** but a scolding. It was supposed to rain all weekend. The little girl tried to imitate the dancer.

## Text No. 17

### Neutral Condition

Old Mrs. McKenzie often thought about her husband. He had recently died of lung cancer. Sometimes she could not believe he was dead. She found these thoughts very painful. She remembered what her husband would tell her over and over again. When you go to bed turn off the **lights/radio** to sleep soundly. She found the house too big without him. Perhaps she should move. But it was getting rather late in the year. Autumn is a good time to buy some new **clothes/tires** at the store. Everybody liked Mrs. McKenzie. She seemed cheerful and was always polite to everyone.

### Constrained Condition

Old Mrs. McKenzie lived alone in the big house. Her husband had recently died of cancer. Now she would spend her time listening to her favourite station. She had a habit of keeping the music on throughout the night. She remembered what her husband would tell her over and over again. When you go to bed turn off the **lights/radio** to sleep soundly. It was getting cold in the evenings. Summer was coming to an end. She would have to check the wheels of her car. Autumn is a good time to buy some new **clothes/tires** at the store. Everybody liked Mrs. McKenzie. She seemed cheerful and was always polite to everyone.

### Sentence Condition

The nurse was very gentle in caring for the sick child. Nick could not get the printer to work with his computer. My sister bought tickets for the opening game. The death of his dog was a great shock. The young boy was granted a small allowance. When you go to bed turn off the **lights/radio** to sleep soundly. He put his feet up on the table. Ample food was made for the party. There's something grand about the opera. Autumn is a good time to buy some new **clothes/tires** at the store. Veronica insisted she could quit smoking any time. Fred was not at all interested in sports.

## Text No. 18

### Neutral Condition

The Adams only had one child. His name was Randy and they loved him very much. He was a bit shy around people but was well behaved. Mr. Adams worked in the Navy as a technician. This meant that he spent extended periods away from home. The child was born with a rare **disease/gift** which was evident. He grew to admire his father and sought to join the Navy. A strong bond was maintained between Randy and his father. They both got along very well. While skiing, Randy broke his **leg/arm** when he fell. He returned to live with his parents for a short time. They were both delighted to have him back.

### Constrained Condition

The Adams only had one child. His name was Randy and they loved him very much. He was somewhat of a celebrity in the neighbourhood. He was a child with a special talent for music. At six years of age, he could play the violin very well. The child was born with a rare **disease/gift** which was evident. He was supposed to play the violin at my sister's wedding. However, he injured himself in an accident. I learned that he would not be able to play. While skiing, Randy broke his **leg/arm** when he fell. It was serious enough to prevent him from practising his music. Randy felt very bad about the whole situation.

### Sentence Condition

Jim never saw her again once she entered law school. The artist finished the sculpture in three days. The paper was too thick to cut. I don't know why he didn't take his coat. Seth couldn't imagine anyone less beautiful. The child was born with a rare **disease/gift** which was evident. Few had the nerve to take the needed shot. There was nothing wrong with the car. His ability to work was good. While skiing, Randy broke his **leg/arm** when he fell. He did not know what kind of a gift to buy her. The zoological gardens were closed for the winter.

Text No. 19

Neutral Condition

Rita was a young girl in her teens who had a lot of temper tantrums. The parents pleaded with their daughter to come down. She was very stubborn and showed no signs that she heard them at all. It was cold up here especially when the wind was blowing. She blew her long hair out of her eyes and looked down. John felt sorry but it was not his **fault/problem** in any way. This child had always been difficult to control. She had the same stubborn persistence that he had. He kept looking at his watch as the time passed. Rita slowly walked down the shaky **ladder/bridge** being very careful. She had had enough up there. She followed her parents home.

Constrained Condition

Rita peered at the water below and wanted to jump and end her life. The parents pleaded with their daughter to come down. As he drove by, John saw that the police had cleared the area. Then he saw a young girl holding on as tightly as she could. It was a delicate situation for the police to handle. John felt sorry but it was not his **fault/problem** in any way. A policeman was trying to get closer to Rita. She was holding on firmly to the unsteady railing as it creaked. Somehow he managed to talk her into coming down. Rita slowly walked down the shaky **ladder/bridge** being very careful. She was whisked into a police car. John continued on his way home.

Sentence Condition

Nancy was becoming tired of the same daily routine. A flock of Canada geese was headed south for the winter. Every spring they held the annual ball. The sail got loose, so they tightened the ropes. Ken built his new house on a quiet lake. John felt sorry but it was not his **fault/problem** in any way. Stan slowed down going around the corner. He was knocked off his board by the first wave. It was a long class and everyone was getting bored. Rita slowly walked down the shaky **ladder/bridge** being very careful. The farm animals became restless long before the hurricane started. John and Linda went to the amusement park together.

## Text No. 20

### Neutral Condition

Sharon wondered where Dale was. You could count on Dale on being late for dinner. He always had things to do at the last minute. She had gotten used to waiting for him. No matter what the occasion was, he was always late. Dale fell down and skinned his **knees/nose** in the process. That seemed a reasonable explanation for being late this time. Yet there would always be excuses. Tardiness was the one constant in Dale's life. Dale licked the bottom of the **bowl/stamp** which he held. He stuck it to the envelope. Even this card was sent a week late.

