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# THE EFFECT OF TEXTUAL ERRORS ON DYADIC AND INDIVIDUAL LEARNING

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ABSTRACT

The major objective of the present experiment was to assess the effects of textual errors on dyadic and individual learning. One hundred undergraduates were taught a four-step learning strategy, after which they studied a text passage either dyadically or individually. Half of the passages within both conditions contained syntactic errors. Total recall measures indicated that dyads performed better than individuals on recall of text in sections not containing errors, whereas the groups did not differ on recall of the material in text sections containing errors. Further, dyads outscored individuals on measures of recall of error location, error frequency, and perceived difficulty of the text sections which contained errors. In addition, subjective processing measures indicated that motivation and interest were strongly related to recall.

A great deal of research has attempted to examine the effects of textual errors on students' comprehension (e.g., Harris, Kruithof, Terwogt, & Visser, 1981; Markman, 1977; 1979; Williams, Taylor, & Ganger, 1981). There are two salient reasons for this interest in responses to textual errors. First, many real-world texts contain errors. Second, and more importantly, the "error detection paradigm" (Winograd & Johnston, 1982, p. 61) is a valuable tool for examining more general comprehension monitoring processes. Research with this paradigm has shown that poor readers monitor their own comprehension less than good readers (Paris &

Myers, 1981), and that errors have a greater impact on the reading performance of good readers than poor readers (Isakson & Miller, 1976).

Despite an abundance of research, there are certain key aspects of students' reactions to textual errors that still warrant examination. First, the experiments have always been conducted within the context of individual learning despite research that has pointed to the efficacy of cooperative learning (Sharan, 1980; Slavin, 1980). Specifically scripted-dyadic learning, utilizing a basic four-step strategy (Dansereau et al., 1979) has proven effective with various types of text (e.g., academic text, McDonald, Larson, Dansereau, & Spurlin, 1985; and technical text, Hall et al., 1988). Since cooperative learning has become more pervasive in recent years (Johnson, Maruyama, Johnson, Nelson, & Skon, 1981; Slavin, 1983a, 1983b) it would be of value to determine the effects of textual errors on processing within cooperative dyads.

An analysis of the impact of errors on scripted-cooperative learning may also provide a unique arena for the examination of successful text processing in general. The authors contend that parallels can be drawn between text processing within the dyadic situation and text processing on the part of good readers. The most obvious similarity is that both good readers and dyadic learners comprehend and acquire text more effectively than baseline groups (e.g., poor readers and persons studying on their own). A similarity especially relevant to the present investigation is that both good readers and dyadic learners tend to be more metacognitively aware while reading text (e.g., good readers: Baker, 1984; Winograd & Johnston, 1982; dyadic learning: Larson et al., 1985; O'Donnell, Dansereau, Hall, & Rocklin, 1987).

An examination of dyadic learning could be used, in lieu of ongoing protocol solicited from good readers, in an analysis of effective text processing. Protocols solicited during a normal text processing episode can act to diminish the ecological validity of the situation. In this sense, examination of good readers' processing and metacognitive tendencies can be problematic. However, in the case of scripted cooperation, oral communication between partners is a natural part of the episode. Thus, by examining dyads within an arena that encourages text monitoring (the error-detection paradigm), metacognitive activities associated with effective text processing can be more readily elucidated.

A second limitation of previous error detection studies is that they rarely attempt to measure the effect of the errors on the processing of surrounding text. The recall of the errors and how they were processed (rather than the effect of the errors on recall of surrounding text) often serve as dependent measures (Baker, 1979; Paris & Myers, 1981; Winograd & Johnston, 1982). Although these studies have shed a great deal of light on the processing of textual anomalies, it is perhaps even more important to determine the effects of these errors on students' overall understanding of the material that surrounds them.

Although the majority of experiments conducted within this paradigm have examined outcomes associated with logical inconsistencies (e.g., structural incohesiveness, Harris et al., 1981; external consistency, Baker, 1984; and internal consistency, Garner, 1980), less meaningful syntactic errors were utilized in the present investigation. This decision involved the aforementioned interest in assessing the accuracy of a model that views scripted cooperation as an analogue for the processing of good readers.

