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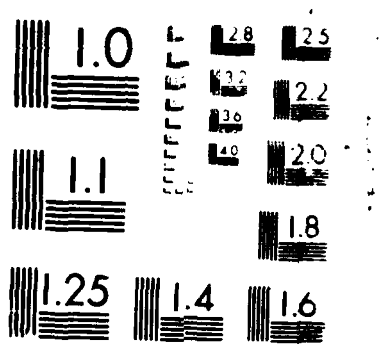
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Technical Memorandum 14-87

TEXT PROCESSING: THE ROLE OF READER EXPECTATIONS AND BACKGROUND KNOWLEDGE

Deborah P. Birkmire

August 1987
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The role of reader expectations and background knowledge in determining the flexibility of text processing strategies was investigated. Two groups of undergraduates, who differed in knowledge of physics principles, read two texts about laser annealing and parakeets. Sentences were identified as high, intermediate, and low in each text structure hierarchy. Subjects were told to expect either an essay, short-answer, or same-different judgment test. Texts were presented sentence by sentence under subject control on a video terminal. Reading rates were recorded. Written tests were administered. Processing strategies changed as a result of different expectations of memory demands. However, these changes appeared to be subtle shifts, rather than dramatic differences, in time spent reading information at various text structure positions. Additionally, processing strategies and memory for text information were not linearly related.

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TEXT PROCESSING: THE ROLE OF READER EXPECTATIONS AND BACKGROUND KNOWLEDGE

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August 1987

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CONTENTS

Text Processing: The Role of Reader Expectations and Background Knowledge

Objective

Advanced technology has made military equipment increasingly more sophisticated and complex. Often, however, the personnel expected to operate this equipment lack the skills necessary to do so efficiently. One proposed solution to this problem is to adopt innovative training techniques. To that end, it would be beneficial to learn more about the materials used for training, as well as the materials that present operation and maintenance information.

Most training, operation, and maintenance information is presented in the form of text. The cost of poorly written text is enormous because it makes performing the specified tasks difficult, time-consuming, and error-prone. Experts commonly agree that training, operation, and maintenance texts need to be improved. However, there is not enough known about how text is structured and used to tell writers how to improve it. The research presented in this report addresses these issues.

Introduction

People typically do not remember everything they read from text. Nor is what they remember usually in the exact form as what they read. However, text recall is far from a random process. There seems to be a great deal of similarity among individuals regarding what is remembered and what is forgotten from a given text. Further, this pattern of text recall is influenced by numerous factors, including the structure or organization of information within a text, the reader's prior knowledge, and the reader's purpose or goal for reading.

One factor influencing what text information is learned and recalled is the relative importance of the information within the text structure (Bartlett, 1932; Gomulicki, 1956; Johnson, 1970). In general, people tend to remember what is important and to forget the unimportant. Earlier studies relied on either subjects' subjective judgments or normative ratings to assess the importance of text elements. More recently, attempts have been made to develop a theoretical framework for specifying the importance of text elements and how text elements relate to one another. Included in these lines of research are the formulations of story grammars (e.g., see Mandler & Johnson, 1977; Rumelhart, 1977) and linguistic text analyses (e.g., see Grimes, 1975; Kintsch, 1974; Meyer, 1975, 1985; van Dijk & Kintsch, 1983). In general, text structure has been treated as an inherent property of the text.

In contrast to the research on text structure that generally assumes text structure is an inherent property of the text, research on prior knowledge focuses on the cognitive structures and processes a reader brings to the reading task. Numerous investigations have shown that the interpretation and memory of a text can be influenced by the perspective assumed by the reader (Pichert & Anderson, 1977), by the reader's cultural background (Steffensen, Joag-Dev, & Anderson, 1979), by the reader's major area of study (Anderson, Reynolds, Schallert, & Goetz, 1977), and by the knowledge of a given topic (Chiesi, Spilich, & Voss, 1979).

A third factor that can determine what is remembered from text is the reader's purpose or goal. Frederiksen (1975) found that the amount of inferred and overgeneralized semantic information included in subjects' recalls of a text was related to problem-solving instructions. Additionally, readers who memorized questions asking for specific information consistently recalled more question-relevant material than incidental material and were able to answer more questions correctly than readers who were instructed to simply learn as much as possible (Rothkopf & Billington, 1979). Further, readers expecting a recall test remembered more words, sentences, and paragraphs from an essay than readers expecting a recognition test (Schmidt, 1983).

All of the previously cited research demonstrate that changes occur in both the form and content of information that are recalled from text. However, because only recall and recognition memory measures have been used, it is not possible to determine whether these changes result from processes occurring during encoding of the information, at retrieval of the information from memory, or both. Although there have been numerous hypotheses and models proposed to account for text memory, there have been few empirical tests of processing strategies. In one such investigation Anderson and Pichert (1978) attributed differences in recall to retrieval operations. However, they did not address the issue of differences in recall due to comprehension and encoding, which they acknowledged could be operating independently. Other findings seem to demand an interpretation that places the locus of effects during comprehension and encoding. For example, comprehension and recall of vague, metaphorical passages lacking specific referents were enhanced when the passages were accompanied by either a descriptive title (Dooling & Lachman, 1971) or a picture (Bransford & Johnson, 1972). Additionally, biasing titles were found to influence the interpretation given to ambiguous passages (Schallert, 197[illegible]) and dual-theme passages (Kozminsky, 1977).

One test of encoding strategies was reported by Birkmire ([illegible]), who investigated relationships among text structure, background knowledge, and purpose in text processing and memory. Reading rate and recall of [illegible] elements were found to be critically dependent upon an element's [illegible] position in a text structure and the reader's knowledge of [illegible] content. Strategies employed by readers were apparently influenced by [illegible] interaction of text structure, the reader's background knowledge, and [illegible] text content. In addition, instructions to learn specific topics [illegible] in the text lowered the reading rates of sentences containing those topics regardless of the reader's background knowledge. Birkmire demonstrated that more time was spent reading sentences in text that provided answers to questions the subjects knew they would be asked. Further, prior knowledge relating to the text topic did not alter this processing pattern. Background knowledge of the text topic was apparently not needed in this case to use these highly specific instructions as a reading strategy.

