

Parsing Ability and Reading Comprehension in a Second Language:
Are the Two Related?

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Many studies of reading comprehension have dealt with how a text's syntax and semantics interfere with or assist the reader in getting meaning. These effects have typically been observed in the product of the reading process, reading comprehension. However, there has been little research into how these phenomena pose problems within the reading process itself. An investigation of parsing as a sub-process of reading which utilizes reader's syntactic and semantic competence may help us better understand how this competence affects the reading process as a whole. Parsing refers to the process of segmenting sentences into units of meaning. By doing so, readers process incoming data economically as memory and processing constraints limit the amount of data which can be dealt with at one time.

This paper discusses the research on parsing and its possible relation to reading comprehension. It also reports a study investigating parsing ability in native and nonnative speakers and the relationship between parsing ability and reading comprehension in a second language (L2). There have been no studies dealing directly with the relationship between the ability to parse and reading comprehension in a foreign or second language. However, the strong influence language proficiency seems to exert on L2 reading suggests that the ability to parse could be a decisive factor in reaching the threshold level of linguistic competence thought by Cummins (1979) to be necessary for fluent reading (Goodman, 1970; Clarke, 1980).

The Role of Constituent Structure

Parsing can be viewed as an important component of the reading process only if the product of parsing is seen as a significant unit. There is evidence suggesting that the product of reader parsing conforms to the syntactic units that constitute clauses or sentences. In other words, the units of constituent structure may correspond to perceptual and conceptual units. Readers perceive the structure of language as hierarchically organized into syntactic units which correspond to semantic structures mediated via these units. Clark and Clark (1977) refer to the constituent as the surface realization of underlying propositions. Therefore, it seems appropriate that we "isolate and identify constituents in working memory for they are useful in building underlying propositions." (p.55)

Bever (1970) hypothesized that language is perceived in terms of its linguistic structure. When we encounter language our perception of it is in terms of an internal sentence structure consisting of subjects, verbs, objects and modifiers. Fodor and Bever (1965) observed in their "click" experiments that "subjects tended to maintain the integrity of grammatical units." They concluded that "the unit of speech perception corresponds to the constituent." (p. 415) Studies involving the Eye-Voice-Span (Schlesinger 1968; Levin and Turner 1968; Levin and Kaplan 1968; Rode 1974-1975) have reported similar findings. Schlesinger notes in his study that reading passages are perceived and segmented in terms of syntactic structure. Further support is provided by Wildman, Martin, and Kling (1978-79) who investigated eye

movements in the reading process. They observed that forward eye movements were affected by immediate constituents.

The notion of the constituent as a perceptual/conceptual unit in reading comprehension has also been shown by studies investigating readers' pauses while reading aloud. Johnson (1970), Kleiman, Winograd, and Humphrey (1979), and Schreiber (1980) have noted that pausal units usually correspond to syntactic units. The ways in which we organize information for storage in memory may also involve major constituent structure. There is evidence which suggests that constituent structure determines the segmentation of information in memory (Aaronson and Scarborough, 1977; Jarvella, 1971; Anderson and Bower, 1973).

Given that constituents may have some conceptual and perceptual reality, we now need to ask the following questions:

- 1) What place, if any, does parsing have in the reading process as a whole?
- 2) What are the roles of syntactic and semantic competence in the parsing of written text?
- 3) Does parsing aid the reader in achieving comprehension?

Parsing in L1 Reading Models

Current reading process models conflict as to how readers parse. Goodman's (1976) model is typical of models which stress top-down processing of incoming data. One might view such a model as being semantically based. The reader's focus is on extracting meaning from text using the least quantity of visual cues. To do this, readers must use their knowledge of the context. If necessary, readers would parse at the proposition level by focusing their attention on content words, determining the

propositions they are likely to occur in, constructing a workable proposition, relating it to previous propositions, and then moving on.

In models which stress bottom-up processing, such as Clark and Clark's (1977), the reader is initially more engaged with processing the local elements of the text. Contextual knowledge is utilized after analysis of the language. One might view this model as being syntactically based. Parsing occurs at the syntactic level. Sentences are parsed into their syntactic constituents, the constituents are labeled as to their functions in the sentence, underlying propositions are determined, a hierarchy of propositions is established, the sentence is interpreted, and the process is repeated.

