Print vs. Computer Screen: Effects of Medium on Proofreading Accuracy

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This study was designed to examine whether the medium by which information is presented would influence participants' proofreading accuracy. A general linear model ANCOVA was conducted to examine participants' ability to detect proofreading errors presented in printed text compared to errors detected in text presented on computer screens. The results suggest that the medium by which information is presented could influence participants' proofreading accuracy, and that the participants' familiarity with the topic of the text may hinder their ability to concentrate on the proofreading task.

A number of studies have indicated that textual errors in newspapers can decrease the perceived credibility of the papers. A recent survey reported that 35% of the public found mistakes in the newspaper more than once a week. "Each misspelled word, bad apostrophe, garbled grammatical construction, weird cutline and mislabeled map erodes public confidence in a newspaper's ability to get anything right."[1] Haiman examined several recent studies and concluded that the public is increasingly skeptical regarding newspapers' credibility because of the amount of both factual and grammatical errors found. Factual errors and spelling and grammar errors are observed in both print and online news stories.[2] However, it remains unclear whether such errors are due solely to deadline pressures or if proofreading on computers is more difficult. If the medium carrying the information affects the detection of errors, there are implications for newsroom personnel and for the training universities provide to students who expect to enter the newsroom.

Medium and Proofreading

Proofreading accuracy is defined as the ability to detect errors in a given text. The study of the effects of medi-

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um on proofreading accuracy began more than twenty years ago, with the comparison of text editing on Visual Display Units (VDU) to paper-based text editing. With technological developments, the medium has evolved to include online presentations.

Proofreading Accuracy. Wright and Lickorish conducted one of the first studies comparing VDU and paper text for proofreading accuracy. Their primary concern was the way in which the text was annotated to indicate errors. Three conditions were used: proofreading and annotation on paper, proofreading and annotation on screen, and proofreading on screen and annotation on paper. The first group participated in the proofreading on screen and annotation on paper condition. The second group participated in the proofreading and annotation on screen condition. Both groups participated in the proofreading and annotation on paper condition. Subjects read four stories, each approximately six pages long, with 134 lines, and thirty-nine errors. Four types of errors were used: misspelled words, omitted words, repeated words, and typing errors.

Wright and Lickorish found no significant difference in proofreading accuracy between the VDU and paper text conditions, and reported that it took subjects longer to proofread on the screen than on paper. However, they indicated that the results might have been affected by the difference in error notations between the conditions. For example, in the VDU condition, errors were indicated by keyboard insertion in the right-hand margin beside the text, whereas in the paper condition, errors were indicated by writing on a piece of paper the line number and type of mistake found. Errors in this study were indicated in a nonstandard fashion. If a spelling error was found, subjects were instructed to mark it with an "S." An exclamation point (!) was used to indicate that words had been omitted. A question mark (?) was used to indicate any error the subject did not otherwise know how to mark.[3]

Initial research did not show significant effects between medium and proofreading accuracy.[4] However, several later studies reported conflicting results. Wilkinson and Robinshaw compared VDU edits and paper text edits for proofreading accuracy. Noting the increasingly widespread use of word processing, they wanted to know whether editing text on paper, rather than working directly on a VDU screen, would produce more accurate proofreading. They tested for accuracy, fatigue, and speed. Subjects were split into two groups, and each group participated in five one-hour sessions across a five-day period. The first day consisted of instructions and a practice test, and the remaining four days were dedicated to proofreading tests. Each of the two groups experienced both the VDU and paper conditions twice. Subjects recorded proofreading errors in both conditions by speaking into a microphone. Contrary to Wright and Lickorish's findings, Wilkinson and Robinshaw's found a significant difference between the VDU and paper conditions. Participants in the VDU condition detected fewer proofreading errors, read fewer pages, and experienced greater fatigue throughout the experiment than participants editing in the paper condition. The researchers argued that participants' fatigue in the computer condition contributed to decreased ability to detect errors. They

noted that as the experiment progressed, a "speed/accuracy trade off" apparently emerged. Participants in the computer condition appeared to be affected by fatigue. They missed more errors as the experiment advanced, but their reading time for the material was increasing.[5] This left the researchers questioning whether it was simply fatigue affecting participants or if the participants were trading accuracy for speed.[6]