Birkmire's study demonstrated the effect of specific instructions on the reading rate of text elements. However, the particular pattern of reading rates in that investigation may have been task specific. It is not surprising that college students were able to locate and devote additional processing time to information in text that they know, in advance, must be learned. A different set of expectations about which information to learn, however, might lead to different patterns of reading rates, and these patterns might be guided by the text structure and the reader's background knowledge. For example, readers who expect to take an essay test might spend more time reading sentences containing macrostructure information, i.e., the gist, the theme, or the topic of a text (van Dijk & Kintsch, 1983), since essays would require, at a minimum, recall of the gist or theme. On the other hand, readers expecting only to recognize changes in text information, as is required for a same-different judgment, might spend more time reading sentences containing lower-level information related to the macrostructure. In contrast, a short-answer test would not require encoding the entire macrostructure, as would be required for writing an essay. However, a short-answer test would require encoding specific details for retrieval, rather than for recognition. Therefore, readers expecting a short-answer test might spend less time processing macrostructure information than if an essay test were expected, but spend more time processing lower-level information than if a recognition test were expected. Furthermore, processing strategies might be influenced or guided by the reader's background knowledge, as well as the expectation of memory demands. It seems likely that readers who possess knowledge related to the content of the text might be more sensitive to the text structure and alter their reading rates accordingly.

Additionally, alterations in processing strategies might not occur until the reader has formulated an idea about the content and the structure of information in the text. Readers may first skim a text in order to develop a framework in which to encode the information during a subsequent reading. For example, all readers, regardless of the type of test they may be expecting, might read text elements similarly during an initial reading. Upon second reading, however, readers holding different test expectancies may read text elements at the various positions in a text structure at different rates.

In summary, the primary purpose of this research is to determine whether readers' expectations for a particular kind of test alter their text processing strategies. A second purpose is to determine whether these test expectancy effects in text processing are a function of the reader's background knowledge of the text topic. Finally, this research will investigate whether processing strategies change during subsequent readings of a text.

Method

Subjects

Forty-two physics and engineering majors (physics group) and 42 social science majors (social science group) met the requirements for inclusion in this experiment. They scored a minimum of a college sophomore level on the combined vocabulary and comprehension measures of the Nelson-Denny Reading Test, Form C (Brown, 1973). Additionally, the subjects' scores from a test of background knowledge were used to ensure that the two groups differed with respect to background knowledge related to the topic of an experimental text. Subjects were paid $10 for their participation in two 1-hour sessions.

Materials

Texts. A practice text and two content specific texts were taken from articles that appeared in published journals or books. Some rewriting of the texts was necessary to control for the number of words per sentence and the number of words per text. The practice text was a news article about significant environmental events during the previous year ("The Year in Science," 1983). A research report on a new laser annealing technique to be used with an ion implantation procedure (laser text) was chosen as the content specific text for four reasons: (a) the content and terminology were judged to be related to the background of the physics group, (b) it was judged to be comprehensible to the social science group, (c) it presented new information to both groups, and (d) it was used in prior research with different subject populations ("Warmed-over Chips," 1980). A second text about parakeets as pets (parakeet text) was used as a control (Meyer, 1975). It was chosen because (a) it was judged to be equally comprehensible to both groups, and (b) it had been used in prior research. The average sentence length for the experimental texts did not differ statistically.

Text analyses. The laser and parakeet texts had previously been parsed into hierarchical content structures by three raters (Birkmire, 1985). (See the Appendix for a portion of the hierarchical structure on the laser text.) The text analysis scheme used was developed by Meyer (1975, 1985) based on Grimes' (1975) semantic grammar of propositions. The nodes in these hierarchical structures contained content words and phrases from the text, and the lines connecting the nodes showed spatially how these content words and phrases were related linguistically. For the laser and parakeet texts, each rater assigned a sequential numerical rating to each level of the hierarchical structure with the number one representing the topmost node. The position or level of each individual node in the content structure was identified by its level number. Each sentence's position in a content structure was determined by averaging the individual level ratings for every node or information unit within a sentence. Each rater assigned each sentence a mean rating in this way. The interrater reliability coefficients between all possible combinations of raters on both texts range from .85 and .95.

Each rater rank-ordered the sentences in each text according to the assigned content structure rating. Those sentences that fell within the upper third or lower third of each rater's distribution were assigned to the high and low content structure categories, respectively. The remaining sentences were assigned to the intermediate content structure category. Sentences in each of the three categories were distributed equally throughout the texts.

Memory tests. To manipulate subjects' expectations, and thereby, possibly their processing of the texts, three kinds of instructions were used, each corresponding to a different criterial memory task. One set of instructions prepared subjects for a free recall (essay) test, another for a cued recall (short-answer) test, and a third for a recognition (same-different judgment) test.

The free recall test for each text required the subjects to recall in writing as much of each text as possible. Subjects were instructed that paraphrases of the original text were acceptable.

The cued recall test consisted of 12 explicit questions that required the subjects to provide an idea or a detail from the text, such as, "What is the natural habitat of parakeets?" Each question was based on a different sentence, four from each content structure category, from each text. A further restriction on selection of these 12 sentences was that serial position order in the text was counterbalanced. Therefore, one sentence from each category, i.e., one high, one intermediate, and one low occurred in about the same area of the text. The order in which the questions appeared was randomized and remained constant for all subjects.

