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Inferentially Cued Recall of Concrete and Abstract Sentences

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ABSTRACT

Subjects were instructed to learn a set of concrete and abstract sentences. Inferential recall cues failed to produce levels of recall above that achieved under free recall conditions. If the cues appeared with their respective sentences at encoding they were facilitative at recall for both concrete and abstract sentences. In a second experiment subjects performed an incidental learning task for each sentence. The task was meant to induce a specific contextual interpretation which was consistent with the inferential cue provided at recall. Under these conditions inferentially cued recall exceeded free recall by a factor of two. Memory for concrete sentences was facilitated by inferential cues to a greater degree than was memory for abstract sentences. The results indicate that successful inferential cuing requires the formation of a specific context which can be reinstated via the inferential cue. Implications for a constructive approach to language processing and for theories of the concreteness effect are discussed.

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## Contextual Specificity in Inferential Cuing of Sentence Recall

The constructive nature of linguistic information processing plays an important role in determining one's memorial representation of linguistic episodes. That subjects spontaneously integrate information into holistic ideas which encompass more information than is present in the particular linguistic input was convincingly demonstrated by Bransford and Franks (1971). People normally make use of their world knowledge to infer consequences, relationships, and other types of information implied but not explicitly stated in a communication. Barclay (1973) and Bransford, Barclay, and Franks (1972) have shown that a complete linguistic analysis of a sentence does not include all the information which will be involved in a memorial representation of that sentence.

Constructive processing of language produces representations that include inferred information. Under appropriate circumstances explicit linguistic statements and inferred information may be represented in the same way. Johnson, Bransford, and Solomon (1973) found that subjects falsely recognized novel sentences that contained information derived from implications of passages which subjects had studied earlier. McKoon and Keenan (reported in Kintsch, 1974) showed that time taken to verify explicit and implicit statements based on a short passage equalized when testing occurred 20 min or more after original reading. During the recall of text subjects may interject inferred information while attempting to recall only explicit statements (Frederiksen, 1975). Furthermore, the nature of the inferential interjections was consistent with the context provided during original reading of the passage. Thorndyke (1976) has shown that false recognition of inferred information is dependent on the

appropriateness of the inference relative to the context established by explicit statements.

These results are consistent with the idea that the representation of comprehended linguistic material contains both explicit information and inferences derivable from explicit statements. These inferences are determined by the context induced by the stimulus environment (e.g., specific statements, contextual pictures or phrases) and the general knowledge activated by the context.

The integration of explicit and implicit information in memory might lead one to expect that recall of explicit information should be aided by providing inferential cues. Attempts have been made to demonstrate that sentence recall can be improved by providing subjects cues based on inferences derivable from the encoded sentences. A series of experiments by Barclay, Bransford, Franks, McCarrell, and Nitsch (1974) was directed at the issue of inferential cuing. Recall of a key word in each target sentence was cued with two phrases appropriate to the general characteristics of the key word. However, only one of the two phrases was appropriate to the context established by the target sentence. Subjects recalled far more key words in the presence of the appropriate phrases as compared to inappropriate phrases.

Anderson and Ortony (1975) demonstrated that recall of a target sentence (e.g., Coins can be flipped) in the presence of a cue word appropriate to inferences derivable from the target sentence (e.g., odds) was frequent while target sentences were almost never recalled with inappropriate cues (e.g., dollar). Till (1977) has reported similar findings and presented evidence that predictions based on an associative model of memory underestimated the size of inferential cuing effects.

Barclay et al. (1974) also ruled out associative explanations of their cuing results, indicating that the success of inferential cuing cannot be accounted for by the associations between the cues and specific parts of target sentences. Rather, the context established by the whole target sentence is the determinant of the effectiveness of an inferential cue.