Reading and text monitoring skills are important for the comprehension and utilization of text containing logical inconsistencies, but such skills appear to actually impair performance with text containing syntactic errors. Isakson and Miller (1976) found that normal good/poor reader differences in reading sentences aloud were eliminated when the text contained verbs placed in erroneous positions. If the authors are correct in their supposition that processing within a scripted dyad mirrors that of good readers, an analogous effect on outcomes would be expected. Further, by including both monitoring and recall performance measures, a more complete picture of this phenomenon will be made available to the researchers.

The present experiment attempted to extend the error-detection paradigm while addressing the issues mentioned above. First, this investigation assessed the effects of textual errors on persons who studied individually and dyadically. Second, in order to converge on the overall impact of the errors and their effect on surrounding text, four different dependent measures were examined. First, the students were asked general error recall questions. They were asked to recall the number of errors, and the sections of the text that contained errors. Second, the students ranked the difficulty of each of the sections of the text. In this way each person's difficulty ratings of the sections that contained errors could be compared with his or her ratings of sections that did not. Third, students completed free-recall tests over all the material studied. Fourth, students completed subjective graphs of their motivation and interest over the course of studying. This graphing technique has demonstrated substantial reliability, as well as sensitivity to situational manipulations and performance in previous experiments (e.g., Hall, Dansereau, & O'Donnell, in press).

## METHOD

### *Participants*

One hundred and four students recruited from undergraduate psychology classes at Texas Christian University participated in this experiment. They received class credit in return for their participation.

### *Materials*

*Delta Reading Vocabulary Test.* The Delta Reading Vocabulary Test (Deignan, 1973) was administered as a potential covariate for the analysis of the experimental objectives in order to reduce within-cell variance (Holley & Dansereau, 1979). Participants were allotted 10 minutes to complete this 45-item test. This measure has proven to be a significant predictor of recall of text studied dyadically (Larson et al., 1984).

*Subjective graphs.* Students were asked to graph their subjective judgment of their interest and motivation over the course of studying (an example of the graphs can be found in Figure 1).

*Study passages.* Three passages were used in the present experiment: one for strategy training and two for the learning task. A passage describing blood pressure was used for strategy training. This same 1,000-word passage has been used to train dyadic learning strategies in previous experiments (O'Donnell et al., 1985). A passage on blood was used for the target learning task. Two versions of the passage were used, one containing errors and one without errors. The passage is approximately 1,500 words and is divided into four sections of equivalent length. This passage has also been used in previous scripted-dyadic learning research (e.g., O'Donnell, Dansereau, Hall, & Rocklin, 1987).

The blood passage that contained errors was exactly the same as the passage that did not include errors with the following exceptions: Every third sentence in the middle two sections (2 and 3) contained a syntactic error according to three alternating error rules. The first consisted of reversing verb and subject order, the second included the use of double negatives, and the third consisted of the reversing of adjective and noun order. (For examples of the different error rules, see Table 1.)

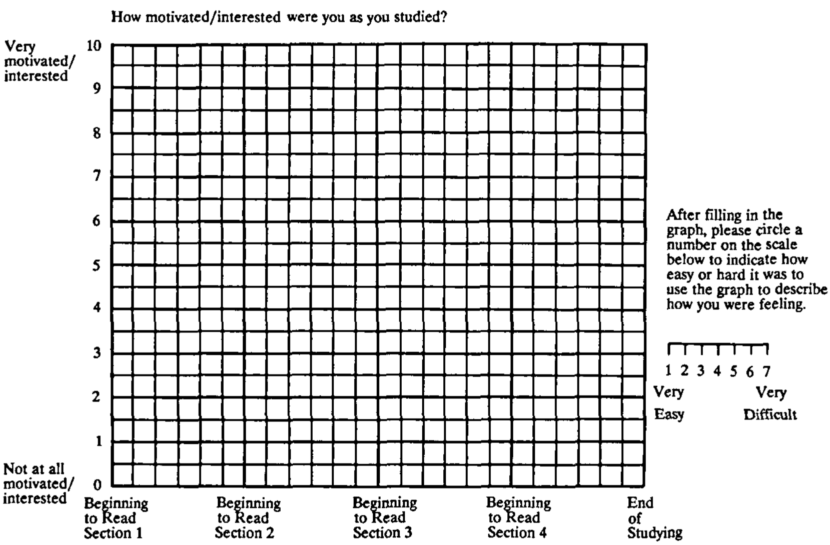


*Figure 1.* Motivation and interest subjective graph.

