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Several years ago Bertram Bruce, in a response to P. David Pearson's description of the "Comprehension Revolution," suggested that future studies will go beyond a focus on reading comprehension to a concern for the relationships between comprehension and more general thinking skills (1985). Bruce's comments were written early in what might be called a "Thinking Skills Revolution," and — given the manner in which this revolution has matured in recent years — they seem even more relevant today. Comprehending a text is one thing. Using comprehended ideas for such thinking tasks as evaluating, problem-solving, comparing, and so on is another. They're two different processes; but, at least when occurring in one reading act, they're interrelated. Researchers and teachers need to understand these complex relationships more thoroughly.

In the spring 1989 issue of *Reading Horizons* I reported the results of a study of one relationship between comprehension and thinking skills, namely the order of processing between comprehending a text and comparing/contrasting the ideas of that text with ideas external to the text itself. In that study (Steinley, 1989) the target text was about a word game, either doublets or crossword puzzles, and before reading the text subjects were instructed to compare/contrast that game with another word game (word search) which had been read about

and discussed earlier in the experiment. I questioned the extent to which two factors — the extent of a reader's background knowledge of the game described in the target text and the reader's self-reported processing style — might affect the relationship between comprehending and comparing/contrasting. Both factors had an effect. When readers had limited knowledge of the target text's topic, they tended to be more linear, attending first to comprehension of the text and then to the task of comparing/contrasting. When they had extensive knowledge, they were more parallel, attending to comprehending and comparing/contrasting more or less simultaneously. Moreover, those who self-reported themselves as typically linear tended to read in that fashion in this particular situation, and those who reported themselves as typically parallel tended to read in that fashion.

This study is a follow-up to the first. The same target texts and comparing/contrasting tasks have been used, but there is an essential difference. In the first study the data for the dependent variable, the order of processing, were collected retrospectively and subjected to quantitative analysis. In this study the data have been collected in one-on-one interviews using an "on-line" reporting procedure — that is, subjects reported on their reading during the process of reading — and the quantitative data analysis has been supplemented with a qualitative one.

I chose this repetition with variation for two reasons. First of all, converging quantitative data from the on-line measure would provide additional support for the original retrospective findings — or conflicting data would challenge the findings. The first research question for this study, therefore, combines the two research questions of the original study: Does the extent of a reader's background and/or a reader's typical

processing style affect the order of processing between the two processes of comprehending a text and using text ideas for a thinking task?

The second reason for repeating the experiment is more complex. The terms *linear* and *parallel* processing are gross labels for the attention allotment between any two processes in a single reading act — in this case the broad processes of comprehending and thinking. Though there is precedent for using these or compatible terms to describe processing styles (Dunn and Gould, 1981; Pask, 1976; Willis, 1985), the actual cognitive interaction between two broad processes, such as comprehending and thinking, with text ideas must certainly be more dynamic and complex as attention shifts from one process to the other during a given reading act. The second reason for repeating this experiment, therefore, is to explore — through an on-line measure and one-on-one interviews — this attention-shifting or maintaining in reading acts prefaced with a thinking task. Answers to the following question, however tentative, would add explanatory power to experimental results; in addition, they would help to guide future research of this phenomenon. The second research question for this study, then, is: How do readers explain their attention shifts or maintenance when reading both to comprehend and to use text ideas for a thinking task?

Method and subjects

Data were gathered from 39 students over one semester. Although this experiment took place one year after the first, subjects shared characteristics of the first group of subjects. That is, most were college juniors, they represented a variety of content areas, and they had — by virtue of being admitted to the teacher education program — met relatively high GPA and competency requirements.

Materials and instrumentation

In the first experiment the two independent variables, background and style, were operationalized through materials constructed for the experiment. The same materials were used here. Background, classified as limited or extensive, was controlled by the target texts. It had been established through previous surveys that subjects who read the text about doublets had, in effect, limited background of the text topic because they had neither heard of nor played the game before; in contrast, those who read about crossword puzzles, because of their familiarity with the game, were considered to have extensive topic background. Style, as in the first experiment, was measured by the "Processing Style Inventory." This instrument asked subjects to classify themselves as typically more linear or parallel; each style was explained in direct, non-technical terms on the inventory.