Another example of the robust nature of the differential effectiveness of appropriate and inappropriate inferential cues was provided by Marschark and Paivio (1977). They replicated the Anderson and Ortony (1975) study using some of the original concrete sentences in addition to abstract sentences and cues. Marschark and Paivio discovered that both abstract and concrete sentences were recalled more often in the presence of appropriate inferential cues than inappropriate cues. It was concluded that both concrete and abstract sentences are integratively processed such that appropriate inferences are made and can be used to mediate recall.

The lack of an interaction between cue type and concreteness in the Marschark and Paivio (1977) study coincides with the Franks and Bransford (1972) finding that when abstract materials were used their original results (Bransford & Franks, 1971) were replicated. Subjects can integrate concrete and abstract information into holistic ideas including the formation of inferences.

The experiments supporting the notion that sentence recall can be improved with the use of cues based on inferences derivable from the original sentences are also important evidence for the constructive nature of linguistic information processing. These empirical results point up the holistic quality of the representation of explicit and implicit information: accessing appropriate inferences via recall cues leads to recall of explicit information.

Unfortunately, all of the experiments (Anderson & Ortony, 1975; Barclay et al., 1974; Marschark & Paivio, 1977; and Till, 1977) cited here as evidence for inferential cuing of sentence recall suffer from fundamental methodological flaws. These flaws could potentially prevent one from concluding that sentence recall can be improved by presenting cues based on probable inferences. The most important problem with the inferential cuing experiments is that no measure of free recall of sentences was reported. In order to demonstrate that inferential cuing aids recall, it should be shown that such cuing produces levels of recall above that obtained under conditions of free recall. If sentences can be recalled just as well without inferential cues we have no evidence that the cues are being used and we lose the ability to infer that representations of sentences are being accessed through relevant implicit information.

A closely related problem is that the comparison that has been made was between appropriate and inappropriate cues. Although the inappropriate cues often provide a good control for simple associative explanations of cuing effectiveness (e.g., Barclay et al., 1974), they are not the proper baseline for comparison. Moreover, if the experimental procedure involves cuing a particular sentence with only one cue type (appropriate or inappropriate) but not both (e.g., Till, 1977) the subject may remember a sentence which has been cued with an inappropriate cue and the subject will not know to which cue the sentence belongs. The occurrence of intrusion errors in Till's study supports this idea and suggests that such a procedure prevents the subject from reporting everything that he/she knows about the target sentences.

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Another problem is that in some studies (Anderson & Ortony, 1975; Marschark & Paivio, 1977) inferentially cued recall was preceded by a recall test in which sentence subjects were used as cues. In this situation the subject is able to recall a number of sentences, a process which probably firmly instantiates the sentences in memory. When the second cued recall test is given subjects are faced with appropriate and inappropriate cues. It is possible that at this point subjects merely search the set of previously recalled sentences when each cue is presented and when a sentence is found that makes sense in the context of the cue it is output in response to the cue. This process is not one of cued recall but more of a sorting process in which already available sentences are simply matched to cue words. It seems that the inferential process in these studies was not related to retrieval of otherwise inaccessible sentences, but rather the inferences were made from sentences which were already established in memory.

Evidence for this alternative explanation of inferential cue effects obtained to date can be found in the Anderson and Ortony (1975) and Marschark and Paivio (1977) studies themselves. In both cases it was reported that sentences recalled on the inferential cued recall test were nearly always sentences that subjects had recalled on the previous test involving sentence subjects as cues.

There is also evidence from the Barclay et al. (1974) study that the inference processes may have been occurring at the level of sorting rather than involving retrieval of otherwise inaccessible sentences. In their second experiment inappropriate cues were not inferentially related to the sentences and subjects would be highly unlikely to see any connection between a sentence and its inappropriate cue even if the sentence was

already retrievable. In this situation almost no sentences were correctly matched with their corresponding inappropriate cues. The last two experiments done by Barclay et al. involved the sentence object as part of the cues. In this case it would be expected that sentences available in memory could be inferentially or otherwise related to even inappropriate cues. This result obtained, although contextually appropriate cues were still more likely to be matched to a recalled sentence.