Recognition memory tests for each text were constructed from the same 12 sentences used to construct the cued recall test. Six of the 12 sentences from each text were selected randomly and were altered semantically from the original wording of the text, such that, identification of changes could only be made after reading the text and could not be based on prior knowledge. For example, the sentence, "The light green body and yellow face color combination is the color of parakeets in their natural habitat, Australia," was changed to "The light green body and yellow face color combination is the color of parakeets in the jungle, their natural habitat." Subjects were required to make a same-different judgment and to underline the specific changes from the original text. The order of the questions was the same as in the cued recall test.

Apparatus. Instructions for reading each text and the actual texts were presented and controlled by an Apple II+® microcomputer and was shown on a 12-inch green phosphorus monitor.

Text display and measurement of reading times were controlled by an internal clock. Reading times were recorded to the nearest tenth of a second and recorded onto disk.

Design

The design of the experiment incorporated two between-subjects and three within-subjects factors, as follows:

1. The first between-subjects factor was the subject's background knowledge in physics demonstrated by the score on the test of background knowledge. The test consisted of 20 questions, primarily on electricity and electromagnetism, taken from sample and study questions for the Graduate Record Examination Advanced Test in Physics. Two nonoverlapping groups of physics and social science majors were formed on the basis of this test score.

2. The second between-subjects factor was the test expectancy. Subjects were instructed to expect either an essay (free recall) test, a short answer (cued recall) test, or a same-different judgment (recognition) test.

3. The first within-subjects factor was the text read. Two texts (laser and parakeets), as described in the Materials section, were used.

4. The second within-subjects factor was the level of each sentence in the content structure. The sentences were rated and categorized as high, intermediate, and low in the content structure.

5. The last within-subjects factor was whether it was the first or second reading of the text.

Procedure

Subjects were tested in two sessions, each lasting approximately 1 hour. During the first session, subjects were tested individually in a small laboratory room. Subjects from each of the two background knowledge groups were tested in random order. Thev were assigned randomly to one of the three test expectancy conditions.

Each subject read instructions presented on the Apple II+® explaining the operation of the Apple® and the general procedures of the experiment. At this point an incentive was introduced to encourage reading as quickly as possible with understanding and to discourage attempts to memorize the experimental texts. Subjects could earn additional money based upon the rate they read a text completely through twice. This total reading time was translated into a reading time factor, based upon reading time data collected during piloting of the materials. The reading time factors ranged from the slowest times (0) to the fastest times (5). This reading time factor and the number of questions answered correctly on the tests were used to calculate a subject's "bonus." Instructions for the kind of test to expect following the reading of each text were then given.

Subjects then read the practice text one sentence at a time. Each succeeding sentence of the text was presented directly beneath the previous sentence when the subject pressed the RETURN key. As one sentence was displayed, the previous one was erased. This procedure was followed until the bottom of the screen was reached, at which time the next sentence was presented at the top of the screen. All sentences were left-justified. After reading the practice text once using this technique, a short pause preceded the second reading of the text using the same procedures. After reading the practice text twice, feedback was provided on the total time taken to read the text twice and the reading time factor used to calculate a subject's "bonus."

A written copy of the expected test was then given to each subject. Instructions, as well as, questions were on the sheet. Subjects were given unlimited time to complete the tests.

These procedures were repeated with the two experimental texts. Presentation order of the experimental passages was counterbalanced across groups. At the end of the first session, any questions about the experiment were answered.

The second session involved administration of subject screening devices as described earlier. The screening devices were administered as posttests to avoid the possibility of biasing the experimental results. The screening tests were given either individually or in groups of 15 or fewer subjects. Administration of the Nelson-Denny Reading Test followed the regular procedures outlined in the Examiner's Manual (Brown, 1976). Subjects were given unlimited time to complete the test on background knowledge.

Results

Reading Rate

The reading rates for sentences were collected in a 2 (Physics vs. Social Science Group) x 3 (Free Recall vs. Cued Recall vs. Recognition Test) x 2 (Laser vs. Parakeet Text) x 2 (First vs. Second Reading) x 3 (High vs. Intermediate vs. Low Content Structure) completely crossed factorial design. The reading rates were calculated by dividing the total reading time per sentence by the number of words in the sentence.

Because the distributions of the raw data were positively skewed, a natural logarithmic transformation was applied (Kirk, 1968). Inspection of the transformed data indicates that approximately 0.5 percent (45 of 9576 observations) of the data points were outliers at the .01 level (Grubbs, 1950). These outlying data points were randomly distributed among the subjects. The mean of the appropriate sample excluding the outliers was substituted for each outlying observation.

The transformed data did not meet the assumptions of compound symmetry necessary for a univariate mixed-model analysis of variance (Box's $\underline{M}$ = 695.76, χ^2 = 437.19, $\underline{df}$ = 390, $\underline{p}$ <.05). Therefore, the data were analyzed using multivariate techniques on a repeated measures design. To allow for interpretation of the data on the same scale as the raw data, the geometric mean will be reported. The geometric mean of a set of positive numbers is the logarithmic inverse of the arithmetic mean of the logarithms of the numbers.

In the analyses of these transformed data a priori contrasts between the various cell means, representing the effects in an analysis of variance model, were specified as the parameters to be entered into the analyses (SPSS^{x}, 1986). The verbal description of main effects and interactions reported here identifies statistically significant differences between levels of an effect. Only those results pertaining to the research questions under investigation will be discussed in detail.

The main effect for text was significant, $F(1, 78) = 225.40$, $p < .001$, with a mean rate of 223 words per minute (wpm) for the laser text and 281 wpm for the parakeet text. The main effect for reading reached significance, $F(1, 78) = 182.61$, $p < .001$, with a mean rate of 224 wpm for the first reading and 280 wpm for the second reading. Additionally, a main effect for content structure was found, $F(2, 77) = 92.10$, $p < .001$, (mean rates = 273 wpm for high, 240 wpm for intermediate, and 239 wpm for low content structure), such that, the high content structure information was read at a faster rate than either the intermediate or low information. The rate at which intermediate and low information was read did not differ.