Speed. Among the research examining proofreading accuracy among media, the majority of studies noted a reduction in speed for participants who read from computer screens.[7] Gould and Grischkowsky conducted several studies in an attempt to discover what variables could explain the difference in reading speed.[8] Oliver summarized the variables and their definition as follows:

- Text Orientation: Paper tends to be oriented in a vertical form with the page narrower than it is deep, whereas a screen is usually wider than deep.

- Visual Angle: The screen's width creates a wider visual angle through which the reader's eyes must pass.

- Reading Distance: People tend to sit further from the text when reading a screen than when reading from paper.

- Display Quality: Computer monitors can vary in the quality of the image that they produce with character formation less defined and pronounced than paper characters.

- Display Contrasts: The contrast between the text and the background differs between paper and text.[9]

While no single variable was found to have a significant impact on proofreading, Gould and Grischkowsky speculated that it was a combination of the variables that could affect proofreading tasks. Even with the elimination of some of these variables through new technology (e.g., display contrast and display quality), subjects tested in Oliver's more recent research still required more time to proofread text in computer conditions than subjects in print conditions.

Error Type. The types of errors detected during proofreading tasks have also been investigated. Creed et al. compared proofreading performances across three different media: VDU, photograph, and print. They tested subjects' ability to distinguish three different types of error: visually similar, visually dissimilar, and synthetic. Their results indicated that when participants proofread materials on the VDU, their scores were significantly lower than on paper. When participants proofread from a photograph of a VDU screen, they displayed intermediate performance. Visually similar errors appeared to be harder to detect than other error types. Creed, Dennis, and Newstead posited that one reason for this finding might be the display font; the font could make distinguishing letters difficult.[10]

Creed, Dennis, and Newstead continued their investigation of medium and proofreading accuracy by not only focusing on error type, but also on the effects of format on proofreading ability. Text materials were presented in three conditions. In the first condition, text was displayed in full-page format for proofreading. In the second condition, the text was shown one paragraph at a time, and in the third condition,

the text was displayed one sentence at a time. Subjects who were given one sentence at a time to proof scored the highest in accuracy, followed by the paragraph and full-screen condition. However, the speed with which the tasks were completed declined, and the researchers suggested further investigation of the issue of speed.[11]

In an extensive literature review of empirical research examining the differences between reading from paper versus screen, Dillon summarized both measures and outcomes from previous research. He listed five possible outcome differences that have most commonly been measured: speed, accuracy (most often measured by proofreading), fatigue, comprehension, and preference. Among all five variables there have been conflicting results.[12] Of the summarized research, however, investigators failed to consider what effect prior proofreading experience may have had on participants' ability to proofread on computer screens or paper.

Proofreading Experience. Oliver attempted to investigate what impact previous proofreading experience might have on participants' ability to proofread between media. Participants read eight pages of text on the computer and were asked to indicate errors by using their mouse and clicking. The computer recorded their responses. Six weeks later, participants saw the same stimulus material in print format and circled any errors they detected. Each participant was asked to indicate his or her previous computer-based proofreading experience, and was placed in either a high or low experience group. The study revealed that participants in the high proofreading experience group showed no significant difference between proofreading in the computer and print conditions. However, participants with low proofreading experience scored significantly higher in the print condition than the computer condition. Participants with high experience found significantly more errors than those in the low group. No matter what the students' prior proofreading experience, participants took more time to complete the computer task than the print. These findings suggest that previous experience in computer-based proofreading may help individuals overcome a possible medium difference in proofreading. The author pointed out that a limitation to the study was that participants were proofreading text that wasn't their own, and because they didn't feel a sense of "ownership," they may not have examined the text carefully.[13] However, if this situation were occurring, it would be taking place in both of the conditions, and could be factored out.

