

Factors Influencing Paragraph Comprehension by Subjects  
with Left or Right Hemisphere Involvement

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An interesting difference between patients with left and right hemisphere involvement is frequently discussed in the literature assessing brain-damaged persons' ability to utilize context. For aphasic subjects, context has been attributed a generally facilitating effect, even when it is strictly verbal and ostensibly would increase length and complexity of the message to be comprehended (Pashek and Brookshire, 1982; Pierce and Beekman, 1983; Stachowiak, Huber, Poeck and Kerschensteiner, 1977; Waller and Darley, 1978). For example, Waller and Darley (1978) showed that prior verbal information allowing anticipation of paragraph content, presented alone or in combination with a picture, could improve aphasic subjects' factual paragraph comprehension. Additionally, Pierce and Beekman (1983) demonstrated that prior linguistic or extralinguistic (picture) cues could aid comprehension of sentences which require attention to different syntactic or semantic structures.

In contrast, most investigations of patients with right hemisphere lesions conclude that they cannot proceed beyond the literal in making contextual inferences (Brownell, Michel, Powelson and Gardner, 1983; Cicone, Wapner and Gardner, 1980; Myers and Linebaugh, 1981; Wapner, Hamby and Gardner, 1981; Winner and Gardner, 1977). For instance, Myers and Linebaugh's (1981) right hemisphere patients selected literal idiomatic interpretations more often than appropriate ones when the idioms occurred in a story context. In another investigation, right hemisphere damaged patients appropriately paraphrased isolated metaphors such as "He has a heavy heart" 85% of the time; however, they were as likely to select literal as metaphorical picture representations to correspond to these idioms (Winner and Gardner, 1977). The difficulty arose in associating idiomatic meanings with situations in which they would occur. Similarly, Cicone, Wapner and Gardner (1980) found that while patients with right hemisphere damage tended to misinterpret emotional reactions of characters in specified situations, their errors were logical and justifiable attributions when considered apart from the given context. The authors posited that for right brain damaged subjects, inference of emotion may be relatively intact, but that its application to an overall situation appears to be more difficult. Wapner, Hamby and Gardner (1981) drew a similar conclusion based on right-hemisphere-damaged patients retelling of stories requiring integration of emotional elements. Foldi, Cicone and Gardner (1983) suggested that this characteristic failure to integrate surrounding information may underlie socially inappropriate behavior of these patients in actual life situations.

However, several other studies have shown that right hemisphere subjects do not differ from normal controls in making certain contextual judgments. Stachowiak *et al.* (1977) found their right hemisphere group similar to normals when required to interpret idiomatic comments embedded in short texts. Similarly, Brookshire and Nicholas (1984) reported that right hemisphere patients demonstrated paragraph comprehension performance comparable to that of normal subjects. As a group, they were capable of understanding even indirectly-stated ideas from a paragraph context. Myers and Linebaugh (1981)

suggested that such inconsistent results might be based on differences in textual redundancy. They indicated that the idioms used by Stachowiak et al. (1977) only elaborated upon events directly explained earlier in the story; whereas metaphoric interpretation was crucial for story comprehension in their own experiment, because the information was not present elsewhere. Brookshire and Nicholas (1984) interpreted their findings in light of Myers and Linebaugh's explanation.

The present study of paragraph comprehension by subjects with right and left hemisphere involvement examines the notion of story consistency or redundancy. Specifically, we sought to determine whether the consistency of information provided by a paragraph, the nature of judgments required of the subjects (factual or inferential), or a combination of the two would influence comprehension of short story context.