#### Experiment 1

It appears that previous studies of inferential cuing of sentence recall have not used procedures which allow the conclusion that otherwise inaccessible sentences can be retrieved if the original context is inferentially reinstated. Consequently, an experiment was designed to test the validity of this conclusion under rather simple conditions. Subjects were presented sentences for a period of study and then tested under either free recall or inferentially cued recall conditions. In addition, concrete and abstract materials were included in order to test the hypothesis that inferentially prompted recall may work best for concrete materials since concrete sentences may be more integratively processed. Marschark and Paivio's failure to find a greater cuing effect for concrete sentences may have been a result of the possibility that the inferential process which they (and others) have studied is one that involves already available sentences and not the access of otherwise unavailable sentences. If a sentence is consciously available in memory it should be possible to make relevant inferences from it regardless of its concreteness.

Another variable involved in the first experiment was whether or not the cue words appeared with the sentences during original encoding.

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The main reason for having some subjects study sentences in the presence of a word that will later be used on a cued recall task was to provide a test of the hypothesis that abstract sentences are harder to process integratively. Each cue was relevant to the sentence context and was expected to aid integrative processing of the sentence. This should be especially true for abstract sentences. Pezdek and Royer (1974) found that when a context was provided for abstract material, detection of meaning changes in test sentences was improved over the level of recognition achieved when no input context was provided. Providing a context did not affect performance on concrete material. From these results one might expect that providing subjects a cue word to aid integrative processing of sentences would be more effective for abstract than concrete sentences.

Finally, the number of presentations of the sentences was varied. If inferential cuing of sentence recall is possible then the effect should be enhanced when more extensive processing can occur, as when sentences are presented more than once.

#### Method

Design. A mixed factorial design was used. The only within subjects variable was sentence concreteness, concrete versus abstract. Between subjects variables were number of presentations (1 vs 2) of the sentences, presence or absence of a cue word for each sentence during learning, and presence or absence of cue words during sentence recall.

Subjects. Seventy-two students at the University of Colorado participated in partial fulfillment of an introductory psychology course requirement. Nine subjects were randomly assigned to each of the 8 between subjects cells of the design.



Materials. The materials were 14 concrete and 14 abstract sentences and their corresponding appropriate cues. These sentences and cues were taken from the materials used by Marschark and Paivio (1977). Some of the concrete sentences and cues had been included in the Anderson and Ortony (1975) study while the abstract materials were first normed and used by Marschark and Paivio. A sample concrete sentence and inferential cue is The container held the apples--basket. An example of an abstract sentence and cue is Betrayal may ruin security--spy. The first two and last two sentences in the list (one abstract and one concrete at each end of the list) were buffers and were not included in the scoring. The mean imaginability ratings (out of a possible 7) of the remaining 12 concrete and 12 abstract sentences were 5.50 and 2.76, respectively. The mean rated (out of a possible 7) comprehensibility of the concrete sentences was 6.56 and for the abstract sentences it was 5.38.

The sentences were typed and photographed on 35 mm slides. A second set of slides was similarly prepared except that the appropriate cue word appeared in capital letters above each sentence. A random order of presentation was then determined and used for both sentence sets and all subjects in the experiment.

Procedure. Subjects assigned to the same condition participated in groups of 1 to 7. Instructions simply indicated that subjects were to learn each sentence shown to them. In the condition which involved presentation of a cue with each sentence, subjects were told to use the cue to help them comprehend the sentence and that such a strategy would aid their learning. No details of the nature of the recall test were given. The list of sentences was presented either once or twice, depending on the experimental condition, at the rate of 10 sec per sentence.

In the free recall condition subjects were asked to recall as many of the sentences as possible. In the cued recall condition subjects were provided an alphabetically ordered list of the inferential cue words printed on a single page. Subjects who had studied the sentences in the presence of the cues were told that each cue word was related to the general meaning of a sentence they had studied. All subjects in the cued recall condition were encouraged to use the cues as reminders of the sentences.