De Beaugrande's interactive model (1981) stresses the flexibility of the reading process:

Reading is seen as an interaction of phases of processing dominance, i.e., as a correlation of processing types sharing the processor's cognitive resources in varying distributions. The phases are: parsing (identifying the grammatical dependencies of the surface text), concept recovery..., idea recovery..., and plan recovery. Any dominant phase freely consults the results of non-dominant ones, so that grammar is continually correlated with meaning, meaning with action planning, and so on. I do not see these phases receiving dominance in a neatly fixed sequence; instead, dominance is probably passed back and forth frequently...(p. 286)

The way in which grammatical dependencies, i.e., phrases, are parsed can be represented by means of an augmented transition network (ATN). The ATN is essentially a phrase structure grammar which describes the syntactic parsing of sentences. This description is in terms of the psychological processes used to organize the words in a sentence into their underlying syntactic

relationships (Kaplan, 1975; Woods, 1970). The ATN describes how readers use their knowledge of syntax to predict upcoming words in the sentence with respect to syntactic class and other characteristics (Stevens and Rumelhart, 1975).

The ATN deals with parsing at the syntactic level. However, the semantic properties of texts also play a role in the parsing of sentences. Readers may attend to semantics after each phrase of the sentence, after the whole sentence, or they may bypass syntactic parsing altogether using top-down processing strategies to derive meaning. All of these strategies are possible according to De Beaugrande. The goal of such processing is not syntactic analysis but "building a model of a textual world" which "is reconstituted with various amounts of prior knowledge and assumptions that might reasonably apply to such a world." (p.287) To build such a text-world model, readers, once the sentence has been syntactically parsed into grammatical phrases, determine the concepts expressed by those phrases. These concepts can be viewed as case relations, such as "agent of", "location of", "attribute of" etc., and act as instructions to activate knowledge in memory, as well as code the semantic function of the grammatical phrase. It appears that it is at this point in the parsing process the reader's semantic competence plays a major role.

The semantic integration model (SIM) proposed by Vasquez, Glucksberg, and Danks (1977-78) helps further clarify the roles of syntax and semantics in the parsing process. The SIM is a "general description of the major processes in oral reading" (p.187) in which parsing is affected by both syntactic and semantic constraints. Higher levels of processing, the conceptual

integration and comprehension of incoming data, take time thereby forcing readers to pace their reading in order to facilitate this processing. An essential pacing strategy is parsing which can then be seen as an integral strategy in the readers' attempt to comprehend and conceptually integrate incoming data. Syntactic constraints may affect pacing, and thereby parsing, yet are subservient to semantic constraints which more directly influence conceptual integration and comprehension. De Beaugrande's model of the reading process also suggests a similar interplay of dominant and non-dominant phases of processing.

De Beaugrande's description of the parsing process seems the most adequate of the three models presented for three reasons: 1) It provides for the syntactic parsing of sentences, through the ATN, in a thorough and psychologically plausible manner. (Stevens and Rumelhart, 1975); 2) It suggests a major role for semantic knowledge in the parsing process as it explains how this knowledge intervenes in the process through the reader's determination of concepts expressed by grammatical phrases; 3) It proposes an interactive operationalization of syntactic and semantic based strategies in the parsing process which is asymmetrical, thus allowing for variables such as the reader's cognitive resources, demands, motivation and the relevance of the text to current tasks and goals (De Beaugrande, 1981)

The Effects of Parsing on L1 Reading Comprehension

Models of the reading process attempt to represent what skilled readers do as they read. The models described above present parsing as a part of the reading process. Therefore,

there should be evidence that skilled readers parse and that readers not proficient at parsing are impeded in the reading process.

Parsing is a term seldom used in reports of research into the relationship between readers' syntactic and semantic competence and reading. Often, the term "chunking" is used instead. There is little difference in the two terms, however, if parsing is to include both a syntactic and semantic perspective. Parsing has also been included under the broader, and sometimes more ambiguous term "knowledge of sentence structure." Again, knowledge of sentence structure would seem to be synonymous with parsing in this sense.