Since the dependent variable — order of processing — was measured by a retrospective instrument on the first experiment, a new instrument, allowing an on-line measure, was constructed for this experiment. Each target text, the doublets text and the crossword puzzles text, was altered so that it contained one set of boxes to the right of each of the six paragraphs. The result was two columns of boxes which were respectively labeled "Comprehension" and "Compare and/or Contrast." This provided a paragraph by paragraph instrument for subjects to record where their primary attention was directed while reading that paragraph; and, when completed, it constituted a profile of their attention allotment in terms of the two components.

Procedure

Since each subject had to be tested and interviewed individually, subjects were assigned their 45 minute appointment

time over the semester on a draw basis.

After the subjects were provided general information, they read the word search text. As with the first experiment, there was a brief discussion to assure familiarity with the game. Then subjects read the target text — texts about doublets or crossword puzzles were assigned on an alternating basis — prefaced by these instructions: "You've read about a word game called *word search*. Now you're going to read about another word game. What I'd like you to do is comprehend this text *and* compare and/or contrast this word game with word search. You'll notice on the text you are about to receive that there are two boxes after every paragraph and that the two columns are labeled. (A mock sample was displayed.) Mark one of the boxes after you finish each paragraph. If you think that, while reading the paragraph, your attention was more on comprehending the paragraph, then put an X in the first box. If you think your attention was more on the task of comparing and/or contrasting with word search, then mark the second with an X." These instructions were at times repeated or supplemented with further explanation or responses to questions.

After subjects completed reading the target text and marking the boxes, they were asked to comment on each marked box in the Profile they had created. The probe question was, "I see you've marked the [first, second, etc.] box. Can you tell me more about why you marked the box the way you did?" At the end subjects were asked to offer any general or overall comments they had about their reading Profile. All discussions were recorded for later reference.

Subjects were then given the "Processing Style Inventory," the same style measure used on the first experiment, and

asked to categorize themselves as *typically* a linear or parallel processor. After further discussion of their choice on the "Processing Style Inventory," subjects were dismissed.

Quantitative analysis. Research question #1

The primary statistic for this analysis was a "parallel processing score" which was determined by the percentage of boxes marked in the compare/contrast column. Though they are only gross approximations of actual processing complexities and attention allotment, these scores provided a means for comparing groups. In this experiment there were four groups, each set of two representing different levels of one of the independent variables. Their mean parallel processing scores were as follows:

TABLE 1

Parallel processing scores for reader categories

Limited background	19.4	(N=19)
Extensive background	42.5	(N=20)
Linear style	21.8	(N=20)
Parallel Style	41.2	(N=19)

Clearly those with an extensive background of the text topic (readers of the crosswords puzzles text) and those who considered themselves typically parallel processors received higher parallel processing scores than the other two groups.

The data were further submitted to a 2 x 2 ANOVA with background (limited and extensive) and style (linear and parallel) as the two independent variables. The results disclosed that there were significant differences between the parallel processing scores of the two background groups

(F=8.26, df=1, 35, p=.006) and the two style groups (F=5.40, df=1, 35, p=.02). The interaction between background and style was not significant.

This analysis provided further support for the results of the first experiment. Readers with limited background of the text topic (the doublets group) read in a more linear fashion. Those who had a more extensive background (the crossword puzzle group) were more parallel. Similarly, those who self-classified themselves as typically linear or parallel tended to read in that manner for this particular reading task.

Qualitative analysis — Research question #2

In the previous analysis each subject's profile was reduced to a percentage which was the primary statistic for the descriptive data and the ANOVA. In this analysis the profiles were left intact and represented a sort of track record of the reader's attention maintenance or shifting between the two processes as s/he read the text. These profiles, and the subsequent discussions of them, were the basic data for exploring the question of how readers explain their attention allotment.

Readers with limited background

Of the 19 subjects in this group, 11 had 6-0 profiles. That is, 11 marked only the comprehension boxes. In explaining why they never shifted their attention from comprehension, the 6-0's offered reasons that fell into one of three categories. They either claimed limited knowledge ("I had never heard of it before so I had to concentrate on understanding it"), the complexity of the game or text ("It [the scoring of doublets] is very hard. I had to read closely"), or a need to have a certain amount of information before moving on to comparing/contrasting ("I had to mark comprehension because I was reading to get more information so I could compare").