### Constrained Condition

Sharon waited impatiently for Dale. You could count on Dale on being late for dinner. When she saw him come in, she knew why. He must have injured himself at work. He had a band-aid stuck haphazardly between his two eyes. Dale fell down and skinned his **knees/nose** in the process. After dinner, Sharon and Dale wrote Christmas cards. They had about thirty cards to write. His job was the envelopes and hers the cards. Dale licked the bottom of the **bowl/stamp** which he held. It tasted horrible. He went to put water in a glass.

### Sentence Condition

The coast guard quickly caught up with the escaping speedboat. The chimpanzee is a very intelligent animal. Most students prefer to work during the day. Bob would often sleep during his lunch hour. Our new green car blocked the narrow driveway. Dale fell down and skinned his **knees/nose** in the process. To tune your car you need a special tool. I added my name to the list. You can't take the test without a pencil. Dale licked the bottom of the **bowl/stamp** which he held. They went to the shopping centre together. The tallest girl got the highest marks.

## Text No. 21

### Neutral Condition

There was a marble bust of Chopin in the living room. Lois threw a rock and broke the statue. That was sure to get her in a great deal of trouble. Lois was one of four children and the only girl. Her family had moved in the neighbourhood over twenty years ago. The old house will be torn **down/apart** if this continues. The family can no longer afford the upkeep. There is always something which breaks down. Almost everything needs to be repaired. Lois is taller than most **girls/boys** of her age. That gives her a tremendous advantage. Nobody ever makes fun of Lois.

### Constrained Condition

There was a marble bust of Chopin in the living room. Lois threw a rock and broke the statue. These children were getting impossible to control. They keep breaking things all the time. One can only guess what will happen if they continue. The old house will be torn **down/apart** if this continues. Lois is by far the naughtiest child. She's the biggest and heaviest of the children. Even the guys are afraid of her. Lois is taller than most **girls/boys** of her age. That gives her a tremendous advantage. Nobody ever makes fun of Lois.

### Sentence Condition

The park was closed that Sunday afternoon. Cathy and Jim wrestled for possession of the ball. Most shark attacks occur very close to shore. Diane slowly sank into the hot tub. The gas station is about two miles down the road. The old house will be torn **down/apart** if this continues. The pamphlet was missing its cover. Did you want to go to the movies? Jim hit his horse with a whip. Lois is taller than most **girls/boys** of her age. No one could blame Marge for abandoning him. Everyone crowded around the celebrity.

Text No. 22

Neutral Condition

Hal was a successful popular singer, and he had numerous fans. It was not uncommon for him to receive a hundred letters in one week. Of course, Hal did not have the energy nor the desire to read most of these letters. Most of them did not mean a great deal to him. There were other things which he considered to be very important. It was important to be on **time/drugs** every single day. Hal had been seeing Jean for a very long time. She had known him before he became famous. Jean was in her last year of college and would soon enter medical school. Hal wrote her a love **letter/song** from his heart. He did like her very much. But they rarely got to see each other.

Constrained Condition

Hal was a successful popular singer, but he had a serious problem. He was addicted to cocaine and often took other substances such as LSD. This habit was interfering with both his personal and professional life. Lately, he seemed to be always stoned. But he had no intention of giving up this habit in the near future. It was important to be on **time/drugs** every single day. As for his girlfriend, she didn't see any reason to stay with him. It was the same thing over and over again. At the last minute, he would say he was composing something especially for her. Hal wrote her a love **letter/song** from his heart. But Jean was glad to be going. She had never loved him anyway.

Sentence Condition

The blind man walked his dog every day. No one could believe Susan had done that. Smoking can give you bad breath. He liked lemon and sugar in his tea. The wooded lake made a pretty scene. It was important to be on **time/drugs** every single day. New York is a very busy city. The sandwich wasn't very good without a slice of cheese. At last the time for action had come. Hal wrote her a love **letter/song** from his heart. The little puppy seemed to be lost. Roger felt he had aced the final exam.

## Text No. 23

### Neutral Condition

It was very difficult to see clearly through the rain. He had no trouble keeping his truck on the road. However, he was driving much too fast in such a downpour. It would be impossible to stop the truck. Sweat began pouring down his back when he realized the truck was sliding out of control. The truck that Bill drove crashed into the **tree/barn** at full speed. Bill was not hurt, but he must have been lying unconscious for a long period of time. He had a cut on his forehead but the blood had already clotted. It was raining just as hard as it had been before the accident. Through the rain it was hard to read the **signs/letters** or see clearly. It took some time before Bill realized another truck had stopped. The driver came to see whether Bill was all right.

### Constrained Condition

It was very difficult to see clearly through the rain. He had no trouble keeping his truck on the road. However, he was driving much too fast in such a downpour. It would be impossible to stop the truck. Through the rain Bill realized too late that he seemed headed towards a farm building nearby. The truck that Bill drove crashed into the **tree/barn** at full speed. Bill was not hurt, but he had to wait a long time before seeing a van come up the road. Bill could not make out what was painted on the side of the van. It probably belonged to one of the large moving companies. Through the rain it was hard to read the **signs/letters** or see clearly. The driver told Bill the barn was an abandoned building. The owner of the property was going to have it torn down the next week.