#### METHOD

Subjects. Subjects were fifteen patients scheduled for anterior temporal lobe resection due to intractable seizures. Each subject had been identified as having a strongly lateralized seizure focus. Eight had right temporal seizure foci, and seven exhibited left temporal foci. All were strongly right handed as determined by the Lateral Dominance Examination (Reitan, 1966) and all showed left hemisphere speech dominance upon bilateral intracarotid sodium amytal testing. All experienced seizures that were partial complex/psychomotor in nature; varying in frequency, but multiple per week. Performance on a comprehensive presurgical neuropsychological test battery (Neuropsychological Battery for Epilepsy, Dodrill, 1978) ranged from mildly to severely impaired. The right group ranged in age from 18-38 ( $\bar{x}$ =25), and years of education from 11-16 ( $\bar{x}$ =12.3). Mean age and years of education for lefts were 27 (range 19-35) and 11.9 (range 9-16), respectively. Nine control subjects, ranging in age from 16-29 ( $\bar{x}$ =24) and years of education from 11-16 ( $\bar{x}$ =12.4) also participated. Six were student volunteers from a public high school health occupations class, and three were beginning graduate students in speech pathology. All were naive to the purposes of the experiment, reported normal hearing, and denied a history of neurologic symptoms or disease.

Materials. Stimulus materials were five sets of paired paragraphs. Each paragraph consisted of two simple sentences which set a mood (a biasing context), a neutral statement, and a final quotation spoken by one of the main characters. The paragraphs were roughly similar in length and syntactic structure. Pairs were constructed such that the mood implied by one of the paragraphs was highly positive, and for the other, highly negative. This contrast was achieved by substituting words of opposing emotional tone into otherwise identical lead sentences. Additionally, for each pair, the content of the final quotation was identical and positive. In this way, a Consistent and an Inconsistent Paragraph Condition were established. In the Consistent Paragraph Condition, the final quote was congruent with the attitude conveyed by the positive paragraph. In the Inconsistent Paragraph Condition, the positive quotation was paired with the negative biasing context. Table 1 contains examples of paragraph pairs.

Each paragraph was followed by a series of eight spoken yes/no questions designed to assess comprehension. The questions were of two types, inferential and factual. Question type was independently judged by a third speech pathologist, whose classifications agreed with those of the first author in all cases.

Questions were written so that there were four contrasting pairs per paragraph, for an equivalent number of yes and no answers. (See Table 1 for examples of the questions.) Question order was randomized for each pair of contrasting paragraphs, but was identical within pairs.

Table 1. Example of contrasting paragraph pair. Word contrasts are under-scored.

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Consistent Paragraph

Nan Smith invited her new neighbor, Mark, to a party. He told hilarious stories. Everyone enjoyed listening. Nan's husband said to her, "Good decision. He's really the life of the party."

Inconsistent Paragraph

Nan Smith invited her new neighbor, Mark, to a party. He told boring stories. No one enjoyed listening. Nan's husband said to her, "Good decision. He's really the life of the party."

Questions (I = Inferential; F = Factual)

- F 1. Did Nan invite her boss to the party?
  - I 2. Did Nan's party go well?
  - F 3. Did the guests dislike Mark's stories?
  - F 4. Did Nan invite her neighbor to the party?
  - I 5. Might Nan invite Mark again?
  - I 6. Did Nan's party go poorly?
  - F 7. Did the guests like Mark's stories?
  - I 8. Might Nan refuse to invite Mark again?
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Procedures. The paragraphs were presented to subjects in a pseudorandom order, with the condition that members of a pair were not adjacent to each other. Subjects were told that they would read each paragraph aloud, after which the experimenter would ask them some questions which could be answered yes or no. Before the oral reading, subjects were reminded to read each card silently in order to familiarize themselves with the content of the paragraph. Following the reading, the card was collected and the questions were asked in the predetermined order.

## RESULTS

Errors were classified according to paragraph and question type (consistent factual, consistent inferential, inconsistent factual, and inconsistent inferential). Group mean errors for these four combinations are shown in Figure 1. An analysis of variance with repeated measures on the error type factor was run to examine group differences. The method of unweighted means was employed due to unequal group size (Winer, 1971). The groups by error type interaction was statistically significant at the .05 level ( $F=3.05$ ;  $df$  6, 63).