There were only eight readers with mixed profiles, such as 5-1 or 4-2. When explaining their comprehension marks, these readers did as would be expected. They offered reasons that fell into the same categories. But, surprisingly, they tended to use the same categories when explaining many of their compare/contrast marks and shifts from comprehension to comparing/contrasting. One said, for example, "It was new to me. I had to figure out what it was about so I could compare" (category #1). According to another: "I finally understood the rules so I began to compare. I tried to compare" (category #2). And another: "I started comparing here because the more information I had the easier it would be to compare" (category #3).

In short, in this group of limited background readers the primary attention allotment was to comprehension and the predominant explanations — even when explaining a shift to comparing and contrasting — were based on limited background, text or game complexity, or insufficient information for comparing/contrasting.

Readers with extensive background

It might seem that when readers were very familiar with the topic of the target text, there would be extremes in the 0-6 direction, a logical counterpart to the 6-0's of the other group. But there were no 0-6's among the extensive background group; in fact, there was only one 1-5 and one 2-4. Almost half (9 of 20) had 3-3 profiles, and one was even a 6-0. In other words, it appears that these readers too felt a considerable allegiance to the process of comprehension. But did they?

Apparently not, at least not in the same way the readers in the other group did. Their explanations were, for the most part, qualitatively different, and they relied on three kinds of

explanations that either directed them to, returned them to, or kept them on the comprehension process. First of all, readers seemed often to attend to details, such as specific rules or exact scoring procedures, for no other reason than that they *were* details. In fact for crossword puzzles readers, attention to detail was the most common reason given for marking a comprehension box. Even in a game they understood well, even with details, examples, and rules they knew, many readers focused on comprehension. It was, in my judgment, the details themselves which cued many of these crossword puzzles readers to shift attention to comprehension, not the degree of familiarity with the topic.

Moreover, most of the subjects used what I labeled a "first paragraph strategy." Of the 39 subjects, 35 marked comprehension on the first paragraph. Their explanations, such as "I wanted to find out what it was about first," support the common sense notion that readers initially put their thinking skills purpose in abeyance in order first to get an idea of what they're reading about. To a lesser degree many of the readers also used a "final paragraph strategy." That is, they shifted back to comprehension on the final paragraph for no other reason than that it was the final paragraph, where, as one reader put it, "everything's tied up."

I noted a pervasive third cognitive phenomenon which doesn't seem quite so obvious or logical, a phenomenon I've labeled "default comprehension." That is, readers would frequently shift their attention to comprehension not because they needed to understand but because there was nothing they judged significant for comparing. "That paragraph didn't have anything to do with the game [word search], so I didn't care. I just read it to understand it." "There wasn't anything worth comparing or contrasting, so I just worked on comprehending." Statements like these, which represent negative

judgments that readers have made about the significance of text ideas to the thinking task, indicate more of a choice not to compare/contrast than a commitment to comprehension.

In short, readers in this group spent more of their time attending to comprehending than might be expected. But their reasons for this attention allotment were different from the reasons offered by those in the other group. The extent of a reader's background apparently affected not only the order of processing but also the kinds of strategies these readers used.

Discussion

The answer to the first research question — *does the extent of a reader's background and/or a reader's typical processing style affect the order of processing between the two processes of comprehending a text and using text ideas for a thinking task?* — is yes, at least with the texts, tasks, and subjects of these two experiments. The answer to the second research question — *how do readers explain their attention shifts or maintenance when reading both to comprehend and to use text ideas for a thinking task?* — provides more information about what occurs in the minds of readers when they maintain attention on one process or the other, or when they shift between the two. Obviously, in order to generalize with much confidence, this line of research needs to be extended to other kinds of texts, a wider range of thinking tasks, and more readers representing different age and skill levels.

The results from the investigation of the two questions within this experiment, however, shed some light on the complex relationships between reading comprehension and more general thinking skills and, I believe, have something to say to classroom teachers. Teachers, especially those in subjects where students are expected to think about or work

with ideas they've comprehended, typically preface reading assignments by suggesting such purposes as "evaluate the author's proposed solution to the population problem" or "compare her solution with other solutions." This research suggests that such assignments are not as straightforward as they might seem — that when, or even whether, students follow such directions depends upon several factors. The more teachers know about these possibilities, the better they will be able to prepare for and follow up reading assignments.

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