That skilled readers parse has been suggested in studies by Weiner and Cromer (1967), Epstein (1967), Anglin and Miller (1968), Wong (1972), McFarland and Rhodes (1978), and Martinez, Ghatala, and Bell (1980). Furthermore, Cromer (1970) has presented evidence that readers who fail to parse may have difficulty comprehending. Because of these findings, researchers have suggested that poor readers should be instructed in the recognition and manipulation of sentence structure, assuming that this would help students to parse (Oaken, Wiener, and Cromer, 1971; Denner, 1970; Wienstein and Rabinovitch, 1971; Mason and Kendall, 1979; and Straw and Schreiner, 1982). An investigation of this assumption carried out by Weaver (1979) concluded that training in sentence organization skills improves reading comprehension in both poor and skilled readers. The major skill Weaver refers to is the ability "to parse and encode meaningful units larger than the single word." (p.130) Similar results have

been reported in a study which involved training in sentence combining and kernel identification training (Neville and Searls, 1985).

In other studies supporting the hypothesis that skilled readers parse, readers have been presented with "parsed prose", i.e., prose which has been pre-segmented into constituents. Poor readers showed an improvement in comprehension when reading parsed prose (Levin, 1973). Skilled readers also improved in their comprehension in studies by Stevens (1981) and Brozo, Schmelzer, and Spires (1978). However, a study by Carver (1970), concluded that skilled readers did not benefit from parsed prose.

The effects of prosodic cues on parsing were studied by Kleiman, Winograd, and Humphrey (1979) who concluded that the lack of prosodic cues in written language which aid in parsing (intonation, stress, and rhythm) may contribute to reading difficulties in children. Schreiber (1980) noted that fluent reading is enhanced by readers utilizing parsing strategies other than those based on prosody.

In summary, for L1 reading, the evidence cited above suggests three hypotheses relevant to the subject of this study. First, the product of parsing can be defined as a major sentence constituent due to its conceptual unity and its usage as a surface realization of underlying meaning. Second, parsing is a process in reading which utilizes readers' syntactic and semantic competence. Third, skilled readers are proficient parsers while the inability to parse proficiently is a characteristic of poor readers.

Parsing and L2 Reading

So far, the focus of much of this discussion has been on parsing in the reading process of the skilled L1 reader. Poor L1 readers have been discussed only in terms of how, not why, they differ from skilled readers. Pike (1976, 1977) points to an analogy between older and younger children and skilled and poor readers. Since reading comprehension involves the organization of words into meaningful chunks (parsing), the reading difficulties of children and poor readers indicate a lack of development in linguistic competence. Pike goes on to suggest that there may be a threshold of language proficiency which is a prerequisite for reading development. Although, as Pike points out, linguistic competence is no guarantee of reading proficiency, the analogy is an interesting one to keep in mind because of its possible application to L2 reading.

L1 models of the reading process seem to be transferable to L2 reading (Goodman, 1981; Clarke, 1981). One can assume, therefore, that the different aspects of parsing in L1 reading already discussed are applicable to reading in a foreign or second language as well. Some evidence for this is reported by Devine (1981) in a study of the developmental patterns of native (NS) and nonnative (NNS) speakers. Using miscue analysis, Devine concluded that L2 readers process larger units of language, a task to which parsing is a prerequisite, as they become more proficient in the L2. Clarke (1981) provides further evidence for the transferability of reading process models in a study of native Spanish speakers reading in Spanish and English. The subjects in the study appeared to be adopting similar strategies

in reading the L1 and L2.

Difficulties in L2 reading seem to be caused by a lack of linguistic competence in the L2 and a lack of appropriate schemas for interaction with the written texts of target culture (Grove, 1981). The ability to parse in L2 reading would seem to be directly related to linguistic competence, as in L1 reading. As mentioned, there have been no studies dealing with the relationship between the ability to parse and reading comprehension in a second or foreign language. However, the strong influence language proficiency seems to exert on L2 reading suggests that the ability to parse could be a decisive factor in reaching the threshold of linguistic competence thought by Cummins (1979) to be necessary for fluent reading (Goodman, 1970; Clarke, 1980). Berman (1984) notes L2 readers have difficulty registering the propositional content of a sentence as they must first recognize the basic constituents of sentences and then determine the propositions encoded within them. Alderson and Urquhart (1984), in their postscript to Berman's (1984) article, state that:

Berman's main interest is in factors affecting readers' ability to parse sentences into their main constituents, and thus to derive meaning from these sentences. (p.157)... it would be interesting to discover whether FL [L2] readers differed in their ability to parse, particularly when faced with unfamiliar structures, and whether this ability correlated with the reading ability.(p.158)