Research Question. This research examines differences in students' abilities to proofread from computers versus printed materials. This study also examines the effects that previous proofreading experience has on students' ability to complete the proofreading tasks. This research was therefore designed to examine the following research question:

> **RQ1:** For students, controlling for proofreading experience, what is the relationship between medium and proofreading accuracy?

It is important to note that this study examines the influence of medium on proofreading rather than on copy editing. The higher level of

knowledge and skill that is necessary for copy editing is acknowledged, and therefore this study examines only students' proofreading abilities—a foundational skill obtained by journalism students.

Method

Subjects. Eighty-four undergraduate students from a large Northeastern university participated in the study. They were awarded a nominal amount of extra credit in exchange for their involvement. Nearly all participants were communication majors (94%), with journalism majors accounting for 73.8%. Sudents were told they would be reading a short newspaper article, indicating any errors they might find, and filling out a questionnaire. Students were randomly assigned to one of two conditions. The first condition (N=42) was the paper condition, and the second condition (N=42) was the computer condition.

Stimulus Material. Two sets of stimulus materials were created for this study. Both were short newspapers articles, approximately 550 words, and each contained seventeen errors within the text. The first article, with the headline "Antismoking Group Sues to Preserve an Ad Campaign's Tone," discussed a lawsuit attempting to protect an anti-smoking commercial that tobacco companies were claiming was libelous. The second article, "Record Labels' Answer to Napster Still Has Artists Feeling Bypassed," covered the then-ongoing copyright controversy between musicians and Napster, an online music trading network.

Stimulus materials were created to look like authentic newspaper articles, and to look as similar as possible. An equal number of each of the types of errors were placed in the text (i.e., punctuation, capitalization, misspelled words, indented paragraphs, and double words), and each contained ten errors on the first page and seven errors on the second page. The types of errors were carefully selected to test students' actual proofreading abilities rather than their grammatical skills, although, granted, it is difficult to entirely separate the two. The stimulus material for both the computer and print conditions were identical, using the same font type, style, and size. Proofreading stimulus materials were pretested with students from the same campus, and modified to ensure variance across the measures.

Procedure. The experiment was administered to groups of participants in a computer laboratory. Paper and computer sessions were conducted separately during six different sections. The study was held two consecutive evenings in the same room. Upon arrival, participants were welcomed and asked to give informed consent by signing the forms furnished by the researcher. They were told that they would be reading a short newspaper article and that if they found any errors they should mark them.

Students in both conditions were asked to "make any changes that were needed," and they were not required to use proofreading marks/symbols. In the paper condition, participants noted errors by making the corrections directly on the paper. In the online condition, students were asked to make corrections by using their keyboard and mouse to make changes on the screen. Students in the computer condition were informed that the Microsoft Word tool "track changes" had been activat-

ed, and that any correction they made would appear in red on the screen. Participants in both conditions were informed that they would have eight minutes to read and make corrections to the newspaper article.

After completing the proofreading task, students in the print condition were asked to hand in their papers and fill out the questionnaire. Students in the computer condition were asked to print their papers (on which the "track changes" function had marked all edits), and to fill out the questionnaire.

Dependent Measure. This study's dependent variable was proofreading accuracy. Proofreading accuracy was measured by the number of errors participants detected, with possible scores ranging from 0 (no errors detected) to 17 (all errors detected).[14] Therefore, the higher a participant's error detection score, the better the participant performed on the proofreading task.

Independent Measures. The independent measures in this study were condition, story, editing experience, and error placement.[15] Students were randomly placed in the computer condition or the print condition, and also randomly assigned the smoking story or the Napster story within each condition. An editing experience scale operationalized participants' previous proofreading experience. This scale was created using four measures. Students answered three self-report questions on a 7-point Likert scale about their proofreading experience on computers and paper, and about any copy editing instruction they had received. Students also reported the number of copy editing courses they had taken. An index of editing experience was subsequently created by averaging the standardized scores for these four measures (Cronbach's alpha =.80).