CF - consistent factual  
 CI - consistent inferential  
 IF - inconsistent factual  
 II - inconsistent inferential

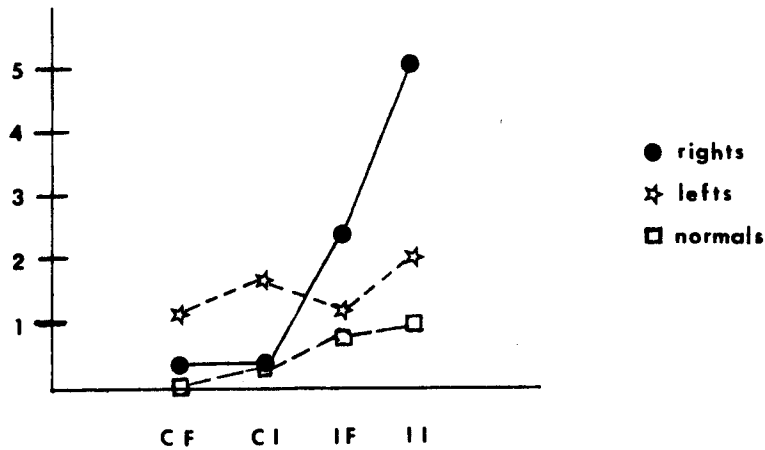


Figure 1. Group mean errors for four paragraph/question combinations.

Results of Scheffe post hoc analyses of simple interaction effects are shown in Table 2. There were no significant differences among the proportions of the four error types within the left hemisphere group or the normal group. Subjects with right hemisphere involvement made more errors on inconsistent paragraphs than consistent paragraphs, regardless of question type. Examining the between-group within-task patterns indicates that subjects with left hemisphere involvement were significantly more impaired than normals on inferential questions, whether these were asked about inconsistent or consistent paragraphs. They did as well as normals on factual questions which followed either consistent or inconsistent narratives. Right hemisphere subjects, by contrast, were worse than normals at answering both factual and inferential questions when they followed inconsistent paragraphs, but performed no differently from normals when answering any questions based on consistent paragraph information. Performance of right and left impaired subjects did not differ for any error type.

Table 2. Scheffe post-hoc comparisons of means for the groups by error type interaction. Homogenous subsets are underscored. CF = consistent factual, CI = consistent inferential, IF = inconsistent factual, II = inconsistent inferential.

WITHIN GROUPS, BETWEEN ERROR TYPES					BETWEEN GROUPS, WITHIN ERROR TYPES				
Right	II	IF	<u>CI</u>	<u>CF</u>	IF	Rt	<u>Lt</u>	<u>Nl</u>	
Left	<u>II</u>	<u>CI</u>	<u>CF</u>	<u>IF</u>	CF	<u>Lt</u>	<u>Rt</u>	<u>Nl</u>	
Normal	<u>II</u>	<u>IF</u>	<u>CI</u>	<u>CF</u>	II	<u>Rt</u>	<u>Lt</u>	<u>Nl</u>	
					CI	<u>Lt</u>	<u>Rt</u>	<u>Nl</u>	

## DISCUSSION

This study examined the effects of paragraph consistency on comprehension of facts and inferences by subjects with right or left hemisphere involvement. The results further delimit the facilitative effects of context described in the literature for left hemisphere subjects, demonstrating that narrative context may not be uniformly beneficial. While they were unimpaired at answering factual questions even when the information provided in the story was contradictory or inconsistent, left hemisphere subjects did more poorly than normals at responding to inferential questions.

Additionally, the results indicate that subjects with right hemisphere involvement may not be uniformly impaired at interpreting and integrating contextual information. When the information in the narrative was highly consistent, the right hemisphere subjects had considerable success answering even inferential questions. This indicates at least a partially preserved ability to process attitudinal linguistic information within a paragraph context. Our findings for the right hemisphere group, in agreement with Brookshire and Nicholas (1984) and Stachowiak *et al.* (1977), but inconsistent with those of some other investigators (e.g. Cicone *et al.*, 1980; Myers and Linebaugh, 1981; Wapner *et al.*, 1981) fit well within the explanatory concept proposed by Myers and Linebaugh (1981). To further test this redundancy explanation, paragraphs varying along a consistency continuum should be employed.

Clinically, different approaches may be useful when interacting with subjects with right and left hemisphere involvement. For right hemisphere subjects, redundancy and consistency can be exploited to aid paragraph-level comprehension. For left hemisphere subjects, however, contextual cues may be less beneficial if subjects are required to draw inferences from the material than if factual responses are expected.

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