Table 1

*Examples of Textual Errors*

| Type of Error<br>Error/Nonerror |
|---|
| Subject-Verb Reversal: |
| *Error:* Albumins also molecules such as fatty acids transport which very soluble are not. |
| *Nonerror:* Albumins also transport molecules such as fatty acids which are not very soluble. |
| Double Negative |
| *Error:* Thus, the mature red blood cell is not not a tiny sac of hemoglobin, not completely not lacking a nucleus, and not not shaped with a considerable surface area for gas exchange. |
| *Nonerror:* Thus, the mature red blood cell is a tiny sac of hemoglobin, completely lacking a nucleus, and shaped with a considerable surface area for gas exchange. |
| Adjective-Noun Reversal |
| *Error:* Protein types three of found plasma in are albumins, fibrinogens, and globulins. |
| *Nonerror:* Three types of protein found in plasma are albumins, fibrinogens, and globulins. |

### *Procedure*

The present experiment was conducted in three sessions (approximately 2 hours each).

*Session 1.* The first part of this session consisted of the completion of the Delta Reading Vocabulary Test. Participants were then randomly assigned to one of two experimental groups (dyad and individual) with an equivalent number of males and females in each group. Those in the dyad groups were further divided into same-sex dyads. The participants then received strategy training. This training consisted of two parts. First, students in both groups were given a description of the four steps in the strategy (see Figure 2). Following this, participants were given 15 minutes to practice the strategy using the blood pressure passage.

The authors acknowledge that outcome differences between dyads and individuals may be partially due to strategy/script differences (i.e., the dyads are required to recall aloud, whereas the individuals are required to recall silently). These differences were included in order to maintain external validity (i.e., in "real world" study situations, most students studying alone do so silently, whereas cooperative learning includes some spoken dialogue).

*STEP ONE: READ*

Both partners read Section 1 of the text.

*STEP TWO: RECALL*

When both partners are finished, they put the passage out of sight. Partner A orally summarizes the contents of Section 1.

*STEP THREE: DETECT/MONITOR*

Partner B orally detects and corrects any errors in Partner A's summary.

*STEP FOUR: ELABORATE*

Both partners work together to develop analogies, images, etc., to help make the summarized information memorable.

These four steps are completed at the end of each text section with partners alternating recall and detect roles. Those who study individually are taught the same basic strategy. They do not, however, recall, detect or elaborate aloud.

*Figure 2.* Four-step abbreviated version of the MURDER method (Dansereau et al., 1979).

*Session 2.* Session 2 took place 2 days after Session 1. Half of the participants in each of the two experimental groups (dyads and individuals) unknowingly received text containing errors. This assignment was made randomly with the following constraints: Half of the individuals and half of the dyads were assigned to each of the groups, both members of a given dyad were assigned to the same group, and there were equal numbers of males and females assigned to each group. Thus, four experimental groups were created, error dyads (ED), nonerror dyads (ND), error individuals (EI), and nonerror individuals (NI).

The participants then studied the blood passage for 30 minutes according to their assigned condition, using the strategy they learned in the previous session (the persons in the dyad group studied with the same partner they practiced with in Session 1). This was followed by the completion of the subjective graph.

*Session 3.* This session took place 5 days after Session 2. During the session participants completed the dependent measures. They were first allotted 10 minutes to complete a location-and-frequency-of-errors recall test over the blood (see the Results section for a detailed explanation of these tests). Participants were then allowed 15 minutes to complete a free-recall test. In completing this test, they were simply asked to recall as much as they could from the text they studied.