All subjects were requested to recall as much as possible, and to provide verbatim recall. If only a paraphrase or partial memory for a sentence was available subjects were encouraged to include this in their recall as well. A maximum of 10 min was allowed for the recall test.

#### Results and Discussion

Three scoring measures were calculated for each subject's protocol. The first measure was based on verbatim recall of subject nouns, main verbs, and complements. Variations in number and tense were accepted. The second measure was a similar but more lenient one based on gist recall of subject nouns, main verbs, and complements. For this measure, semantic substitutions such as synonyms were allowed. The final measure was for complete sentence recall. If all three elements of a sentence were recalled as a unit (at least at the gist level) such that the original meaning of the sentence was preserved, credit was given for recall of a complete sentence. Results of analyses will be reported in detail only for the verbatim scoring criterion and for the other two measures when they show effects not found (or fail to replicate results) in the analysis of verbatim scores.

Table 1 presents the mean proportion of sentence elements recalled at the verbatim and gist levels of scoring and the mean number of complete

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sentences recalled. An analysis of variance of the verbatim scores showed that two presentations of the sentences generally produced higher levels of recall than did one presentation,  $F(1, 64) = 29.22, p < .001$ . When a cue word appeared with each sentence recall was improved over the level of recall obtained without an input cue,  $F(1, 64) = 4.27, p < .05$ . This effect was not significant in the analysis of complete sentence recall. Providing a list of inferential cue words during recall resulted in better performance than the free recall condition,  $F(1, 64) = 31.93, p < .001$ . The interpretation of the input and recall cue effects must be made in light of a significant interaction between the presence or absence of the cues at input and their presence or absence during recall,  $F(1, 64) = 22.19, p < .001$ . Specifically, cuing recall had no effect if the cues were not present at encoding (mean cued recall = .32, mean free recall = .29), but cues were very helpful if present at encoding (mean cued recall = .51, mean free recall = .22).

The interaction between input and recall cuing conditions clearly supports the idea that earlier experiments dealing with inferential cuing of sentence recall should be viewed with some caution. Even under rather optimal cuing conditions (subject paced, only appropriate cues) inferential cues did not facilitate recall unless they explicitly appeared with the appropriate sentence at encoding.

The free recall baseline proved to be a valuable measure against which the effects of inferential cuing could be gauged. It appears that the earlier studies of inferentially cued recall should have included such a baseline rather than limiting their comparisons to appropriate versus inappropriate cues. The present results seem to confirm the idea that the differential effectiveness of cue types observed in previous studies was due to subjects' ability (or inability) to make an inferential connection between an already accessible sentence and a cue word or phrase. No support was found for the hypothesis that an otherwise inaccessible sentence can be retrieved via an inferentially derived cue not present at encoding.

Previous experiments that could be interpreted as supportive of the notion that inferential cuing can be facilitative (Anderson & Ortony, 1975; Barclay et al., 1974; Marschark & Paivio, 1977; Till, 1977) have been shown to lack the proper controls that might have allowed the conclusion that sentence recall can be enhanced by inferentially derived cues. The present experiment involved the same materials as some of the earlier studies so differences in materials cannot be considered a reason why inferential cuing was not effective here.

In general, presenting cue words at encoding did not produce the expected overall facilitation of abstract sentence recall. Either the cues used in this study were not capable of providing a facilitative context or the provision of an appropriate context is not the key to the concreteness effect. Concrete sentences were recalled more often than abstract ones,  $F(1, 64) = 318.90, p < .001$ . The concreteness effect was slightly enhanced when two list presentations were given, as evidenced by an interaction between sentence concreteness and number of list

presentations,  $F(1, 64) = 4.11, p < .05$ . With one exposure, the mean proportion of concrete sentence elements recalled verbatim was .38 while the mean for abstract sentences was .13. When two exposures were used the concrete and abstract means were .57 and .25, respectively. The analysis of gist recall did not show this effect. The implication is that the time parameters used in this experiment were such that concrete sentences could be more fully elaborated (both integratively and at the verbatim level) than abstract sentences when given extra processing time. It is possible that when dealing with concrete sentences the processing of wording, of the sentence as a whole, and of its general elements all continue when the number of encodings is increased. However, for abstract sentences only the processing of general sentence elements seems to continue as encoding opportunities are increased, while integrative processing and verbatim processing are discontinued or reduced at an earlier point in time.