Purpose of This Study

Mason and Kendall (1979) investigated differences in L1 parsing ability between adults and children and the effects of

pre-parsed texts on reading comprehension. Parsing ability was assessed through a pause location task. Subjects were required to read a passage and mark where they would pause if they were reading the text aloud. Results of the first experiment indicate that young children have difficulties distinguishing meaningful intrasentential units. In the second experiment, subjects were presented unparsed and pre-parsed texts. The children's reading comprehension scores improved under the pre-parsed condition while good comprehenders' did not. Mason and Kendall suggest that, in normal reading tasks, poor readers do not properly parse more complicated sentences.

Cioffi (1982) investigated differences in L1 parsing ability between skilled decoders, i.e. readers with an adequate knowledge of word meanings but difficulties in comprehending, and good comprehenders. As in Mason and Kendall's study, parsing ability was assessed through a pause location task. Good comprehenders marked more pause locations than skilled decoders; however, there were no significant differences in the quality of the locations marked by the two groups. That is, skilled decoders were shown to be almost equally sensitive to grammatical structure when reading. Cioffi concludes, therefore, that differences in reading comprehension ability between skilled decoders and good comprehenders are more likely due to factors other than parsing ability.

As shown above, there are conflicting opinions concerning the role of parsing ability in L1 reading comprehension. Neither of the studies, however, directly address the question of whether

readers who have difficulty parsing a text also have difficulty in comprehending the same text. The children in Mason and Kendall's second experiment were not given the parsing test. Their comprehension improved under the pre-parsed condition, but there is no direct indication that their lower scores under the unparsed condition were related to parsing ability. In Cioffi's study, poor and good readers were discriminated by their scores on the Stanford Diagnostic Reading Test. Their comprehension of the text in the parsing test was not measured. Here, there is little indication that the poor reader's comprehension was not related to their parsing ability. The following study attempts to show the relationship between parsing ability and reading comprehension in a more direct manner by testing both abilities on a single text. This study also differs in that it investigates the relationship between parsing ability and reading comprehension in a second language. If the ability to parse is a reflection of linguistic competency, then one would expect L2 learners to be, in general, poorer parsers. Also, one would expect parsing ability to vary with L2 proficiency.

To summarize, the research questions for this study are:

1. Are students of English as a second language (ESL) poorer parsers than native English speaking students?
2. Do L2 readers who have difficulties parsing a text also have difficulties comprehending that text?

METHODS

Subjects

Thirty native American English speaking (NS) college students and sixty-eight nonnative speaking (NNS) college students participated in this study. The NS and NNS groups were composed of undergraduate and graduate students from the University of Hawaii. The majority of the NNS students (98%) were from Asia and the Pacific Basin and had an average age of 25 years. The NNS students were currently enrolled in an advanced course in academic reading for foreign students given by the English Language Institute at the university. Placement into this course is based on scores from a battery of placement tests. Students scoring below the twelfth grade reading level are usually required to take the course. The average reading grade level for these students is approximately ninth grade.

Materials

A pause location task, where subjects are required to read a passage and mark where they would pause if reading the passage aloud, was used to assess parsing ability. Johnson (1970) argued for the validity of this task claiming it taps subjects' awareness of the prosodic aspects of parsing and also reflects the psychological reality of grammatical phrases. Cioffi (1982) utilized the task as a measure of parsing ability and suggested further evidence for the task's validity. In Cioffi's study, anecdotal reports collected from the subjects revealed two major strategies for locating pause locations: 1. recognition of the

prosodic characteristics of spoken language; and 2. recognition of semantic relationships among words.

Three texts were chosen for use in the study from a kit of graded reading materials, an easier text of 351 words, a moderately difficult text of 354 words, and a difficult text of 358 words. Text selection was based on the subjects' current level of reading as determined by their progress in the graded materials. The mean for this level of progress was used for selecting the moderately difficult text, "Customs Men on the Job" (C). The easier text, "Meatless Meats" (M), was -1 S.D. from the mean and, the difficult text, "Clean Water, of Course?" (W), was +1 S.D. from the mean. Text difficulty was determined by the text's ranking in the graded kit. Care was also taken to choose texts which were as culturally unbiased as possible, hence the rather neutral topics of the texts.