There was a Test x Text interaction, $F(2, 78) = 4.35$, $p < .05$. For the laser text, reading rates for the free recall group were slower than for the recognition group, but for the parakeet text these recall groups were reversed. The cued recall group was slower than either of the other two test groups on both texts (see Figure 1).

Of more interest to the proposed test expectancy hypotheses was the Test x Reading x Content Structure interaction, $F(4, 156) = 3.59$, $p < .01$. Although high content structure information was read at a faster rate than information lower in the structure by all test groups, the difference between high and lower information was greater in the cued recall group than in either the free recall or recognition groups. Further, the differences between the reading rate of high and lower structure information was greater during the second reading than during the first reading (see Figure 2). Again, this difference was greater for the cued recall group than for the other test expectancy groups. After reading the text once, the subjects appeared to adopt a strategy that resulted in longer reading times for lower content structure information. Although this processing strategy followed the same pattern for all test expectancy groups, it was more exaggerated for the cued recall group.

There was also a Group x Text x Content Structure interaction, $F(2,$ [illegible]$)$ $= 3.54$, $p < .05$. For the laser text, the physics group read the high content structure information at a faster rate than the lower structure information, while the reading rates of the social science group did not differ. However, when reading the parakeet text, both groups read

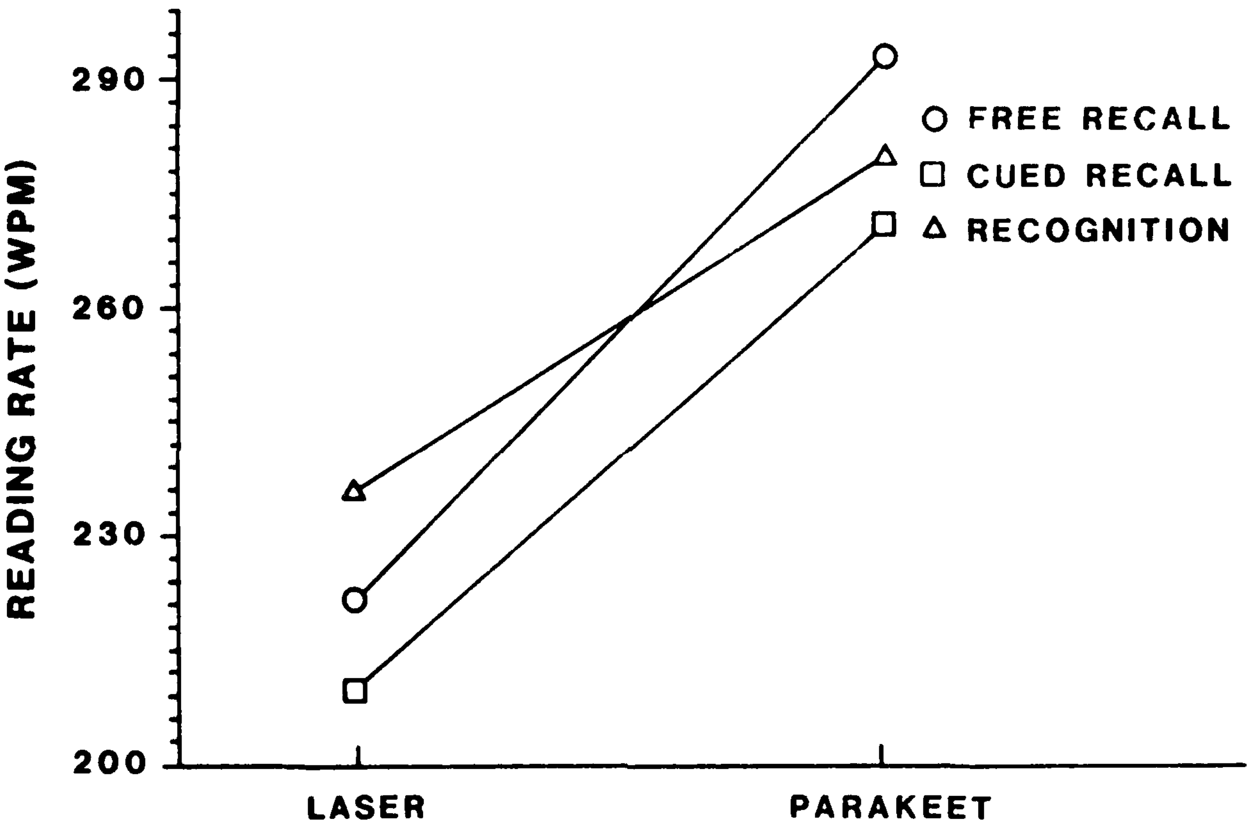

Figure 1. Mean reading rate by test and text.