Error placement was the variable used to examine the speed with which students were able to complete the proofreading task. Error placement was operationalized by splitting the total number of errors into two groups, the first eight errors and last eight errors. Therefore, if participants ran out of time to complete the proofreading tasks, their first errors score should be higher than their last errors score. The operationalization of error placement was used to avoid simply counting last errors missed in case participants did not have the ability to detect the errors due to error type.

Control Measures. A questionnaire with twenty-seven items was administered after the proofreading task. Questions pertaining to participants' previous proofreading experience and perceptions of the article as being informative, accurate, easy to read, and enjoyable were included as control measures. The participants' perceptions of the article being informative, accurate, and enjoyable were included to lessen the possibility that the participants' liking of the story influenced their ability to focus on the task of proofreading. The measure of how easy the article was to read was included to ensure participants did not find the text difficult to read, allowing additional cognitive resources to focus on the task of proofreading rather than on comprehension of the text.

Results

A general linear model ANCOVA was conducted to examine participants' ability to detect proofreading errors.[16] Error detection scores were

Table 1
ERROR DETECTION: CONDITION X STORY INTERACTION

Error Detection: Condition x Story Interaction

		Condition	
		Print	Computer
Stimulus			
Napster	*M*	9.01_{aA}	8.25_{aA}
	SE	.57	.51
Smoking	*M*	10.54_{aB}	7.33_{bA}
	SE	.51	.55

$F(1, 71)=5.25$, $p<.05$.

Note: Using Holm's sequential bonferroni post hoc comparisons within rows, means with no lowercase subscripts differ at $p<.05$; comparisons within columns, means with no uppercase subscript differ at $p<.05$.

analyzed with condition, story, and editing experience employed as predictors, controlling for students' perceptions of the article as being informative, accurate, easy to read, and enjoyable. As expected, the analysis revealed a significant main effect for condition, with higher scores for participants in the print condition (M=9.77, SE=.38) than those in the computer condition (M=7.78, SE=.38), $F(1,71)=13.26$, $p<.001$.

However, this main effect for condition must be interpreted in light of the Condition x Story Interaction that was also obtained, $F(1, 71)=5.25$, $p<.05$. Table 1 shows the means associated with this interaction. The table illustrates that while there was a significant decrease in error detection across mediums, the Napster stimulus material decrease between the computer and print condition was not significant, whereas the smoking stimulus material decrease was significant.

An exploratory analysis was conducted to examine the issue of error placement. A 2 (Error Placement) x 2 (Condition) x 2 (Story) mixed model repeated measures analysis of covariance, was conducted with error placement as a within-subjects factor, controlling for proofreading experience.

The analyses revealed a significant main effect for errors missed due to time/speed $F(1,79)=78.33$, $p<.001$, with participants detecting a greater amount of first errors (M=5.21, SE=.12) in comparison to last errors (M=3.53, SE=.20). However, this main effect should be interpreted in light of a significant Story x Time/Speed interaction, $F(1,79)=4.79$, $p<.05$. Table 2 shows the means associated with this interaction, and illustrates that while error detection scores for the smoking story decreased over the time of the proofreading task, this decrease was not as significant as the Napster story scores decrease.

Table 2
ERROR DETECTION: STORY X ERROR PLACEMENT INTERACTION

Error Detection: Story x Error Placement Interaction

		Error Placement	
		First Error	Last Error
Stimulus			
Napster	*M*	5.34_{aA}	3.24_{bA}
	SE	.17	.28
Smoking	*M*	5.08_{aA}	3.81_{bA}
	SE	.17	.28

$F(1,79)=4.79$, $p<.05$.

Note: Using Holm's sequential bonferroni post hoc comparisons within rows, means with no lowercase subscripts differ at $p<.05$; comparisons within columns, means with no uppercase subscript differ at $p<.05$.

Discussion

Again, this study was designed to examine whether the medium by which information is presented would influence participants' proofreading accuracy. Medium had a significant main effect on proofreading accuracy. These findings support both Wilkinson and Robinshaw's and Creed, Dennis, and Newstead's research. The results suggest that students are justified in printing out material to conduct a more thorough proofreading.