## RESULTS

The results will begin with a report of the intercorrelations between the dependent measures. Four more sections, representing each of the dependent measures (total recall, error location/frequency recall, perceived difficulty, and subjective graphs), will then be presented.

### *Dependent Variable Correlations*

A zero-order correlation matrix was created with the four dependent measures (see Table 2) in order to assess the degree of interrelationship between measures.

Based on this analysis the authors concluded that the measures were independent enough to consider separately. The only correlation that was significant ($p<.05$) was the correlation between error recall and perceived difficulty. Since the measures still only share 25% of common variance, and since the measures are conceptually independent, these scores were also analyzed separately.

### *Total Recall*

Scoring of the free-recall tests was based on a procedure developed by Meyer (1975) and Holley, Dansereau, McDonald, Garland, and Collins (1979). First, a scoring key was constructed for the blood passages by dividing the original material into an inclusive set of idea units. Each unit contained one fact, stated in the form of a simple declarative sentence. An experienced scorer matched the idea units contained in a participant's free-recall test with the set of established idea units. For every idea unit on the key that also appeared on a given participant's free-recall test, the participant received from 1 to 4 points depending on the accuracy of the match. The points received for idea units within each section were summed to create

Table 2

*Dependent Variable Correlations*

| | Error Recall | Perceived Difficulty | Motivation/Interest |
|---|---|---|---|
| Total Recall | .08 | .03 | .15 |
| Error Recall | — | .49 | .13 |
| Difficulty | — | — | .17 |

*Note.* The correlations involving difficulty and error recall include only the textual-error groups.

section recall scores. It should be noted that the sections were clearly delineated by landmarks within the text in order to make these divisions salient to the student. More specifically, reminders were placed after each section to insure that the readers engaged in the four-step strategy.

Reliability was established by having a second experienced rater score a randomly selected subset (15%) of the free-recall tests. A reliability coefficient of $r = .98$ was achieved.

Preliminary tests for the homogeneity of within-cell variances and the homogeneity of the regression slope of the covariate (Delta) and the dependent measures were not significant. Consequently, the participants' Delta scores served as covariates in the total recall analyses.

Sectional recall scores were converted to standard scores (i.e., $M = 0$ and $SD = 1$). This conversion was performed in order to facilitate comparison of groups across sectional recall scores (total score possible was slightly different for the different sections). (Although the analysis of covariance was based on Z scores, the mean percentages of propositions mentioned, broken down by group, can be found in Table 3.) A three-way repeated-measure analysis of covariance was performed to analyze the total recall tests. Error/nonerror condition and dyad/individual served as between-subject factors. The two scores for the sections that contained errors (2 and 3) were summed. In addition, the sections that did not contain errors (1 and 4) were summed. These two composite scores constituted a within-subject factor, "section."

Table 3

*Adjusted Total Recall Means (Z scores and percentages) as a Function of Experimental Group*

| Group | Total Recall | |
|---|---|---|
| | Sections 2 and 3 | Sections 1 and 4 |
| Error Dyads | | |
| *M (SD) Z* | .03 (.71) | .40 (1.13) |
| *M (SD) %* | 5.52 (4.81) | 14.56 (8.30) |
| Error Individuals | | |
| *M (SD) Z* | −.02 (1.14) | −.29 (.76) |
| *M (SD) %* | 5.02 (7.72) | 9.58 (5.64) |
| Nonerror Dyads | | |
| *M (SD) Z* | .31 (1.34) | .07 (.99) |
| *M (SD) %* | 7.15 (8.92) | 12.06 (7.27) |
| Nonerror Individuals | | |
| *M (SD) Z* | −.25 (.61) | −.12 (1.05) |
| *M (SD) %* | 3.10 (3.94) | 10.60 (7.57) |

A significant main effect was found, $F(1, 85) = 6.10$, $p < .05$, $MS_e = 6.87$ with dyads ($M = .20$) outscoring individuals ($M = -.20$). In addition, a Dyad/Individual × Error/Nonerror group × Sectional recall interaction was found, $F(1, 85) = 5.58$, $p < .05$, $MS_e = 2.87$. No other significant effects emerged. (Table 3 contains the cell statistics associated with this ANCOVA.)

