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Summarizing the *Wall Street Journal*

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Summarization, whether it is used incidentally in text comprehension or intentionally as a study technique, is an important skill to acquire. Various models have been presented which attempt to describe this complex process of transforming detailed knowledge representations into concise, coherent summaries (Lehnert, 1981, and van Dijk and Kintsch, 1977). The majority of these models are based upon the study of individual summaries of narratives. The models were created by noting differential characteristics across summaries. This research, however, used people with average experience in summarization and thus, only a limited aspect of the summarization process was examined. A problem with this approach is that it does not allow one to study summarization as a cognitive skill with various levels of expertise.

The expert/novice paradigm has recently received a great deal of attention in fields such as Cognitive Psychology, Cognitive Science, and Artificial Intelligence. This paradigm is particularly useful in the study of the development of a given behavior. Brown and Day (1983) examined the differences in the summarization processes used by novices (young children) and experts (graduate students). Using variations on the macrorules of van Dijk and Kintsch (1977), they were able to trace the development of the summarization process from simple deletion of trivial and redundant information to more complex transformational rules of condensation.

The current study extends the development of summarization to the expert level and examines the characteristics of summaries after the acquisition of basic summarization strategies. These characteristics will include both content differences and processing differences that may be accounting for differences in summarization. The domain in which we looked at these characteristics is the summarization of *Wall Street Journal* articles. This domain is optimal because (1) expert summaries appear in the newspaper every day and (2) novices (college undergraduates) understand the content of articles, but lack advanced summarization knowledge.

We used six articles from the *Wall Street Journal*. These articles were chosen because (a) they were summarized on the front page of the paper and (b) they were written in a narrative style rather than the style of a stock report. The stories were about economic concerns such as bankruptcies and marketing changes. Subjects, who served as the novices in our experiment, were asked to give the story a title and write a one to two sentence summary of the story. The expert summaries were taken directly from the *Wall Street Journal* and were roughly the same length.

The titles generated by the novices were used to be sure that the subjects understood the main topic of the article. For all the stories, the titles were similar to the actual article titles. In some cases, the titles stated the main topic, while in other cases, the novices sensationalized the titles to sound like a newspaper article. The latter finding suggests that the subjects were using their knowledge of typical newspaper articles, though the articles were referred to as "stories" in the experiment.

To exemplify the novice/expert differences that were observed, we present a sample expert summary along with a two novice summaries. These summaries are for an article which discussed the possible failure of Osborne Computer and the situation that the company was currently facing.

Expert Summary

Osborne Computer faces possible failure, unless it finds a purchaser. The company is deeply in debt to suppliers, just furloughed nearly 80% of its employees and has halted computer production. One possible buyer, ITT, denies any involvement.

Novice Summaries

Osborne Computer Corp., a portable computer industry, is failing and looking for someone to acquire it and lend it money for debts. The company began as a prosperous, fast-growing company which was ruined when it tried to change the computer market and tangled with the jumbo companies such as IBM.

Osborne Computer Corp., being deeply in debt, faces failure unless it is acquired by a larger company, possibly ITT. Its downfall can be attributed to too rapid a climb, trying too much and pressure from a much larger competitor, IBM.

Before comparing the novice and expert summaries, we analyzed each type of summary and possible strategies that could account for the information that was selected from the article and put in the summary. It should be noted that each story generally presented a main event and several sub-events that either elaborated upon the main event or described past events relevant to the main event. There are three types of information reported in the expert summaries. The first information type is a concise statement of the main event. This statement is usually a condensed version of the first paragraph of the article. The second type of information is an elaboration of the event, with other information present in the article. Using the example above, this information refers to the second sentence in which Osborne's failure is defined by its debt, furlough of employees and halting of computer production. The final type of information present in the data refers to implications of the current situation. That is, statements about the future outcome of the event described. In the example above, this information is the denial of involvement by ITT.

For the novice summaries, only one of the experts' three types of information is present. Novices present the main topic of the story, but do not elaborate the event or note the implications of the event. Instead, they include information about the causes of the situation. Examples of this information can be seen in the second sentences of the novice summaries previously presented. This type of information was found in over one half of the novice summaries for each article. Thus suggesting that novices see causes of an event as more important than elaborations or implications of an event.

Having examined the content of each of the novice and expert summaries, we proposed algorithms that could account for these observed behaviors. It appears that experts decide on the main event of the article and then infer a possible goal that is active for this event. Using this goal, the expert follows the events associated with the goal and notes the success or failure of these events. That is, the expert seems to look at the future results of the situation.

The novice summarization process begins in the same manner as the expert process in that the current goal is inferred. However, rather than carrying the goal through to the possible implications, novices attempt to explain the goal by reporting other events that are causally linked to the active goal and present these events.

These content differences suggest that there are novice/expert distinctions in summarization even after they have acquired the basic structural strategies such as those presented in Brown and Day. These distinctions appear in the different selection and abstraction strategies used. When

selecting what to report in a summary, novices focus on the causes of the main topic, whereas, experts focus their attention on the possible outcomes of the event. In addition, experts present a more detailed representation of the event, rather than presenting a number of causally related events at less detailed levels.

The question which must now be answered is why does this difference occur? The explanation that we would like to give for the observed differences is that novices are viewing summarization as a process by which one attempts to put as much information as possible from the article into the constraints of the summary. As a result, they present less detailed versions of as many events as possible. On the other hand, experts see summaries as brief, coherent presentations of the most important event in the passage. Therefore, they present a more detailed account of the event and the implications of that event that might later be of importance.

However, there are other possible explanations for these results which should be noted. One explanation is that the experts in our experiment have had experience with the individual events and assume that the readers of their summaries have also been following the story. Thus, they do not see the past causally related events as important, but rather try to predict future events that the reader should be aware of. We are currently testing this explanation by giving novices a set of related articles that describe the entire progression of the event and asking for summaries of each article in the set. If the above explanation is true, then the summaries of the first articles in the set should be similar to the novice summaries above and the final summaries should be similar to the expert summaries.

Another explanation is that the novices and experts in our study had different goals. That is, the experts were trying to get someone to read the full article presented later in the paper and the novices were simply complying with our instructions and presenting a basic summary. This explanation, if true, suggests that past models of summary are incomplete in that the goals of the writer of the summary have not been considered. We plan to test this hypothesis by telling the novices that they are writing a summary for the Wall Street Journal and giving them an example of a summary written for the paper. If the goal explanation is correct, then the novice summaries should be more similar to the expert summaries.

This study was proposed as an exploratory experiment. From the data, we were able to generate an number of hypotheses about summarization and content differences that are present after the acquisition of general summarization rules. At this point, we are pursuing several of these hypotheses. In addition, we use verbal protocols of the summarization process to get a better picture of the process. The results that we have observed thus far suggest that summarization is more dynamic than previous models have suggested and needs further exploration of the goals in summarization as well as the plans used to achieve these goals.

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