There was also an interaction between concreteness and presence or absence of the cues at recall,  $F(1, 64) = 6.71, p < .02$ , indicating a tendency for the cuing effect to be greater for concrete (mean cued recall = .58, mean free recall = .38) than for abstract sentences (mean cued recall = .25, mean free recall = .13). One reason why Marschark and Paivio (1977) did not find this effect could be that the cuing paradigm they employed was not one that dealt with retrieval but instead involved making inferences from available sentences. On the other hand, the present experiment clearly involved a retrieval effect. Inferential cuing facilitated recall only when the cues were present at encoding, and there appear to be two possible reasons for this outcome. Cuing effectiveness may have been due to the cue word being explicitly inte-

grated into the memorial representation of the sentence. When presented at recall, the cue word could then provide direct access to the explicit sentence information. It may also be that while processing the sentences within the context of their respective cue words, subjects established a very specific context for each sentence--one that was closely related to the cue word. When the cue word was presented at recall it could readily reinstantiate the specific context which it helped form at encoding, thereby improving recall. An interpretation of the interaction between concreteness and presence or absence of cues at recall would necessarily be affected by the underlying reasons for the success of cued recall. Since the second experiment was designed to clarify the reasons for facilitative cuing effects, further discussion of this interaction will be deferred until that experiment has been described.

#### Experiment 2

The most important result in Experiment 1 was that when free recall performance was compared to inferentially cued recall no difference was observed unless sentences were encoded in the presence of the cues. This result is not completely consistent with Brunner's (Note 1) findings concerning cued recall of homographs. Brunner had subjects encode homographs using a context sentence for each that biased one particular meaning of the homograph. Each homograph was then compared to a number of feature words, some of which were consistent with the homograph meaning implied by the context sentence and others which were consistent with an alternative meaning. Recall was then cued with the feature words present at encoding and words which were not present but which

were consistent with one of the meanings of a homograph. He found that all cue words consistent with a homograph's originally encoded meaning were equally effective, regardless of whether they were present at encoding. Furthermore, recall cued in this manner was better than free recall and recall cued with words inconsistent with the originally encoded meaning of a homograph.

Brunner's results suggest that the reason the cuing effect was obtained in Experiment 1 only when cues appeared at encoding is that when sentences were processed in isolation subjects were not processing them within the appropriate context. It appears that providing an input cue helped induce a specific context which was highly appropriate for the cued recall test. This interpretation is consistent with other results concerning context and cued recall. Bobrow (1970) found that cuing the recall of homographs embedded in sentences was more effective if multiple presentations maintained the same semantic interpretation of the homographs. If multiple presentations induced different interpretations cuing recall was less effective. Building a representation based on a specific context was the best method for successfully cuing recall. The importance of reinstating the original encoding context at retrieval was demonstrated by Baker and Santa (1977). They discovered that recognition of key words was improved when they were encoded and tested in the same sentence frame. Recognition declined if a different sentence frame was used at the time of testing. This effect was strongest when using congruous, meaningful sentence frames and was attenuated when anomalous or incongruous sentence frames were used.

These studies are in line with the notion of encoding specificity which has recently been elaborated by Watkins and Tulving (1975). Re-

trieval is radically affected by reinstatement of the originally encoded context. If the encoding context is changed when retrieval is attempted, successful recall or recognition is not likely. Therefore, if subjects who process sentences in isolation do not readily form specific contexts that will be consistent with the recall cues, providing those cues at recall will not be helpful. This idea is consistent with the suggestion that in Experiment 1 cued recall of sentences encoded with cue words was effective because specific, reinstatable contexts were formed. A procedure was designed to test the idea that establishing a specific contextual interpretation of a sentence is important for inferential cuing of recall. The procedure was expected to provide a specific context for each sentence while allowing for later inferential cuing of that context.