Excerpts from the three texts, M (168 words/12 sentences), C (162 words/8 sentences), and W (180 words/7 sentences) were selected for the three parsing tests. The two criteria for excerpt selection were length and coherence.

The texts in their entirety were used in the three reading comprehension tests which featured a fifty item cloze format (every 7th word deletion ratio). Unaltered sentences served as lead-in's and lead-out's for the tests. Support for the validity of the cloze test as a measure of reading comprehension is provided by Oller (1979). Oller reports the high correlations between cloze scores and multiple-choice tests found in studies by Ruddell (1965), Potter (1968), and Anderson (1971) and that these high correlations apply to NNS subjects as well (p.357).

Split-half reliability coefficients, corrected by the Spearman-Brown Prophecy formula, for the three cloze measures , and Kuder-Richardson 21 reliability coefficients for the the parsing measures are presented in Table 1.

Table 1: Reliability Coefficients

Text	Test	
	Parsing	Cloze
M	.67	.82
C	.72	.60
W	.74	.79

Procedure

All three parsing tests were administered to the thirty NS subjects. Each test package consisted of a set of instructions, a warm-up text, and the three excerpts described above. A warm-up task was performed before taking the test in both the NS and NSS administrations. Subjects were instructed to read the warm-up text silently. Before this reading, as with all other parsing tasks in this study, the subjects were instructed to raise their hands if they were having difficulties with any of the vocabulary in the texts. After doing so, the administrator explained the meaning of the item. However, it was rare that subjects asked for vocabulary explanations. The subjects were then instructed to form pairs for the task itself. One of the subjects in each pair was instructed to read the text aloud. The other member of the

pair marked with the text where the person reading aloud paused. The procedure was then reversed. The NS subjects were then instructed to read one of the first of the three excerpts (several times, if necessary) in order to familiarize themselves with the content. After the initial reading they were instructed to read the text again and mark with a slash on the text where they would pause if they were reading the text aloud to someone. This procedure was repeated with the remaining two excerpts.

The eighty NNS subjects were given a parsing test packet consisting of a set of instructions, the warm-up text, and one of the three excerpts. Excerpt selection for individual subjects was determined randomly. Procedures for the NNS administration were the same as those mentioned above for the NS administration. Only the NNS subjects were given the cloze tests. Subjects who had parsed a particular text excerpt were given the cloze test incorporating that text in its entirety. The test was administered five days after the parsing test. Procedures for the development and administration of the cloze tests follow the guidelines established by Oller (1979).

Analysis

A parsing score was determined for each subject and, in the case of the NS subjects, for each text parsed. The scores were based on the number of marked pause locations in agreement with at least 50% of the NS subjects (HITS) and the number of incorrectly marked pause locations (MISSES). MISSES were calculated into the score using a formula developed by Manning (1985). This formula was designed to eliminate the effects of

guessing. Thus, a subject with, for example, 8 HITS and 9 MISSES would have a lower parsing score than a subject with 8 HITS and 2 MISSES. As the number of correct HITS for each test differed, the parsing scores are presented as percentages. The reading comprehension tests were scored using the acceptable word method and are also reported in percentages. Answers which were grammatically incorrect were marked incorrect as were all blanks which contained more than one word. Correct answers were those which were grammatically correct and semantically acceptable as determined by a group of 4 native speaker graduate students in ESL.

NNS subjects were then grouped according to which of the three reading comprehension tests they took. Parsing test scores for members of each group were then averaged as were their scores on the reading comprehension tests. Finally, Pearson Product-Moment correlation coefficients were calculated between each group members' scores on the two tests.

RESULTS

The results of the parsing tests comparing the NS and the NNS groups can be seen in Table 2.