Although the error detection across media for both stories decreased, it was significant only for the smoking story. One explanation might be that students were more familiar with the content of the Napster story than the smoking story. Napster is a subject that has gained much attention on college campuses. Readers may have been too involved with the content of the article and were not focused on the proofreading task. Students who read the smoking story may not have been as familiar with the topic, which allowed them to concentrate on the proofreading task. The extent to which participants are unfamiliar with a given issue or topic may force them to read more carefully, and will therefore enable them to detect more errors under the right conditions.

Within the print condition there was a significant difference for error detection between the smoking article and Napster article, but no significant difference was found between the two stimuli in the computer condition. It is possible that students in the computer condition focused on proofreading for the smoking story, but the medium hindered their proofreading abilities.

This study also indicates that previous proofreading experience did not affect participants' abilities to per-

form proofreading tasks. The results contradict Oliver's findings. Again, he found that participants with previous computer-based proofreading experience revealed no significant difference in error detection between medium, whereas participants with little or no previous proofreading experience did differ significantly in error detection between conditions. One possible explanation could be that Oliver operationalized previous proofreading experience by using one self-report measure of computer-based experience.[17] This study used self-report measures and the number of copy editing courses taken to create a scale to measure previous copy editing experience. The scale represents both print and computer proofreading experience, unlike Oliver's measurement.

Previous research has indicated that it takes more time to complete a proofreading task on a computer than in print. The current study examined error placement by comparing the sum of the first eight scores to the sum of the last eight scores to determine whether the participant ran out of time to complete the task. Results indicated that participants detected more errors at the beginning of the story than at the end of the story, regardless of medium. However, it cannot be concluded from these findings that speed was not affected by the medium. It is possible that students skimmed the reading, detecting errors throughout the text. In addition, types of errors were not identical between the first errors and the last errors.

The results also indicated a significant Story x Error Placement interaction. Participants reading the Napster article showed a significantly greater decrease in errors detected from the first eight errors to the last eight errors than did those reading the smoking article. Again, the familiarity of the Napster topic may have led participants to attend less closely as they proceeded, thereby missing more errors, whereas participants' unfamiliarity with the smoking article may have led them to attend closely to all of the material.

Implications

These findings have strong implications for professional newsrooms. Proofreading on-screen instead of on paper may be more efficient and more ecological for newsrooms, but if differences exist between individuals' abilities to proofread on screen, newsrooms will need to adjust their actions. Although most newsrooms proofread both electronic and print copies, professionals in the field should question how efficient the use of computers is in the editing process if fewer errors are detected electronically. Several layers of additional checks for proofreading errors could be instituted.

This study also has implications for universities that are training future newsroom professionals. The notion of "the more technology in the classroom the better" appears to be accepted among many faculty, yet little empirical research validates such a claim. Elementary, secondary, and higher education educators are being pressured to incorporate new technologies into their curricula without knowing the effects. This study's results imply that institutions should be cautious when incorporating computer-mediated technologies into classrooms.

Limitations

While these findings are interesting, this study has several limitations. Subjects were communication students from a large Northeastern university. This limits the external validity of the research because the participants are students in training to become communication professionals. These findings cannot be generalized to the larger professional field of journalism.

Another external validity limitation was the short length of the newspaper articles. Although the brief stimulus materials were created to avoid potential problems with participant fatigue, the findings cannot be generalized to longer manuscripts that students and newsroom personnel encounter.

There were several potential internal validity and/or reliability limitations. Students completed the proofreading task in a laboratory setting. Participants' speed to complete a task was measured by the completion of the first eight errors and the last eight errors. Participants could have skimmed the stimulus materials trying to catch errors, and the speed measurement (error placement) would have indicated that they finished the article if they detected any of the last eight errors. The types of errors were not identical between the first and last error groups.

Finally, the notation used to indicate errors and its effect on proofing scores may be important. But this study did not have any measure that retrieved feedback from participants about how comfortable they were using the directed means of annotation to indicate error.