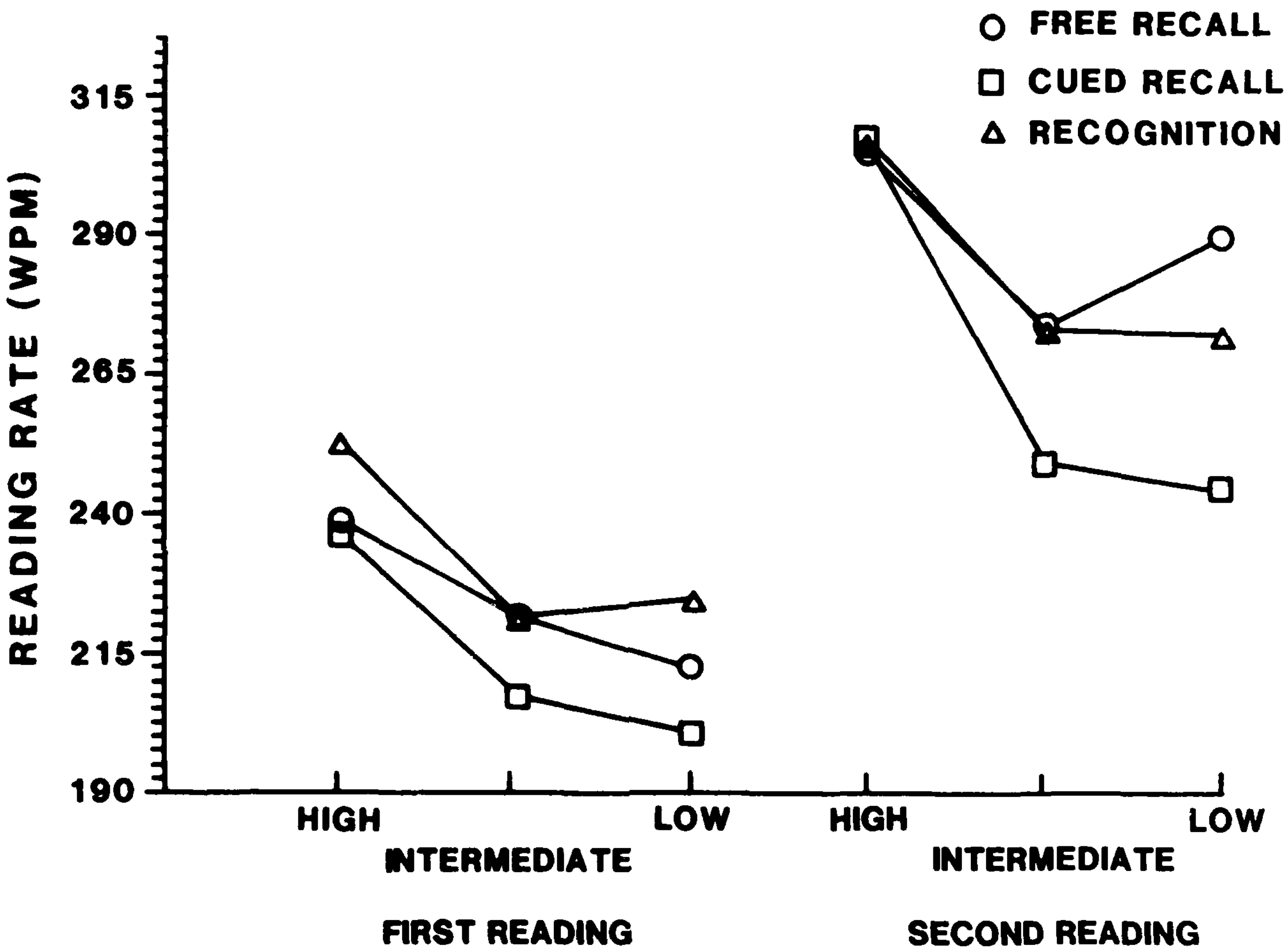

Figure 2. Mean reading rate by test, reading, and content structure.

information high in the text structure at a faster rate than lower structure information. Further, the rates at each level of the content structure were approximately the same for both groups (see Figure 3). When reading a text that subjects possess either specialized background knowledge or general knowledge of the text topic, they read information high in the content structure faster than information located lower in the text structure. When subjects lacked background knowledge related to the text topic, this differentiation in reading rates between levels in the text structure was not made.

Other interactions were significant, but were either involved in the higher order interactions previously discussed, or do not have any direct bearing on the hypotheses being tested.

Memory Test Data

The test data were analyzed as three separate sets: (a) the proportion of idea units recalled at each content structure level on the essay test, (b) the proportion of correct answers on the cued recall test, and (c) the proportion of correct answers on the recognition test. Each of these was analyzed as a 2 (Physics vs. Social Science Group) x 2 (Laser vs. Parakeet Text) x 3 (High vs. Intermediate vs. Low Content Structure) completely crossed factorial design.

Each set of data was analyzed using a chi-square test of independence for a 2 x 2 x 3 frequency table. The description of the main effects and interactions that follows identifies statistically significant differences between levels of an effect.

Free recall. The experimenter scored the written protocols for the presence or absence of the words or phrases located at each node within the text structure hierarchy generated from the linguistic parsing. Paraphrases of the exact wording were acceptable provided the main idea was retained.

A main effect for group was found, $\chi^2(1, 11) = 187.18$, $p < .001$, with a mean proportion recalled of 0.326 for the physics group and 0.187 for the social science group. The main effect for text was also significant, $\chi^2(1, 11) = 262.90$, $p < .001$, with a mean proportion recalled of 0.188 for the laser text and 0.315 for the parakeet text. The main effect for content structure was significant, $\chi^2(2, 11) = 42.76$, $p < .001$, with a mean proportion recalled of 0.317, 0.212, and 0.270, for high, intermediate, and low content structure, respectively.

More importantly, the Group x Text x Content Structure interaction was significant, $\chi^2(2, 11) = 19.87$, $p < .001$. For the laser text, the physics group recalled proportionately more high content structure information than information lower in the text structure, while the social science group tended to recall proportionately less intermediate content structure information than either high or low information. For the parakeet text,