#### Method

Design. All subjects performed an incidental learning task on each sentence but only half of the subjects received the inferential cues during recall. A free recall test was given to the remaining subjects. Once again sentence concreteness was a within subjects variable.

Subjects. Thirty-two subjects were recruited from the same source as that used in Experiment 1. Sixteen subjects were randomly assigned to one of the two recall conditions, cued or free recall.

Materials. The set of sentences from Experiment 1 which did not have a cue word typed above each sentence was used in the present study. The same random ordering of sentences was also used and the two sentences at each end of the list were treated as buffers and were not included in the scoring. A pair of words intuitively considered to be related to one of the sentences and likely to induce a contextual interpretation



consistent with the respective inferential cue was obtained for each sentence. For example, consider the sentence The container held the apples. The appropriate word pair was harvest, carry. The inferential cue word was basket. The word pairs were typed on a single page and arranged vertically so as to correspond to the order of sentence presentation. The inferential recall cues were the same as those used in Experiment 1 and were presented alphabetically arranged on a single page during recall.

Procedure. Groups of 2 to 5 subjects assigned to the same condition were told that they would be viewing a set of sentences. Each sentence was associated with a word pair and the subjects were requested to mark the member of the word pair that was best related to the overall meaning of the sentence. Sentences were consecutively exposed for 12 sec each. The lists of word pairs were then collected and instructions were given for an unexpected recall test. The free and cued recall instructions were identical to those used in Experiment 1 for subjects who did not see the cue words at encoding. Verbatim recall was encouraged but it was made clear that paraphrases, sentence fragments, anything that could be remembered should be written down. A maximum of 10 min was allowed for recall.

### Results and Discussion

The scoring measures used in Experiment 1 were applied to the protocols of the present experiment. Although analyses of variance were carried out for all three measures only the significance levels from the analysis of verbatim recall will be reported. Any new effects or effects that failed to replicate in the other two analyses are also reported.

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Mean proportion of sentence elements recalled according to verbatim and gist criteria and mean number of complete sentences recalled are shown in Table 2. The hypothesis that inferential cuing of recall requires a specific and consistent context to be established at encoding

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was strongly supported. Cued recall ( $\bar{M} = .27$ ) was generally twice as high as free recall ( $\bar{M} = .13$ ),  $F(1, 30) = 22.40$ ,  $p < .001$ . In the first experiment cuing had no effect unless the cues were presented with their respective sentences at encoding. The present result indicates that one important factor for successful cuing in the first experiment was the formation of a specific context during encoding that was reinstated at recall by providing context specific cues. Therefore, it appears that successful inferential cuing of sentence recall is highly context dependent. This result is consistent with a recent study by Anderson, Pichert, Goetz, Schallert, Stevens, and Trollip (1976). They constructed sentences such that each included a general term and was likely to be encoded on the basis of a specific instantiation of that term. Cuing sentence recall was more effective with the specific instantiation than with the general term. Although the general term was present in the linguistic input, the specific term had been integrated with the other sentence elements to form a specific context for the memorial representation of the sentence.

The present results also parallel the encoding specificity effects obtained with single words (e.g., Watkins & Tulving, 1975), and emphasize the variability of interpretations available when processing isolated

sentences. Not only can one induce different interpretations of single words but it appears that numerous interpretations of sentences (at least those used in this study) are also possible and can be controlled. The large inferential cuing effect found in this experiment attests to this notion and also to the idea that the appropriate context must be established at encoding so that an inferential cue related to that context can facilitate recall. Without consistent encoding and recall contexts inferential cuing may not aid recall.