Table 2: NS/NNS Parsing Scores

	Test					
	M		C		W	
	NNS	NS	NNS	NS	NNS	NS
n	26	30	22	30	20	30
k	11	11	12	12	16	16
x (%)	63	79	48	75	57	80
SD (%)	24	21	24	17	21	15
difference btw means	16		27		23	
T observed	2.640*		4.623*		4.817*	

*p < .05

Three main points emerge from Table 2. The first is that the NS subjects seem to have nearly equivalent scores on the parsing tests. That is, there were no observable differences between their scores on the three tests nor does there appear to be much variance within the group as can be noted by the relatively low standard deviations. The second point is that the NS subjects scored significantly better than the NNS subjects on all three tests. The observed T values are high enough to ensure that the probability of these differences between the NS and NNS subjects being due to chance alone is less than 1 in 20. The third point to notice is that there are differences between NNS scores on the moderately difficult text (C) and the difficult text (W). This would seem to indicate that text difficulty may not affect

parsing ability. However, it will be seen from the reading comprehension scores that the text used for test C was, in fact, more difficult than the text used for test W (from Table 3 below; Test C \bar{X} = 39%, Test W \bar{X} = 42%).¹ This disparity in the grading of the two texts need not concern us to any great extent, however. The fact remains that three texts of differing degrees of difficulty were used in the study.

Table 3 shows a comparison between NNS results on the parsing tests and NNS results on the reading comprehension tests and the correlation coefficients for the tests within each group. For the sake of clarity, test C scores and test W scores are reversed.

Table 3: NNS Parsing/Reading Comprehension Scores

Test	Parsing		Reading		Correlation
	\bar{X}	SD	\bar{X}	SD	
M (%)	62	24	53	13	.258, n.s. ^a
W (%)	57	21	42	11	.345, n.s.
C (%)	48	24	39	9	.174, n.s.

^a
n.s. = not significant

Here it can be seen that, although reading scores and parsing scores seem to fluctuate similarly, there were no significant correlations at the $p < .05$ level between the measures, i.e., the observed correlation coefficients were not sufficiently large to be 95% sure that they occurred for other than chance reasons.

DISCUSSION

In this section, direct answers to the research questions will be given first. This will be followed by a restatement of the research questions and a discussion of the results. From the results shown above it appears that the first research question can be answered affirmatively while the second question cannot be given a conclusive answer.

1. Are students of English as a second language poorer parsers than native speaking college students?

The consistency of the NS subjects' scores gives good indication that the test is adequately measuring a skill that native speakers are proficient at. The lower NNS subjects' scores gives us some indication that ESL students, who have less linguistic proficiency, are poorer parsers, and, the variance in their scores across tests suggests poor parsing may be related to reading comprehension.

2. Do L2 readers who have difficulties parsing a text also have difficulties comprehending that text?

The results of the comparison between parsing scores and reading comprehension scores did not show a significant correlation between the two skills. One possible explanation for this is that parsing ability is not a significant factor in the reading comprehension of students at this level. The L2 readers in this study may have been utilizing strategies other than parsing in order to derive meaning from the texts. However, another explanation is also possible. The reading process is exceedingly complex and, while the evidence suggests parsing is a

component of this process, its relationship to the process as a whole may not be detectable through the instruments utilized in this study. In both Mason and Kendall's and Cioffi's studies, reading comprehension was measured by two standardized multiple-choice formatted measures, the Metropolitan Achievement Test and the Stanford Diagnostic Test (SDT). The subjects in this study had taken the SDT three months previous to the study. A post-hoc analysis of SDT and parsing scores showed significant correlations between SDT and parsing scores for two of the three test groups; group M, .484 $p < .01$ and group W, .338 $p < .05$. This helps to explain Mason and Kendalls' conclusions, yet contrasts with the results of this study which has attempted to clarify in a more direct manner the relationship between parsing ability and reading comprehension. This study has shown that high-proficiency L2 learners may have difficulties parsing and thereby distinguishing meaningful intrasentential units while reading. It also appears, however, that these difficulties may have little relationship with the reading comprehension of these learners.

Further Research

The generalizability of this study is limited by the relative homogeneity of the subjects' reading proficiency level. Research into parsing and reading comprehension needs to be undertaken with subjects at lower and higher levels of reading proficiency before it can be more conclusively stated that the two skills are are unrelated.

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There are essentially two possible explanations for this disparity. First, the criteria used for the initial selection of the texts to be used for the tests could have been faulty in relation to the subjects in this study. The grading scale for the materials used in this study is based on the capabilities of secondary school aged native speakers. Second, the content of text W allowed for a greater number of acceptable answers as judged by native speakers, and might have been a more familiar topic to the subjects. Text C was about the workings of the U.S. Customs Bureau while text W was about the causes of water pollution.

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