Directions for Future Research

It is critical that further research is conducted to examine the effects of previous proofreading experience on error detection among mass media. Research results conflict about whether experience can help participants increase proofreading accuracy. Researchers should consider both computer- and paper-based experience and should look at creating more accurate tools for measurements of previous proofreading experience. Future research could require participants to complete proofreading tasks on both print and electronic text so that previous experience could be controlled as a factor. Using an experimental design that requires participants to complete an exercise in both conditions would also provide a more accurate depiction of how journalism professionals typically approach their work.

Future research should also consider using both brief and lengthy manuscripts to examine whether medium differences vary as a function of the length of the manuscript. The time it takes to complete the proofreading task should also be taken into consideration. Most research indicates that proofreading on computer screen takes more time than proofing on paper.[18] To obtain accurate information regarding the time/speed for completion of the task, researchers may consider not including a time restriction and simply record the time it takes each participant to finish the task.

For this study, college students were used as subjects. Further examination of proofreading differences should be conducted among journalism professionals. The previous proof-

reading experience of the students in this sample was measured by self-report measures and a count of how many copy editing courses the students had taken. By sampling professionals for future research previous experience could be measured in number of years, and could possibly create a better method of measurement for proofreading experience. Additionally, measurements could be created to look at copy editing abilities rather than simple proofreading abilities.

The importance of the relationship between participants and their familiarity with the content of articles used for stimulus material should also be carefully examined. If participants are familiar with the topics of the articles or are personally affected by them, they may not focus on the proofreading task. Oliver discusses the notion of "ownership"; if participants have some form of attachment to an article, they may take the task more seriously.[19] Researchers should include measurements of how familiar, involved, or attached a participant might be toward an article topic, in order to control for these effects.

Individuals' lack of ability to proofread as accurately on computer screens as they do on paper suggests that there is some type of disruption in cognitive processing among these media. Future research should examine the psychological mechanism, which might indicate a cognitive explanation for the differences.

The introduction of computers and desktop publishing into journalism classrooms has restructured curricula and practices throughout journalism schools across the country.[20] Journalism education quickly embraces any new technology as it surfaces in hopes to stay abreast of industry practices.[21] Journalism educators have felt pressed to revamp their existing courses to include current technological advances[22] and have increasingly experienced stress in an attempt to keep up with technology in their classrooms.[23] As the assumption persists that technology enhances and is beneficial to journalism practices, it is important to investigate the effectiveness of adopting different technologies.

The findings from this study suggest that using computers to proofread may not be as effective as proofreading from printed copy. Many educators and administrators may argue that computers will not be taken out of newsrooms, and therefore question what the current findings imply for journalism instruction. As just over one-third of the public has reported finding errors in their newspapers and expressed a diminishing perception of the news media to be a credible institution, it is important that journalism educators understand the influence of technology on students' performances and ability to be accurate.

Journalism educators can begin by looking at the variables that have been identified as influencing participants proofreading ability. Oliver's findings suggest that individuals with high levels of proofreading experience do not experience significant differences in ability to detect proofreading errors across mediums, whereas those individuals who have low proofreading experience detect a greater number of errors in print conditions than computer conditions. Oliver's finding suggests the medium effect can be diminished through proofreading experience.[24] However, it is important to note the current study did not support Oliver's

finding. Previous research also suggests that the format the text is presented in may influence participants' ability to proofread.[25] Students may detect proofreading errors more easily when text is presented in smaller "chunks," rather than through pages of text, which must be navigated. While other variables have been investigated—time, fatigue, annotation method, ownership, familiarity—conflicting results lead to greater confusion as to what variables affect individuals' ability to proofread across media. Further investigation is needed to gain a clearer understanding of the effects of such variables, which in turn could produce effective interventions that could address a medium's influence.

Based on the current study and prior research, researchers are unable to predict with certainty the influence mediums have on individuals' ability to complete proofreading tasks. In light of the current technological explosion, it is important to continue research in this area so that we can better understand how learning and understanding are affected by medium.