A strong concreteness effect was obtained, with more concrete sentences being recalled,  $F(1, 30) = 27.42, p < .001$ . The size of the concreteness effect was greater under cued than under free recall conditions,  $F(1, 30) = 5.40, p < .05$ . This means that inferential cuing was more effective for concrete sentences than for abstract sentences, supporting the hypothesis that integrative processing is more extensive for concrete than for abstract sentences. This interaction is consistent with recent results obtained by Anderson, Goetz, Pichert, and Halff (1977) that supported the redintegration interpretation of the concreteness effect. Anderson et al. found that when concrete phrases were made more specific they were recalled and recognized with greater frequency. They concluded that when a more specific context was encoded and when more specific cues are used, the reinstatement of the original information is facilitated. The results of their experiment agree with the idea that a specific context is an important asset and that such contexts are especially available for concrete sentences.

It could be argued that the cuing by concreteness interaction was due to the particular word pairs used in this study. That is, the word pairs for the abstract sentences may have been less successful in

establishing a specific reinstatiable context as compared to the success of the word pairs for the concrete sentences. Two points should be made in regard to this argument. First, if the reason for the cuing by concreteness interaction was a fundamental difference in the quality of the word pairs the interaction should generalize across all scoring criteria. However, the interaction did not reach significance when the gist scores were analyzed, while the interaction was strongest for complete sentence recall,  $F(1, 30) = 8.77, p < .01$ . This pattern of results for the three different scoring measures corresponds to the concreteness by number of list presentations interaction observed in Experiment 1. The similarity is probably more than circumstantial. In the discussion of Experiment 1 it was suggested that the concreteness by number of list presentations interaction was not significant when gist scores were analyzed because for abstract sentences only general sentence elements receive full processing when extra encoding opportunities are available. For concrete sentences processing of wording and holistic sentence processing are given full attention as well. A similar effect could be responsible for the present cuing by concreteness interaction: the establishment of an appropriate context via word pairs may have occurred completely only for concrete sentences while for any abstract sentence only the general sentence elements were optimally integrated into the context implied by the word pair.

The second point to be made regarding the quality of the word pairs as a causal factor in the cuing by concreteness interaction is that if the word pairs for abstract sentences were less successful in establishing specific contexts, this would imply that it is inherently more difficult to produce a specific context for a particular abstract sentence.

Certainly this implication is consistent with the idea (an idea that is in agreement with the arguments presented here and by Anderson et al., 1977) that the concreteness effect is due to the difficulty involved in developing a specific encoding of an abstract sentence.

#### General Discussion

The results of the two experiments reported here have strong implications for two general issues. The first is the constructive nature of language processing. An important result of constructive processing is the formation of a memorial representation which contains both explicit and inferentially derived information. Attempts to demonstrate that retrieval of explicit information can be facilitated by inferential cues (e.g., Anderson & Ortony, 1975; Barclay et al., 1974) were shown to be inconclusive by the outcome of Experiment 1. However, when a specific context is provided at encoding such that the context can be reinstated with the aid of an inferential cue, then inferential cuing is facilitative.

The importance of contextual specificity has implications for isolated sentence processing. Although studies such as that of Barclay et al. (1974) have convincingly demonstrated how a sentence can provide sources of information that converge on a particular interpretation of a word, the present experiments show that the sentence as a whole is capable of inducing divergent interpretations. Unless a specific context is implied, subjects seem to form interpretations which are not consistent with the sets of inferences necessary to make the recall cues used in this study effective. Isolated sentences can be open to subtly different interpretations. Perhaps if presented in paragraphs or longer texts a specific context could be established for any of the sentences used here

thereby allowing a convergent interpretation and subsequent facilitative effects of inferential cuing.