Tukey post hoc analyses (Hays, 1981) of the three-way interaction indicated that the nonerror dyad group significantly outperformed the nonerror individual group on recall of the material in the sections that corresponded to the error sections for the error groups. In addition, the error dyad group significantly outscored both individual groups on recall of the material in the sections which did not contain errors.

In order to provide the reader with a clearer understanding of the recall results, the mean percentage of propositions recalled are also presented in Table 3. Although these percentages appear quite low, it is important to keep in mind the mechanics of the scoring system. The participant's percentages are based on the total number of propositions in a given section of the passage. Thus, for example, for a participant to score 100%, he or she would be required to accurately reproduce every proposition in a 300- to 400-word section, 5 days after studying, with no recall cues.

### *Recall of Error Location and Frequency*

This measure consisted of two questions. First, the participants were asked to recall how many of the text's sections contained errors or anything else out of the ordinary (with two as the correct answer). Second, they were asked to rate the approximate number of errors in each of the text's four sections. If the perceived number of errors attributed to both the second and third sections exceeded the perceived number of errors for both the first and fourth sections, the student's answer was scored as correct (since only the second and third sections contained errors).

These results were analyzed with a 2 × 3 Chi-square analysis (experimental group × 0, 1, or 2 of the questions correct). Only the two error groups were compared since they were the only groups that studied text containing errors. A significant Chi-square was found for this comparison, $\chi(2, N = 47) = 9.12$, $p < .05$. An examination of the cell counts (Table 4) indicates that there were substantially more from the dyad group who answered both questions correctly (10 vs. 1).

### *Perceived Difficulty*

Students were asked to rate the difficulty of each of the text's four sections on a scale of 1 to 4. In order to analyze this measure, the two difficulty scores for the nonerror sections and the two difficulty scores for the error sections were summed separately. Each person's perceived difficulty rating of the sections containing

Table 4

*Cell Counts for Error Location/Accuracy Recall as a Function of Dyad vs. Individual Group (Error Groups Only)*

| Number Correct | Individual | Dyad |
|---|---|---|
| 0 | 11 | 7 |
| 1 | 11 | 7 |
| 2 | 1 | 10 |

errors was then subtracted from his or her perceived difficulty rating for the sections which did not contain errors. Thus, a perceived difficulty differential score (error minus nonerror sections) was created for each person.

An analysis of variance was performed comparing the dyad and individual error groups on perceived difficulty differential. The error dyad group ($M = 2.41$) significantly outscored the error individual group ($M = 1.04$), $F(1, 42) = 4.44$, $p < .05$, $MS_e = 20.94$.

### *Subjective Graphs*

Students' subjective graph scores were broken down into motivation/interest for the sections which contained errors for those in the error conditions, and motivation/interest for the nonerror sections. To compute the former, the mean of the two points where a student's graph crossed the vertical landmark line corresponding to the end of section two and section three was computed. The latter consisted of the mean of the two points where a student's graph crossed the end of section one and four landmarks.

An analysis of variance was performed in which dyad/individual and error/nonerror condition served as between-subject factors and sectional graphs as a within-subject factor.

Table 5

*Interest and Motivation as a Function of Error vs. Nonerror Group and Section*

| | Interest/Motivation | |
|---|---|---|
| Group | Error Sections | Nonerror Sections |
| Error Conditions | | |
| *M* | 3.59 | 4.19 |
| *SD* | 1.75 | 1.93 |
| Nonerror Conditions | | |
| *M* | 3.80 | 3.34 |
| *SD* | 1.79 | 1.55 |

A main effect was found for dyad/individual with dyads ($M = 4.10$) more motivated and interested than individuals ($M = 3.37$), $F(1, 88) = 4.78$, $p < .05$, $MS_e = 5.18$. In addition, error/nonerror condition significantly interacted with section, $F(1, 88) = 12.52$, $p < .001$, $MS_e = 1.04$. (Table 5 contains the descriptive statistics for the cells within this interaction.) No other significant effects were found.