### Sentence Condition

Mark had to stop at the grocery store to buy some milk. Janet saw the boy slip the watch in his pocket. The old house was built entirely of wood. Being stood up made Paul mad. He loosened the tie around his neck. The truck that Bill drove crashed into the **tree/barn** at full speed. On his vacation he got some needed rest. The apple pie had a delicious taste. The child learned to count to ten. Through the rain it was hard to read the **signs/letters** or see clearly. Sally had never won anything in her life. He gave the last piece to the smallest individual.

## Text No. 24

### Neutral Condition

Larry's friends pressured him to join the swimming team. Larry was firm in refusing to join. He had other things to do. He would much rather concentrate on his studies and do well. He was enroled in the engineering program. It's hard to admit when one is **wrong/scared** no matter what. The truth is that Larry was afraid of water. Alone, he looked at the pool for a long time. No one else was there. The surface of the water was nice and **smooth/warm** to the touch. Larry went in at the shallow end. He found it a lot more pleasant than he had thought it would be.

### Constrained Condition

They learned to swim to participate in competitions. Larry chose not to join the team. He was terrified of water. He did not want to appear frightened in front of his friends. He gave them some excuse why he couldn't go. It's hard to admit when one is **wrong/scared** no matter what. One day Larry went to the pool alone. It was indoors in a large room. It was a heated pool. The surface of the water was nice and **smooth/warm** to the touch. Larry went in at the shallow end. It was a lot more pleasant than he had thought it would be.

### Sentence Condition

He was shocked at the news of the car accident. Both of them loved animals very much. The girl was advanced for her age. During class Jack had to borrow some paper. They liked to sleep out under the stars. It's hard to admit when one is **wrong/scared** no matter what. The boys were given hamburgers for lunch. The train was still on time. Even their friends were left in the dark. The surface of the water was nice and **smooth/warm** to the touch. Veronica enjoyed riding her bicycle. Many people were suddenly out of work when the plant closed.

## Text No. 25

### Neutral Condition

Mrs. White showed the squirrel to her grade five class. The children enjoyed hearing about animals. She found this was a good way to get them to concentrate on a topic. The children thought it was fun. Mrs. White decided to give the children a simple problem. The teacher wrote the problem on the **board/ground** then sat back. The class sat around her in a circle. Mrs. White was proud of her class since they behaved well on this hike. There was one pretty little girl that was frightened, however. The little girl was afraid of the **dark/snake** so she cried. Mrs. White told her not to look at it. She only looked at the non-frightening animals.

### Constrained Condition

The children saw the squirrel digging up some earth. The squirrel stored some nuts in the hole. Mrs. White was taking her grade six class for a hike in the woods. They sat on the grass to rest. The teacher decided to give the students a simple problem. The teacher wrote the problem on the **board/ground** then sat back. Most students were able to solve it. When evening came, the boys found a serpent on the trail. They showed it to the group, but a little girl began to cry. The little girl was afraid of the **dark/snake** so she cried. Mrs. White took her hand and they went back. Altogether, it had been a good experience.

### Sentence Condition

Steve could not handle one more beer. The cat stalked the chipmunk and pounced on him. Sam could not believe her story was true. Barry wisely chose to pay the bill. You can't buy anything for a dime. The teacher wrote the problem on the **board/ground** then sat back. Shuffle the cards before you deal. He bought them in the candy store. Every month Rick had to clean his room. The little girl was afraid of the **dark/snake** so she cried. Lava flowed from the active volcano. Mary was happy when tests confirmed she was pregnant.

## Text No. 26

### Neutral Condition

Ted saw the dark clouds in the distance. Soon afterwards a terrible storm began. He had left his wife alone on the farm, and the pigs had gotten loose. She tried to head them off but was unable to direct them back to the pen. She went back to the farm house. She cleaned the dirt from her **shoes/face** and her hands. When the storm was over, she went out to find the pigs. She searched the neighbouring farms for the beasts. She came across children but did not see the pigs. The children held their hands and formed a **circle/chain** to help her. She asked them whether they had seen any pigs. They told her they had not seen any animals.

### Constrained Condition

Ted saw the dark clouds in the distance. Soon afterwards a terrible storm began. He had left his wife alone on the farm, and the pigs had gotten loose. She splattered herself all over when she slipped and fell in the dirt. She was not able to head them off. She cleaned the dirt from her **shoes/face** and her hands. The storm turned most of the riverbank into mud. Her feet got stuck and she couldn't grab on to anything to pull herself out. Luckily a group of children were passing nearby. The children held their hands and formed a **circle/chain** to help her. They managed to free her from the mud. She thanked all of them very much.

### Sentence Condition

The pilot addressed himself to the passengers. The repair bill was over a hundred dollars. The grocer checked his stock before going home. Dick waited and read a book. He disliked having to commute to the city. She cleaned the dirt from her **shoes/face** and her hands. Abby brushed her teeth after every meal. The storm made the air damp and cold. The sun went down before we could leave. The children held their hands and formed a **circle/chain** to help her. They all agreed to play a trick on Jennifer. The boat circled around the island and disappeared.