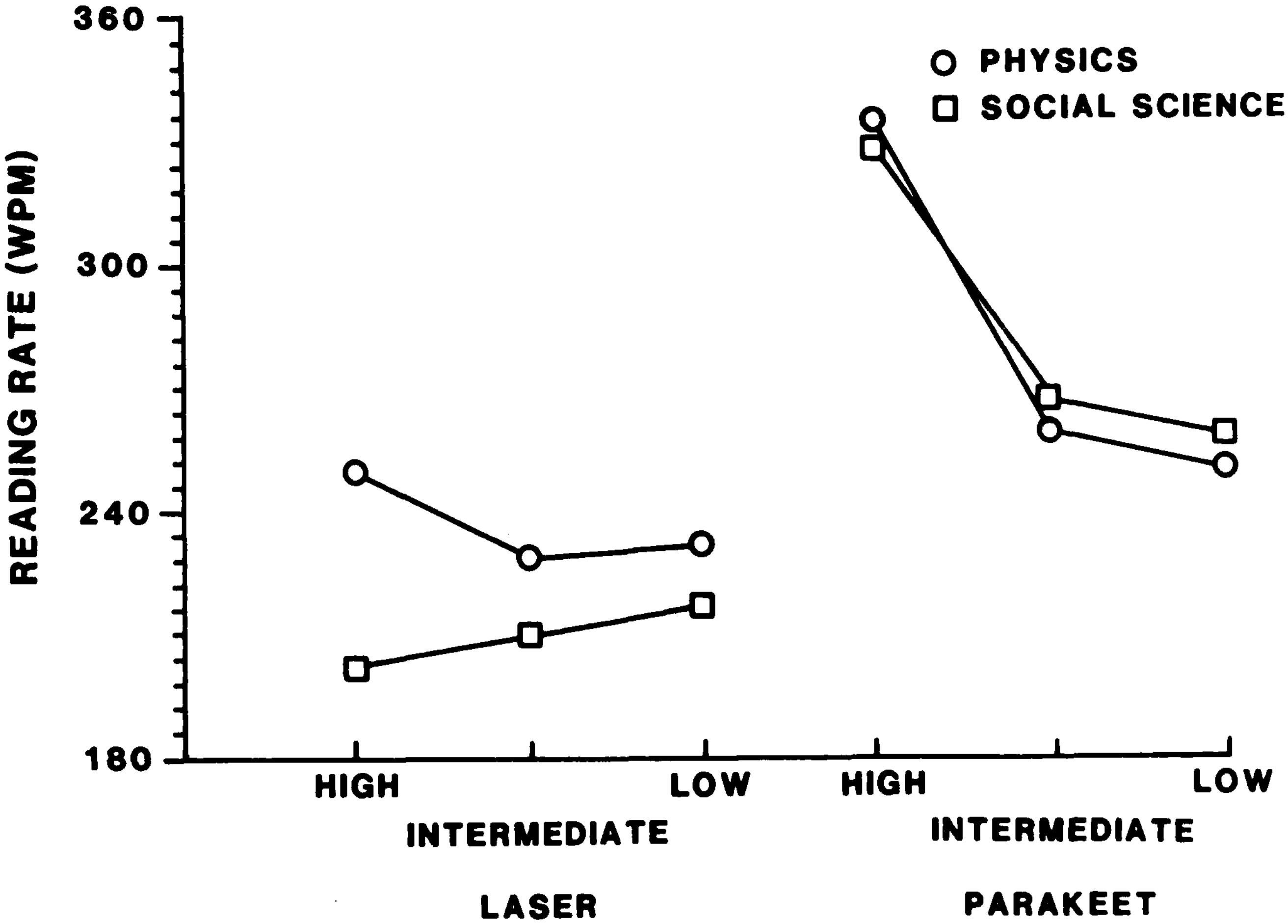

Figure 3. Mean reading rate by group, text, and content structure.

both groups recalled proportionately less intermediate information than high or low structure information (see Figure 4). The intermediate content structure information tended to be less well recalled in all conditions with the exception of the physics group reading the laser text.

Other interactions reached significance, but will not be discussed further since they were involved in the higher order interaction discussed previously.

Cued Recall. The written responses were scored for inclusion of the idea or detail from the text requested by the question. Paraphrases of the exact wording from the text were accepted as correct.

A main effect for group was found, $\chi^2(1, 11) = 4.09$, $p < .05$, with a mean proportion of 0.705 of the physics group answering correctly and 0.580 of the social science group answering correctly. The main effect for text was also significant, $\chi^2(1, 11) = 22.89$, $p < .001$, with a mean proportion answered correctly of 0.496 and 0.790, for laser and parakeet texts, respectively.

Interpretation of these effects was qualified by the significant Group x Text interaction, $\chi^2(1, 11) = 14.25$, $p < .001$. For the test on the laser text, the physics group answered more questions correctly than did the social science group; however, for the parakeet text, the difference between the two groups was very small (see Table 1).

Table 1

Mean Proportion Correct on the Cued Recall Test by Group and Text

Group	Laser	Parakeet
Physics	.655	.756
Social Science	.336	.824

Recognition. There were no significant main effects or interactions in the recognition memory data.