It is possible that the word pair task used in Experiment 2 resulted in facilitative cuing because subjects were induced to more elaborately process the sentences than they would when only instructed to learn. Contextual specificity would not be an important factor. If this were the case one might expect that, at the simplest level, providing subjects with extra time to process the sentences should induce further elaboration. Contrary to this expectation the results of Experiment 1 revealed that number of list presentations had no effect whatsoever on the size of the cuing effect. Furthermore, the elaboration induced by the word pair task is not of a very general nature. Indeed, it is rather specific and involves elaboration of a particular context which is relevant to the inferential cue provided at recall. The constructive processing of a sentence seems to have to meet the requirement of forming a specific context and corresponding inferences so that appropriate inferential cues can be devised for use as retrieval aids.

The other general issue relevant to the results discussed here is the concreteness effect. Evidence was obtained which supports the prediction that inferential cuing would be more effective for concrete sentences than abstract ones since the former can be more integratively processed.

Paivio has argued on numerous occasions (e.g., Begg & Paivio, 1969; Paivio, 1971) that a fundamental difference between concrete and abstract verbal material is the verbatim nature of representations of abstract material. The dominance of the verbal code in processing abstract material is theoretically the reason for abstract representations being

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closely tied to actual wording of the input. The results of Experiment 2 are not consistent with this reasoning. If abstract sentences are primarily represented in verbatim form, then when a verbatim scoring criterion is used the difference between concrete and abstract sentence recall should be no greater than when a gist criterion is used. This expectation was violated by the inferential cuing results. With the verbatim measure, inferential cuing was more beneficial for concrete sentences than for abstract sentences. The analysis of gist scores did not indicate a significant difference in the effectiveness of inferentially cuing recall of concrete and abstract sentences. An important difference between concrete and abstract sentences is that when they are processed within a specific context only the general elements of the abstract sentences seem to be fully incorporated into the context. For concrete sentences, a more holistic type of processing, including actual wording, apparently takes place. The complete sentence is incorporated into the context.

Once a sentence has been represented within the confines of a known specific context, one can then facilitate retrieval by providing inferential cues which are consistent with that context. Those aspects of the sentence, whether they be holistic ideas or only sentence elements, which are elaborated with respect to the context can be recalled with the help of cues which allow the subject to reconstitute the original context. Isolated sentences can take on numerous interpretations and unless a particular one is specified it may be difficult to predict the nature of the inferences derived from the sentence. If the set of inferences can be reliably predicted the constructive nature of the

representation can be used advantageously; retrieval processes can be assisted by providing information not only about explicit parts of the sentence but also about the inferences derived from the sentence.



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## Footnotes

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Table 1  
 Mean Proportion of Sentence Elements Recalled at Verbatim and Gist  
 Scoring Criteria and Mean Number of Complete Sentences Recalled  
 (Experiment 1)

No. of List Presentations	Encoding Condition	Recall Condition	Scoring Criterion					
			Verbatim		Gist		Complete Sentence	
			C	A	C	A	C	A
			Sentence Type <sup>a</sup>					
			C	A	C	A	C	A
1	Cue	Cue	.57	.25	.65	.33	7.3	3.2
1	Cue	No Cue	.21	.06	.23	.07	2.4	0.6
1	No Cue	Cue	.40	.11	.46	.12	5.1	1.2
1	No Cue	No Cue	.36	.09	.42	.11	4.8	1.0
2	Cue	Cue	.81	.41	.89	.52	10.1	4.7
2	Cue	No Cue	.43	.16	.47	.18	5.4	1.3
2	No Cue	Cue	.54	.22	.60	.26	7.0	2.4
2	No Cue	No Cue	.50	.20	.53	.25	6.3	2.6

<sup>a</sup>C = Concrete; A = Abstract.

Table 2  
 Mean Proportion of Sentence Elements Recalled at Verbatim and Gist  
 Scoring Criteria and Mean Number of Complete Sentences Recalled  
 (Experiment 2)

Recall Condition	Scoring Criterion					
	Verbatim		Gist		Complete Sentence	
	Sentence Type <sup>a</sup>					
	C	A	C	A	C	A
Cue	.36	.17	.43	.27	4.8	2.0
No Cue	.17	.10	.20	.14	2.1	1.2

<sup>a</sup>C = Concrete; A = Abstract.