## Text No. 27

### Neutral Condition

Sandra was alone to take care of her father after her mother's death. They still lived in the old house where Sandra had been born. Her father would not want to move. While Sandra was away at work, a nurse came by every day to see that he ate a good lunch. Her father was a very sick man. Surgery was needed to repair his failing **heart/lung** despite his age. He did not like staying in the hospital. The doctor told Sandra he should stay in the hospital for a little while. If he seemed all right, they would send him home. She locked the valuables in the **safe/trunk** and turned around. She did not like leaving them around the house when nobody was home. She would take them out when her father returned.

### Constrained Condition

Sandra was afraid whenever her father began coughing uncontrollably. She was certain this occurred because he was a heavy smoker. Yet even now he refused to quit. The doctor had confirmed that his difficulty with breathing required surgical intervention. This was a very serious problem. Surgery was needed to repair his failing **heart/lung** despite his age. Sandra parked her blue car in the driveway. She had decided to auction off some very valuable paintings she had. She opened the door and paused for a moment. She locked the valuables in the **safe/trunk** and turned around. Auctioning these paintings should bring her a considerable sum of money. She had gotten tired of these paintings anyway.

### Sentence Condition

Sylvie liked to play games on the computer. Ted was distraught when he heard Mike and Diane had split up. The lecture should last about one hour. They went to see the famous actor. The cigar burned a hole in the couch. Surgery was needed to repair his failing **heart/lung** despite his age. The old milk tasted very sour. Karen awoke after a bad dream. Joan boiled the eggs in water. She locked the valuables in the **safe/trunk** and turned around. Harry saved his money to buy a stereo system. Tom had no idea how she would react to the news.

## Text No. 28

### Neutral Condition

The farmers were generally unhappy that summer. They believed the government would provide financial aid during the drought. Yet so far they had received nothing. For some of them, the losses would significantly affect their way of life. Many were talking about selling their farms once and for all. After speaking Allen left the noisy **room/crowd** to go home. Walking back to his car, he thought about his family. Unpredictable weather simply made farming too risky. There were no guarantees. Allen found that he had no spare **tire/keys** for his car. He would have to find someone to give him a lift home. He had to go back inside and call for help.

### Constrained Condition

The farmers were generally unhappy that summer. They believed the government would provide financial aid during the drought. Yet so far they had received nothing. Allen would have to tell them to be patient a little while longer. A group of irritated farmers had gathered in front of the mayor's office. After speaking Allen left the noisy **room/crowd** to go home. Walking back to his car, Allen had an uneasy feeling. He searched his pockets but saw them in the ignition. He had locked himself out! Allen found that he had no spare **tire/keys** for his car. His car was practically impossible to get into. He had to go back inside and call for help.

### Sentence Condition

The mood was very pessimistic at the meeting. Every Sunday they went to his parents place to eat. Even infants can be taught to swim. The pizza was too hot to eat. The police had never seen a man so drunk. After speaking Allen left the noisy **room/crowd** to go home. I could not remember his name. The gambler had a streak of bad luck. The actor was praised for being very good. Allen found that he had no spare **tire/keys** for his car. The dolphins followed the ship to sea. Our mailman always delivers the mail at the wrong place.

## Text No. 29

### Neutral Condition

The senator walked calmly down the street. The senator was startled by the sudden pain in his back. He continued walking and the pain finally disappeared. He had to prepare for a very important meeting early the next morning. He met Baxter whom he saw every day on his way to work. His job was to keep the sidewalk **clean/clear** so he did. That night, however, there were more pains. The senator sought admission to the nearest hospital for a complete physical examination. Without any immediate warning, the senator had a heart attack. The surgeon tried vainly to save his **patient/life** which seemed impossible. But he didn't make it. The senator died of a heart attack at 36 years old.

### Constrained Condition

The senator heard a shot behind him. The senator was startled by the sudden pain in his back. It took him a moment to realize that he had been shot! What the police sergeant had to do was evident once the medics arrived. Sergeant Hanson kept anyone from approaching too closely. His job was to keep the sidewalk **clean/clear** so he did. The senator was rushed to the hospital. His days would end shortly if the damage to the senator's heart could not be repaired. During the operation, the senator had a heart attack. The surgeon tried vainly to save his **patient/life** which seemed impossible. But he didn't make it. No one could understand why he had been shot.

### Sentence Condition

A skunk can make a surprisingly nice pet. Amanda could not decide which car to buy. They took short trips during the summer. Even for an amateur, he was pretty good. Nothing can beat a bowl of hot soup. His job was to keep the sidewalk **clean/clear** so he did. Ira turned on the radio and listened to the music. A large stone blocked the entrance to the cave. Fred sat in his chair on the back porch. The surgeon tried vainly to save his **patient/life** which seemed impossible. The dog was trained to perform in the circus. The television set broke down in the middle of the movie.

Text No. 30

Neutral Condition

Mr. and Mrs. Smith had two sons and a daughter. They were very proud of their children. The whole family was very close. Mr. Smith always talked about his children at work. But what he enjoyed most were the weekend outings with his family. The Smiths had never visited that **place/park** before this day. Mrs. Smith spread out a blanket to have a picnic. She took out the sandwiches and passed them around. But she could not anticipate what was to happen. Their picnic was ruined by the **rain/ants** and the wind. They had to pack up and get back in the car. There would be other picnics.