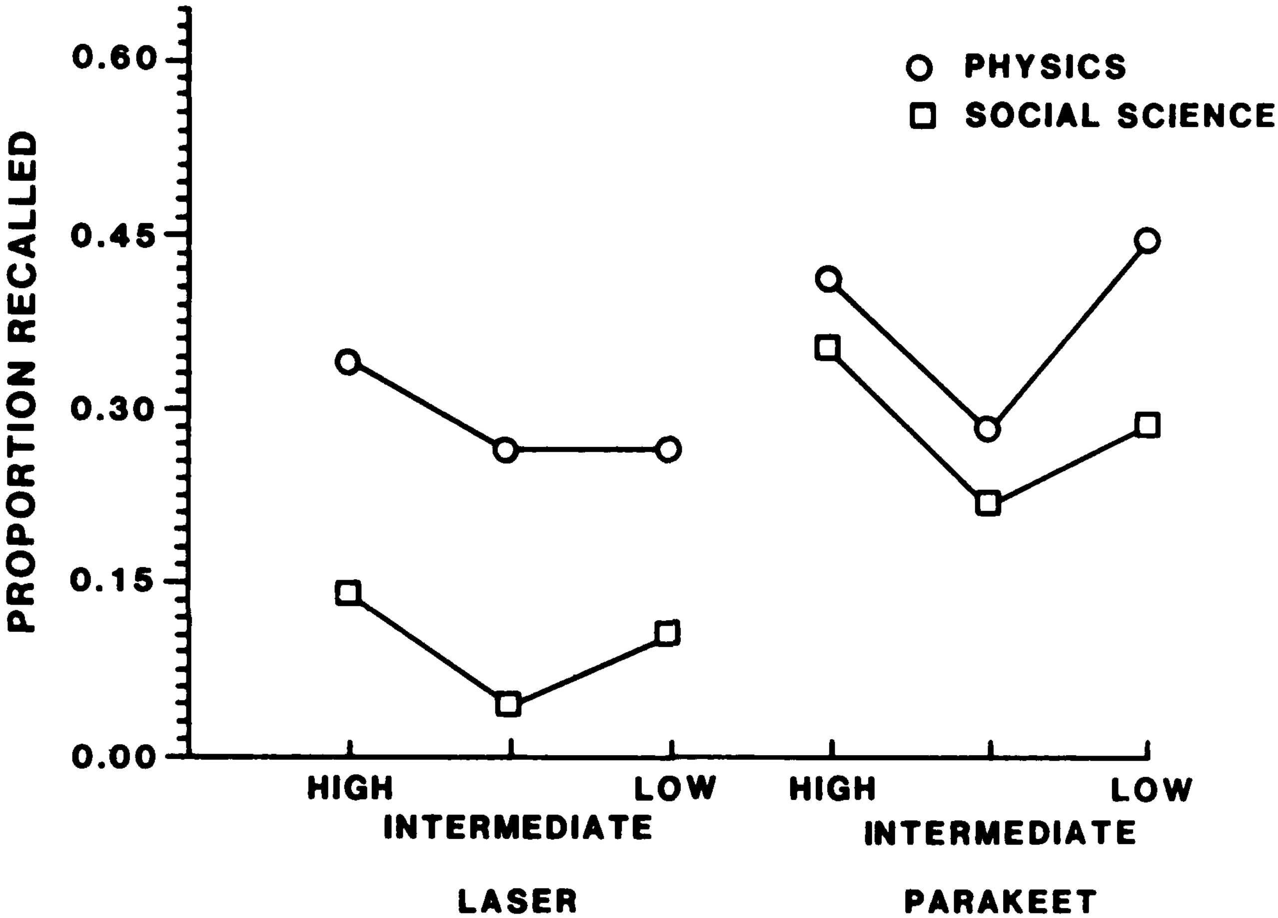

Figure 4. Mean proportion of idea units recalled on the essay test by group, text, and content structure.

Discussion

In the present experiment, subjects altered their reading strategies as a function of their purpose or goal. The kind of test subjects expected influenced the reading strategy across content structure categories from the first reading to the second reading. Apparently subjects read text elements located at various heights in the text structure hierarchy at different rates depending upon what they expected to have to remember. Further, the subjects modified their processing strategies after the initial reading of the text. However, these changes in processing strategies between test expectancy groups seem to be subtle shifts in the amount of time devoted to reading information at various levels in a text structure, rather than dramatic differences in processing patterns.

Even though cued recall was considered intermediate in difficulty between free recall and recognition memory tasks, it apparently was not in this investigation, because those readers expecting a cued recall test devoted more processing time to comprehension and encoding of information lower in the text structure than did either of the other two groups. One possible explanation for this pattern is that students have learned that short-answer questions generally require a more extensive knowledge of details from a text than do essay tests or recognition tests. Free recall tests generally require recall of the information contained in the macrostructure of a text with fewer details from the microstructure. Same-different judgment or multiple-choice tests generally require recognition, rather than recall, of details from the microstructure. Although few test expectancy studies have compared all three types of tests, Duchastel (1981) reported superior delayed recall for a group that expected a cued recall test as compared to groups that expected either free recall or recognition tests. Although Duchastel did not control for level of test information in the text structure, his findings do correspond to the processing strategy reported in the present investigation. The design of the present study did not allow direct comparison of the memory tests between the test expectancy groups. Future research should compare memory test results between test expectancy groups and levels of information in the text structure.

Subjects read text elements at different rates depending upon their expectations and the content of the text. There is no obvious explanation as to why the free recall group required more processing time than the recognition group for the laser text, but less processing time for the parakeet text. Information about pets and their requirements is likely to be common knowledge, whereas information about annealing is highly specialized even for the physics group. This difference may in some subtle fashion account for the interaction between the free recall group and the recognition group.

These strategies did not depend upon background knowledge related to the text content. Subjects in the three test expectancy groups showed different reading strategies regardless of their conceptual knowledge about the text topic. This finding agrees with earlier work (Birkmire, 1985) that attempted to alter text processing strategies by manipulating the reader's purpose. In the earlier work subjects read texts knowing that specific information would be tested. As in the present study, processing strategies were altered depending upon what information was to be tested, but these strategy alterations were not guided by background knowledge of the text topic. It may be that the ability to alter text processing patterns depending upon the purpose for reading is a study skill that is independent of the text topic.

Of additional interest was the finding that sentences containing information located high in the text structure were read faster than sentences containing information lower in the text structure when background knowledge was related to the text topic. When a group did not possess background knowledge corresponding to a text topic, this differentiation of reading rates was not apparent. This finding replicates the results of Birkmire (1985). These results provide support for theories suggesting that memory for text information is a function of how well the information "fits" with existing knowledge structures (Craik & Lockhart, 1972; Goetz, Schallert, Reynolds, & Radin, 1983). If new information is compatible with existing memory structures, it is easy to comprehend and encode. Therefore, less processing is necessary. If new information does not fit well with existing memory structures, it is more difficult to comprehend and encode. Consequently, more processing time is necessary.

As noted previously, it is not possible to make direct comparisons of the memory tests for the three test expectancy groups. However, results from each of the three types of tests can be examined individually. Not surprisingly, there was a different pattern of recall for the physics group than for the social science group on the laser text. The results of the physics group corresponded to expectations: high text structure information was recalled better than lower text structure information. The social science group recalled high and low information equally well, with a decrease in recall of intermediate information. However, the pattern of recall for the parakeet text did not conform to the expectation of a decrease in recall as the level in the text structure hierarchy decreased. Both groups recalled low text structure information better than expected. Meyer (1975) found that, whereas recall of information from higher levels of the content structure seemed to be a function of the content structure, recall of information from lower levels of the content structure seemed to be determined by particular aspects of the information contained in those levels. There was some evidence that this was also the case in the present experiment. For example, information that was historical in nature, such as, the original habitat of parakeets, was recalled frequently, although it was located low in the text structure.