Tukey's HSD tests (Hays, 1981) of the cell differences within this interaction indicated that those in the error conditions were significantly more motivated and interested than those in the nonerror conditions on the sections which did not contain errors. No other comparisons were significant.

## DISCUSSION

Two significant findings emerged from the total recall analysis. First, overall the dyad groups significantly outscored the individual groups on recall. This result must, however, be qualified by a three-way interaction. The most significant aspect of this interaction, in terms of the research objectives, is the impact of the errors on the dyad group. Specifically, the errors appeared to have a negative impact on the normally positive effect of dyadic learning for recall of text immediately surrounding errors. However, for the text in nonerror sections the positive effect of dyadic learning on recall was strengthened. That is, the error-dyad group substantially outscored all groups on nonerror recall although they did not significantly outscore any groups for the recall of the material in the text sections containing errors.

The analysis of the subjective graphing of motivation and interest indicates that motivation (at least for the dyad groups) was strongly related to recall. Dyads were significantly more motivated overall than were individuals. In addition, those in the error groups were significantly more motivated while studying the nonerror sections than with the error sections, although there was not such a difference for the groups whose text did not contain errors. These findings are consistent with the pattern of recall results.

The analysis of the measures of error recall and perceived difficulty indicated that the dyads were more aware, or at least were more able to recall, the pattern of errors within the text. For the groups which encountered errors, the dyads were more effective in recalling which sections contained errors in addition to rating these sections as more difficult than the sections which did not contain errors.

The first conclusion that dyads recalled significantly more material independent of the section, or whether or not errors were encountered at all, is consistent with a great deal of previous research (e.g., Spurlin, Dansereau, Larson, & Brooks, 1984; Larson et al., 1985). So it appears that the effectiveness of dyadic learning can be generalized even to text material which includes sections containing errors.

However, the pattern of this effectiveness is somewhat different than with error-free text. The positive effect of dyadic learning is decreased for text immediately surrounding the errors, and increased for recall of text in sections which do not contain errors. If one considers the results with respect to motivation, error recall, and perceived difficulty, a more coherent picture for these somewhat confusing results begins to emerge. First, those in the error dyad group presumably were able to clearly differentiate the pattern of errors within the text (i.e., sections 1 and 4 did not contain errors whereas sections 2 and 3 did). This was very probably due to the increased emphasis on monitoring activities within scripted dyadic learning (Larson et al., 1985). Second, the motivation measures indicate that the dyads consequently focused their attention on the sections which did not contain errors (i.e., those in the dyad-error group reported significantly greater motivation associated with the studying of the nonerror vs. error sections). Thus, the effectiveness of dyadic learning was amplified for those sections and decreased for the error sections.

Further, it is quite possible that the dyad members felt more comfortable employing the strategy with respect to the more familiar nondisrupted material than with the disrupted material. Research with respect to social facilitation theory indicates that persons perform familiar activities (such as the oral recall of the nonerror sections) more effectively when being observed by another, although such observation decreases performance of nonfamiliar activities (such as recall of the error-filled material; Markus, 1978).

In conclusion, a parallel will be drawn between the processing of students who study dyadically and good readers in general. More specifically, the data indicate that, to a large extent, the effect of embedded errors on students who studied dyadically mirrors the responses of good readers when faced with a similar situation. First, those in the dyad groups detected the errors more readily. This finding is analogous to a number of investigations that have found that good readers monitor their comprehension to a greater degree than do poor readers (e.g., Paris & Myers, 1981). Further, the detrimental effect that the errors had on dyadic performance parallels research that indicates that textual errors have a more negative impact on good, as opposed to poor, readers (Isakson & Miller, 1976).

Thus, in terms of the "error detection paradigm" alluded to earlier, the responses of those in dyads appear to be consistent with the responses of good readers. Therefore, just as with good readers, the educational practitioner can probably expect those who study dyadically to more effectively monitor their comprehension than would normally be the case. However, this increased vigilance, with respect to textual anomalies, may have some negative consequences on the overall understanding of material. The effect of these errors on the comprehension of those in dyads may have been especially detrimental in the present experiment due to the fact that resolution of the errors added little to the overall meaning of the material.

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