Constrained Condition

Mr. and Mrs. Smith took their children out on a picnic. They were new to this neighbourhood. They had just moved here a week ago. They walked on the grass towards a beautiful lake. There were swings for the children, benches, and many flowers. The Smiths had never visited that **place/park** before this day. Mrs. Smith spread out a blanket to have a picnic. Hordes of insects were crawling over the blanket. Everyone had to constantly sweep the bugs away. Their picnic was ruined by the **rain/ants** and the wind. At the end of the day Mrs. Smith was tired. They would stay at home the next day.

Sentence Condition

The bear invaded the campsite in search of food. It had been a wonderful evening for both of them. John swept the floor with a broom. The rabbit hid in the tall grass. The power went out, and all the food went bad. The Smiths had never visited that **place/park** before this day. He hung her coat in the closet. Cathy is liked by all her friends. You can't open the door with the wrong key. Their picnic was ruined by the **rain/ants** and the wind. The teacher tried to control the students. The batteries in the radio had begun to leak.

Text No. 31

Neutral Condition

Karen was definitely a very heavy smoker. She was not the least bit worried about getting lung cancer. She smoked six packs of cigarettes a day. She could not tolerate anyone telling her she should quit. She could not stand nonsmokers who petitioned for anti-smoking laws in public areas. Some of the ashes dropped on the **floor/bed** which she ignored. She enjoyed smoking and the feeling that it gave her. Karen turned around to get in a better position. She sensed the pain becoming slowly worse. The pain she felt was all in her **head/legs** for the moment. She took another puff of her cigarette. She would definitely have to go see the doctor.

Constrained Condition

Karen stretched out underneath the blanket. She rested her head on the pillow and opened the book. Reading would hopefully help her get to sleep. She had gone to sleep later than usual the past few nights. Karen took a long puff from her cigarette. Some of the ashes dropped on the **floor/bed** which she ignored. She couldn't help it because it hurt so much to move. Her lower limbs felt like there were pins sticking into her. The pain extended from her thighs to her ankles. The pain she felt was all in her **head/legs** for the moment. She would never be able to get to sleep. This was the worse pain she had in a long time.

Sentence Condition

The auditorium was full for the boxing match. Sarah was nervous about her upcoming presentation in class. Harriet sang while my brother played the piano. My aunt likes to read the daily paper. The governor vetoed the new bill. Some of the ashes dropped on the **floor/bed** which she ignored. The winter was very harsh this year. Success is often just a matter of hard work. In the morning Jake took out the garbage. The pain she felt was all in her **head/legs** for the moment. Mark listened to the radio almost all the time. The new shopping centre is supposed to open next week.

## Text No. 32

### Neutral Condition

Hank and Mary had just bought their first house. It was not a big house but it would suit their needs. The back yard was large and would make an ideal playground for their daughter. The neighbourhood was clean. There was a school nearby. Hank reached into his pocket to get the **money/keys** that he needed. He ordered out for chinese food that night. Everyone was tired after a hectic day. It would take a few days to unpack everything. Suzy liked to play with her toy **doll/duck** which she treasured. Her mother came and put her to bed. She had no trouble falling asleep in this new house.

### Constrained Condition

Hank and Mary had just bought their first house. It was not a large house but it would suit their needs. Their daughter Suzy was eager to move in. Hank verified he had the papers with him. The door was locked. Hank reached into his pocket to get the **money/keys** that he needed. Little Suzy discovered the bathtub upstairs. She filled the tub half full of water. Then she got her brand new toy out. Suzy liked to play with her toy **doll/duck** which she treasured. Her mother came and helped her clean herself. Then the moving truck came with their furniture.

### Sentence Condition

The wary dog would not go near the porcupine. Helen was the most popular person in our drama class. At night the old woman locked the door. The airplane went into a dive. The bill was due at the end of the month. Hank reached into his pocket to get the **money/keys** that he needed. The rider walked his beautiful horse. Our guests should be arriving soon. What you find depends on where you look. Suzy liked to play with her toy **doll/duck** which she treasured. He did not wish to step down from the position. They won a trip to the Caribbean Islands.

Text No. 33

Neutral Condition

Mark listened carefully to Betsy. Betsy could never tell a joke. Mark liked Betsy a lot. He would ask her to marry him. They had been going out steadily for the past two years. After dinner they washed the **dishes/car** as they talked. They seemed to be an ideal couple. Mark had graduated from the Computer Science program. He had a good job and thought seriously about the future they could have together. He lay down and went to **sleep/work** without any delay. Soon he would ask Betsy to marry him. But the thought of asking still made him nervous.

Constrained Condition

Mark listened but it was not funny. Betsy could never tell a joke. Mark liked Betsy a lot. She had invited him to dinner. He had promised he would help her wash her Toyota today. After dinner they washed the **dishes/car** as they talked. He also had to change her muffler. He wanted her to time him to see how long it took. He borrowed her brother's skateboard in order to wheel himself under the car. He lay down and went to **sleep/work** without any delay. Mark changed the muffler in record time. He also got a sore back from the skateboard.

Sentence Condition

Jill accompanied her younger sister to the skating rink. The giraffe was Tom's favourite animal. The better students thought the test was too easy. The final score of the game was tied. The piano was out of tune. After dinner they washed the **dishes/car** as they talked. Joan fed her baby some warm milk. The judge warned about the dangers of perjury. Jan tried to squeeze in, but there was no room. He lay down and went to **sleep/work** without any delay. They trained their poodle to perform several tricks. Julie's income had doubled in the past year.