No differences were found in either cued recall or recognition of information at the various levels of the text structure. This finding could be the result of differences in memory measures. That is, most studies have used free recall tests to measure the structure of the text representation in memory. However, other researchers have not always found positive correlations between recall of text information and its location in the text structure (Meyer & Rice, 1984; Piche & Slater, 1983). This failure to find a positive correlation has sometimes been attributed to the text parsing system. Whether the pattern of responding in this investigation is the result of the memory measures used or of the text parsing system needs to be determined.

There was not a strong relationship between text processing strategies and memory for text information. The memory for information at various heights in the text structure did not correlate linearly with the processing strategies. That is, the amount of time spent reading information did not predict whether that information would be recalled. It may be that studies on the representation of text in memory provide little information about the processes used to comprehend and encode that information.

In summary, this research demonstrated that text processing strategies do change as a result of different expectations of memory demands. Further, processing strategies change during subsequent readings of text. However, these changes in processing strategies appear to be subtle shifts, rather than dramatic differences, in the time spent reading text information at various heights in a text structure hierarchy. In addition, there was no evidence that the reader's background knowledge was used to guide processing strategies that were determined by the reader's expectations. Finally, text processing strategies and memory for text information were not linearly related.

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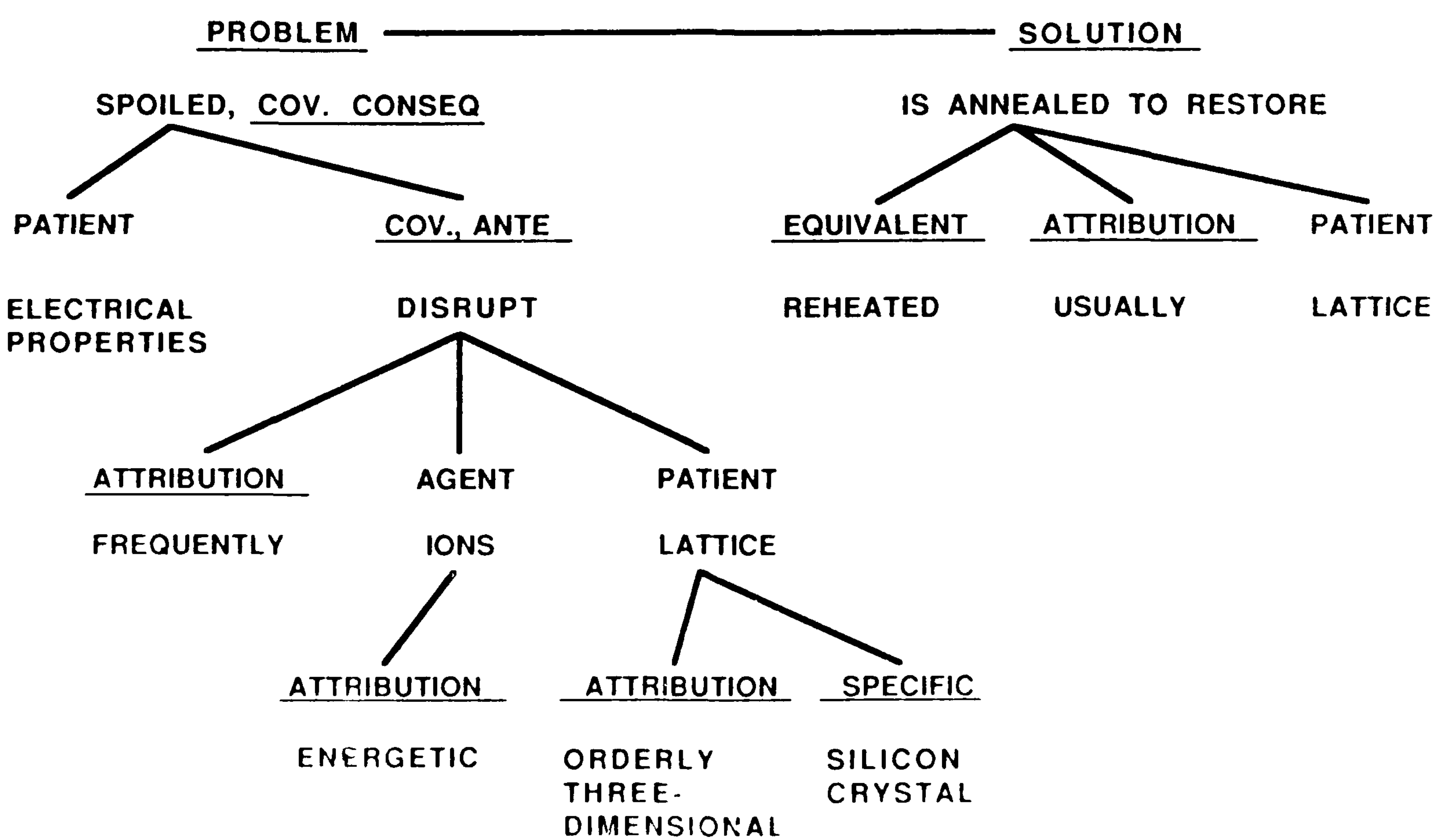
APPENDIX

EXAMPLE OF HIERARCHICAL STRUCTURE

A DRAWBACK OF ION IMPLANTATION IS THAT THE ENERGETIC IONS FREQUENTLY DISRUPT THE ORDERLY THREE-DIMENSIONAL LATTICE OF THE SILICON CRYSTAL AND SPOIL ITS ELECTRICAL PROPERTIES. THEREFORE AFTER ION IMPLANTATION THE SILICON IS USUALLY ANNEALED, OR REHEATED, TO RESTORE THE LATTICE.



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