Endnotes

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3. Peter Wright and Alan Lickorish, "Proof-reading Texts on Screen and Paper," *Behavior and Information Technology* 2 (3, 1983): 227-35.

4. J. D. Gould and N. Grischkowsky, "Doing the Same Work with Hard Copy and Cathode-ray Tube (CRT) Computer Terminals," *Human Factors* 26 (3, 1984): 323-37; and Wright and Lickorish, "Proof-reading Texts on Screen and Paper."

5. R. T. Wilkinson and H. Robinshaw, "Proof-reading: VDU and Paper Text Compared for Speed, Accuracy, and Fatigue," *Behavior and Information Technology* 6 (2, 1987): 125-33.

6. Anthony Creed, Ian Dennis, and Stephen Newstead, "Proof-reading on VDU's," *Behavior & Information Technology* 6 (January 1987): 3-13; and Wilkinson and Robinshaw, "Proof-reading: VDU and Paper Text Compared for Speed, Accuracy, and Fatigue."

7. Andrew Dillon, Cliff McKnight, and John Richardson, "Reading from Paper versus Reading from Screen," *The Computer Journal* 31 (5, 1988): 457-64.

8. Gould and Grischkowsky, "Doing the Same Work with Hard Copy and Cathode-ray Tube (CRT) Computer Terminals."

9. Ron Oliver, "Proof-Reading on Paper and Screens: The Influence of Practice and Experience on Performance," *Journal of Computer-Based Instruction* 20 (fall 1993): 118-24, 119.

10. Creed, Dennis, and Newstead, "Proof-reading on VDU's."

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12. Andrew Dillon, "Reading from Paper versus Screens: A Critical Review of the Empirical Literature," *Ergonomics* 35 (10, 1992): 1297-1326.

13. Oliver, "Proof-Reading on Paper and Screens: The Influence of Practice and Experience on Performance."

14. False errors detected by participants were not included in the analysis.

15. Previous research has identified medium, editing experience, time/speed, and fatigue as influential variables on the process of proofreading. See Wilkinson and Robinshaw, "Proofreading: VDU and Paper Text Compared for Speed, Accuracy, and Fatigue"; Gould and Grischkowsky, "Doing the Same Work with Hard Copy and Cathode-ray Tube (CRT) Computer Terminals"; W. H. Cushman, "Reading from Microfiche, VDT and the Printed Page: Subjective Fatigue and Performance," *Human Factors* 28 (1, 1986): 63-73; Dillon, "Reading from Paper versus Screens: A Critical Review of the Empirical Literature"; and Oliver, "Proof-Reading on Paper and Screens: The Influence of Practice and Experience on Performance." Different story or stimulus materials have been implemented to make certain the text itself is not a confounding factor (Dillon, "Reading from Paper versus Screens: A Critical Review of the Empirical Literature"; and H. van Oostendorp, "Studying and Annotating Electronic Text," in JeanFrancois Rouet, Jarmo J. Levonen, Andrew Dillon, and Rand J. Spiro, eds., *Hypertext and Cognition* (Mahwah, NJ: Lawrence Erlbaum Associates, 1996).

16. A *t*-test was conducted before the multivariate analysis to examine the relationship between medium and proofreading. A significant difference between conditions was found [$t(56)=-3.87$, $p<.001$]. Participants in the print condition were more likely to detect proofreading errors ($M=9.23$, sd=2.8) than participants in the computer condition ($M=6.66$, sd=2.084).

17. Oliver, "Proof-Reading on Paper and Screens: The Influence of Practice and Experience on Performance."

18. Dillon, "Reading from Paper versus Screens: A Critical Review of the Empirical Literature."

19. Oliver, "Proof-Reading on Paper and Screens: The Influence of Practice and Experience on Performance."

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24. Oliver, "Proof-Reading on Paper and Screens: The Influence of Practice and Experience on Performance."

25. See Rouet, Levonen, Dillon, and Spiro, eds., *Hypertext and Cognition.*