## Text No. 34

### Neutral Condition

Dean liked to travel on his motorcycle. In the summer he would go on long trips. He liked to go up in the mountains away from the city. He would often camp in the woods by the side of the road. He found public campgrounds too crowded. Motorcycles can create a lot of **noise/accidents** on the road. Dean had been driving all morning. He did not notice the oil slick until it was too late. Ed Barr witnessed the accident passing in his truck. Dean's leg was broken, so Ed went to get **help/him** on his own. Dean was driven to the nearest hospital. He was very grateful to Ed for his help.

### Constrained Condition

Dean was speeding along in his motorcycle. He wanted to get home early. He banked sharply as he went through a curve. He didn't notice the oil slick until he was on top of it. The wheels slipped from under him and he ended up sliding into a ditch. Motorcycles can create a lot of **noise/accidents** on the road. Luckily Ed Barr was passing in his car. He offered to drive Dean into town. Unfortunately, Dean found he could not get out of the ditch alone. Dean's leg was broken, so Ed went to get **help/him** on his own. Dean was driven to the nearest hospital. He was very grateful to Ed for his help.

### Sentence Condition

They did not know where that man came from. Frank did not want to wash the dishes. The person who caught the thief deserves our thanks. Jeff was sent to bed without dinner. He crept into the room without a sound. Motorcycles can create a lot of **noise/accidents** on the road. They went to the rear of the long line. He had to fill his truck with gas. Helen reached up to dust the shelf. Dean's leg was broken, so Ed went to get **help/him** on his own. Melanie did not know whom to ask for advice. The dog looked as though it had not eaten in a long time.

Text No. 35

Neutral Condition

Despite the racial problems, many tourists visited South Africa last year. Many of them wanted to go on safaris in the jungle. The large animal parks were the most popular tourist attractions. Cape Town and Durban were also popular with tourists. There is a lot to visit in South Africa. It's easy to get lost without a **map/guide** or a compass. Most safaris in the jungle were well organized. The routes through the jungle were well marked and familiar to the guides. One could find his own way out. The exit was marked by a large **sign/rock** against a tree. To the tourists, the jungle was a mysterious place. Everyone followed the guide very closely.

Constrained Condition

Despite the racial problems, many tourists visited South Africa last year. Many of them wanted to go on safaris in the jungle. Many such expeditions were organized exclusively for tourists. This necessitated hiring many people familiar with the area. Tourists did not want to venture in the jungle alone. It's easy to get lost without a **map/guide** or a compass. Frank knew this part of the jungle very well. Mabu territory was marked off by boulders rolled into place. One could hardly miss the exit. The exit was marked by a large **sign/rock** against a tree. There was no way someone could get lost. Of course he didn't tell this to the tourists.

Sentence Condition

Joanne chose the red dress to wear at the opening ceremonies. Suzie tricked Tom into giving her the largest piece of candy. The long test left the class exhausted. Bob proposed, but she turned him down. Fred realized the old house was up for sale. It's easy to get lost without a **map/guide** or a compass. Before jogging, it's a good idea to stretch. He was soothed by the gentle music. They sat together without speaking a single word. The exit was marked by a large **sign/rock** against a tree. The racehorse collapsed a short distance from the finish line. The old man had lost all his hair.

## Text No. 36

### Neutral Condition

I waved to my parents from the driveway. They rested under a tree in the yard. I went into the house to get the books I needed tonight. I am taking a course in investment and money management. I want to become an investment broker. My father and mother are getting **divorced/angry** and it shows. They would rather I go into some other profession such as law. I tried to explain to them that it doesn't interest me. My father has done a great deal of work in the back yard. To keep the dogs out of the yard he put up a **fence/wall** six feet high. We never had problems with dogs again. I got my books and called a friend to come pick me up.

### Constrained Condition

I waved to my parents from the driveway. They rested under a tree in the yard. Lately, dogs have been coming into our yard to chase our cat. They tend to trample all over my mother's garden. Anyone would become upset at this eventually. My father and mother are getting **divorced/angry** and it shows. My father put up various enclosures but they always get through. Whether it's steel or wood, they just dig underneath. It seems that only cement would be effective in the long run. To keep the dogs out of the yard he put up a **fence/wall** six feet high. We never had problems with dogs again. But our cat didn't want to stay in the yard after that.

### Sentence Condition

Bill drove his two daughters to school. The farmer expected to hire over a dozen people this year. He mailed the letter without a stamp. Bill jumped in the lake and make a big splash. She tied up her hair with a yellow ribbon. My father and mother are getting **divorced/angry** and it shows. There are times when life seems dull. Water and sunshine help plants grow. At first the woman refused, but she changed her mind. To keep the dogs out of the yard he put up a **fence/wall** six feet high. Elaine did not feel like going to the party. The football player broke his arm in the fall.

Text No. 37

Neutral Condition

Jim often dreamed about making a lot of money. Like most kids his age, he had no definite plans for the future. He thought vaguely about a career in law or medicine. But not enough to pursue the matter seriously. He was more concerned about enjoying life at the present time. His ring fell into a hole in the **sink/street** and he cursed. He did not bother trying to retrieve it. It was of no great value to him. He had found it on the side of the street. Jim wanted to change the way he **looked/lived** from now on. But there was nothing to push him into taking some kind of action. Without motivation, he would probably not change.

Constrained Condition

Jim often dreamed about making a lot of money. The truth was that he couldn't even afford to buy a lousy lottery ticket. He took his ring out of his pocket and looked at it. He had found it on the sidewalk ten minutes ago. The sudden blast of the truck's horn caused him to jump. His ring fell into a hole in the **sink/street** and he cursed. Jim did not like his present situation. He was 21, poor, and illiterate. He rented an old, filthy apartment. Jim wanted to change the way he **looked/lived** from now on. He took night courses to learn how to read and write. It was very difficult work for him.

Sentence Condition

Sandra stayed near the shallow end of the pool. Jennifer lost thousands of dollars when the stock market crashed. The movie was so jammed they couldn't find a single seat. Father carved the turkey with a knife. To pay for the car, Al simply wrote a cheque. His ring fell into a hole in the **sink/street** and he cursed. The wealthy child attended a private school. The dough was put in the hot oven. The difficult concept was beyond his comprehension. Jim wanted to change the way he **looked/lived** from now on. It was Sally's responsibility to make sure all the equipment was turned off. Joseph was arrested for drunk driving.

## Text No. 38

### Neutral Condition

Mark and Joan transported cars across St. George's Bay all day long. It was pleasant when they had good weather. It was true it was the same routine every day. But they could sit out in the sun and simply relax. Mark looked at the chair before him. It was clear that the leg was **broken/shorter** and he frowned. Mark and Joan knew many of the people that took the ferry daily. It wasn't a big town and it was easy to make friends. Most of the people they encountered were nice and pleasant. Joan showed her friend a new card **trick/design** that she liked. Mark came over to see what was going on. He offered to make some lemonade.

### Constrained Condition

Mark and Joan transported cars across St-George's Bay all day long. Mark looked at one of the chairs on deck. Whenever you sat on it, it tilted to one side. Obviously, one leg was different in size than the others. Mark looked at the leg closest to him. It was clear that the leg was **broken/shorter** and he frowned. For most of the day, Joan worked at her other job. She had a private business selling greeting cards. She was very talented at coming up with new ideas all the time. Joan showed her friend a new card **trick/design** that she liked. Mark came over to see what was going on. He offered to make some lemonade.

### Sentence Condition

The bald eagle swooped down to grasp the fleeing hare. Mary has been feeling ill all week. Ted was the only male student in his cooking class. The children continued to play even though it had started to rain. It takes a strong will to save money these days. It was clear that the leg was **broken/shorter** and he frowned. John was always the last to finish. They all went to meet their father at the airport. She did not know where to go on her vacation. Joan showed her friend a new card **trick/design** that she liked. He preferred playing baseball to doing his homework.

## Text No. 39

### Neutral Condition

It was a mild day in October and we were playing baseball. The game was called when it started to snow. My father decided to take me to the museum. There were exhibits of old cars, trolleys, and carriages. We were the only ones in the building except for an old caretaker. The kind old man asked us to **stay/move** just a bit. He wanted to show us a picture in another room which he was fond of. It depicted a scene which was very familiar to the old man since he had been there. He asked us if we knew who Dillinger was. Dillinger once robbed that **bank/train** in the picture. The man knew because he had been there when the robber had attacked. That picture seemed to mean a lot to him.

### Constrained Condition

It was a freezing day in November and we were playing baseball. The game was called when it started to snow. My father decided to take me to the museum. There were exhibits of old cars, trolleys, and carriages. We stepped in front of a very old man examining a picture. The kind old man asked us to **stay/move** just a bit. We did and he brought our attention to the picture he had been looking at. It showed a building in front of which was a large locomotive with the number 959 on it. The man smiled at us. Dillinger once robbed that **bank/train** in the picture. The man knew because he had been one of the passengers at that time. It was an event just to have met this person.

### Sentence Condition

Although Glen had a very good job, he was not well educated. Lisa was saving her money to buy a new car. No one came to visit him when he was hospitalized. Tommy changed completely when he me Suzanne. He gave the horse a good rubdown before the major race. The kind old man asked us to **stay/move** just a bit. Larry and Sandra spent three months in Ireland cycling from one town to another. Fred was much too absorbed with his computer game to notice that someone had entered the house. Pick up some bread on the way home. Dillinger once robbed that **bank/train** in the picture. It has been one month since my dog has stopped barking altogether. The mailman delivered two letters today.

Text No. 40

Neutral Condition

The Boy Scouts were out for a hike in the woods. They spend most of the morning just walking. By noon they had reached the edge of a large valley. They had never seen so many different types of wild berries. They spent the next two hours picking and eating berries. When the shooting started, they ran for **cover/help** without any delay. Nobody knew exactly what was going on at that time. They just knew something had happened. The Scout leaders seemed to be quite worried. One of the scout troops got **lost/shot** in the woods. Everything had happened very quickly and then it was over. Nobody could find out who had fired the shots or why it had happened.

Constrained Condition

The Boy Scouts were out for a hike in the woods. All of them knew what to do in an emergency. First and foremost, they should contact their leader. He would assist them with any problems that came up on the trail. The Boy Scouts knew exactly where to find their leader. When the shooting started, they ran for **cover/help** without any delay. Nobody knew exactly what was going on in the woods. They heard guns go off at close range. It sounded like one or more people had rifles. One of the scout troops got **lost/shot** in the woods. The leader realized that the scouts had encountered poachers. He managed to bring medical help for one boy that was wounded.

Sentence Condition

The little boy did not want to eat his carrots. Sarah was the fastest runner on the team. To his astonishment, he found a raccoon sleeping under the sofa in his living room. Janet was a difficult child and she did not make friends easily. They finished the project at the very last minute. When the shooting started, they ran for **cover/help** without any delay. Nancy spent most of her time at the health club. Nobody showed up for the meeting. Joanne created sound effects for a recording company. One of the scout troops got **lost/shot** in the woods. The old man had absolutely no one to take care of him. He could count seven wolves in the pack, maybe more hidden by the trees.

# Appendix 2

## ANOVA Source Tables

Source Table for ANOVA on Mean Word Reading Times of Target Words (Exp. 1).

| Source | SS | df | MS | F |
|---|---|---|---|---|
| Blocks/Subjects | 11159802.08 | 31 | | |
| Word probability | 21981.26 | 1 | 21981.26 | 1.01 |
| Error | 672921.36 | 31 | 21707.14 | |
| Context | 46195.08 | 1 | 46195.08 | 2.05 |
| Error | 698251.86 | 31 | 22524.25 | |
| Word probability x Context | 137909.64 | 1 | 1357909.64 | 9.65 |
| Error | 442010.89 | 31 | 14287.74 | |
| Total | 13179981.17 | 127 | | |
| (Residual) | 1814093.11 | 93 | | |

Source Table for ANOVA on Mean Word Reading Times of Target Words (Exp. 2).

| Source | SS | df | MS | F |
|---|---|---|---|---|
| Blocks/Subjects | 1267835.40 | 31 | | |
| Word probability | 367.62 | 1 | 367.62 | .25 |
| Error | 46296.66 | 31 | 1493.44 | |
| Context | 128.33 | 1 | 128.33 | .08 |
| Error | 46307.06 | 31 | 1493.78 | |
| Word probability x Context | 1636.03 | 1 | 1636.03 | .53 |
| Error | 95152.12 | 31 | 3069.42 | |
| Total | 1457723.23 | 127 | | |
| (Residual) | 187755.83 | 93 | | |

Source Table for ANOVA on Mean Word Reading Times of the Sum of Target and Target + 1 Words (Exp. 2).

| Source | SS | df | MS | F |
|---|---|---|---|---|
| Blocks/Subjects | 4412631.34 | 31 | | |
| Word probability | 2115.19 | 1 | 2115.19 | .55 |
| Error | 119677.72 | 31 | 3860.47 | |
| Context | 729.56 | 1 | 729.56 | .27 |
| Error | 83564.47 | 31 | 2695.63 | |
| Word probability x Context | 18797.91 | 1 | 18797.91 | 2.29 |
| Error | 254005.53 | 31 | 8193.73 | |
| Total | 4891521.62 | 127 | | |
| (Residual) | 457247.72 | 93 | | |

Source Table for ANOVA on Mean Word Reading Times of the Last Words (Exp. 2).

| Source | SS | df | MS | F |
|---|---|---|---|---|
| Blocks/Subjects | 28533977.97 | 31 | | |
| Word probability | 14747.19 | 1 | 14747.19 | 1.21 |
| Error | 376264.47 | 31 | 12137.56 | |
| Context | 116043.41 | 1 | 116043.27 | 3.16 |
| Error | 1139041.31 | 31 | 36743.27 | |
| Word probability x Context | 489353.41 | 1 | 489353.41 | 9.13 |
| Error | 1661252.69 | 31 | 53588.80 | |
| Total | 32330680.31 | 127 | | |
| (Residual) | 3176558.47 | 93 | | |

Source Table for ANOVA on Mean Word Reading Times of Target Words (Exp. 3).

| Source | SS | df | MS | F |
|---|---|---|---|---|
| Blocks/Subjects | 10052868.31 | 31 | | |
| Word probability | 292926.25 | 1 | 292926.25 | 6.26 |
| Error | 1450089.94 | 31 | 46777.09 | |
| Context | 165926.94 | 1 | 165926.94 | 3.62 |
| Error | 1418647.81 | 31 | 45762.83 | |
| Word probability x Context | 1819087.19 | 1 | 1819087.19 | 20.46 |
| Error | 2756707.19 | 31 | 88926.04 | |
| Total | 17956253.62 | 127 | | |
| (Residual) | 5625444.94 | 93 | | |

Source Table for ANOVA on Mean Word Reading Times of Last Words (Exp. 3).

| Source | SS | df | MS | F |
|---|---|---|---|---|
| Blocks/Subjects | 40640388.37 | 31 | | |
| Word probability | 24756.00 | 1 | 24756.00 | .17 |
| Error | 4462964.37 | 31 | 143966.59 | |
| Context | 2860607.87 | 1 | 2860607.87 | 4.56 |
| Error | 19439902.87 | 31 | 627093.64 | |
| Word probability x Context | 176956.62 | 1 | 176956.62 | .87 |
| Error | 6324481.75 | 31 | 204015.54 | |
| Total | 73930057.37 | 127 | | |
| (Residual) | 30227349.00 | 93 | | |