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**Internet Financial Reporting:
The Effects of Hyperlinks and Irrelevant Information on Investor Judgments**

A Dissertation Presented for the
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ABSTRACT

The flexibility provided by hyperlinks may have detrimental cognitive effects on investors, including cognitive overload. Users must perform multiple tasks simultaneously when browsing with hyperlinks, including navigating through the system, reading, understanding, and analyzing the information, and recalling information previously viewed. Simultaneous performance of these tasks places a high cognitive load on the information system user. This study investigates the effects of presentation format and the type of information on nonprofessional investors' judgments. Specifically, I examine whether viewing a company's web-based financial disclosures with hyperlinks (as compared to paper-based disclosures) causes an increase in cognitive load, resulting in nonprofessional investors' acquiring less information, making less accurate decisions, and taking more time making decisions. Additionally, I examine whether investors viewing relevant and irrelevant information cues with hyperlinks are more likely to exhibit a dilution effect, such that the irrelevant information dilutes the impact of the relevant information. Results of this study have implications for financial disclosure regulation and information system design. There are currently limited regulations as to the content of corporate websites and as to auditors' responsibilities to review web disclosures. Evidence from this study indicates that presentation format and type of Internet disclosures affect investor judgments and suggests that regulations may be needed for the Internet reporting environment.

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1. INTRODUCTION

The participation and impact of the individual (i.e., nonprofessional) investor on the capital markets continues to grow. Approximately 34 million individual investors invest directly in the stock market (NYSE 2000). Individual investors frequently use the Internet to research investment opportunities and conduct stock trades online (Spiro and Baig 1999). Companies disseminate financial information on their corporate websites to improve communications with individual investors (Ashbaugh et al. 1999).

Financial disclosure on the Internet is for the most part voluntary; consequently, there are limited assurances as to the quality of the information reported on corporate websites. The Financial Accounting Standards Board's Business Reporting Research Project (2000) noted concerns with the quality of web financial information: "with increased timeliness there is the potential for decreased reliability" (FASB 2000, p.3) and "information provided on the Internet does not have the same quality of predictable completeness" (FASB 2000, p. viii). Regulators have also expressed concern over the format in which information is displayed on the web: "a company may inadvertently give visitors the impression that all information provided in other Web sites to which the company's Web site is linked is afforded the same level of accuracy and reliability" (FASB 2000, p.3). Hodge (2001) substantiated this concern with evidence of investors mistakenly classifying unaudited information as audited when the information was hyperlinked to the audited financial statements. Thus, both the content of Internet disclosures and the manner in which they are presented are of concern to standard setters and regulators.

The Internet is a unique information disclosure tool in that it encourages flexible forms of presentation and allows immediate, broad, and inexpensive communication to investors. Internet financial reporting (“IFR”) provides companies with more flexibility as to the type of information disclosed and the presentation format of web disclosures. As compared to traditional, paper-based disclosures, IFR allows companies to disseminate information to a broader audience on a more timely basis and permits the distribution of alternative types of disclosures (not required by the SEC or other regulatory bodies) at one location (i.e., corporate website) (Ettredge et al. 2002). The content of IFR may include annual and/or quarterly reports, stock price data, press releases, analyst reports, and management discussions of operations. The presentation formats used in IFR include video and audio files, hyperlinks, processable file formats, and dynamic graphics (Kelton and Yang 2006). Thus, investors have several options regarding which Internet financial disclosures to view and the format in which to view them.

Hyperlinks are commonly used by companies to present financial information to existing and potential investors. Kelton and Yang (2006) report the following: approximately 98% of their sample companies provide hyperlinks as a navigational tool within the corporate website; 48% use hyperlinks inside the annual report; 47% provide a hyperlink to EDGAR or 10K Wizard; and 30% use hyperlinks to data on a third-party website. Hyperlinks provide increased flexibility in the amount of information that can be acquired and the manner of information acquisition. However, the flexibility provided by hyperlinks may lead to increased cognitive effort by investors, which leads to cognitive overload. Users must perform multiple tasks simultaneously when browsing with hyperlinks, including navigating through the system, reading, understanding, and

analyzing the information, and recalling information previously viewed (Conklin 1987; Boechler 2001). Simultaneous performance of these tasks involves an increase in cognitive effort resulting in cognitive overload for the information system user (Conklin 1987; Kim and Hirtle 1995; Boechler 2001).

Cognitive overload is associated with negative effects, such as navigational disorientation (Conklin 1987), decreased learning (Sweller 1988; Tarmizi and Sweller 1988; Sweller et al. 1990; Niederhauser et al. 2000; Rose and Wolfe 2000), and errors during problem-solving (Tarmizi and Sweller 1988; Sweller et al. 1990). Thus, I hypothesize that nonprofessional investors viewing hyperlinked financial information will experience an increase in cognitive effort and cognitive overload, as compared to those viewing paper-based financial information. The cognitive overload will cause nonprofessional investors to acquire less information, make less accurate decisions, and take more decision time. Additionally, I posit that investors viewing relevant and irrelevant information cues with hyperlinks will be more likely to exhibit a dilution effect than those viewing the same paper-based information, due to the cognitive overload.

Accounting research suggests the presentation format of financial disclosures can influence decision-making (Clements and Wolfe 2000; Rose 2001; Rose et al. 2004). However, research on the impact of IFR on investor judgments is limited (Hodge 2001; Dull et al. 2003). To date, research examining website disclosures has been primarily descriptive (Ashbaugh et al. 1999; Debreceeny et al. 2002; Ettredge et al. 2002). Since the use of the Internet to disseminate financial information is a growing practice with limited regulation, the impact on investors is an interesting and important area of research.

I propose a theoretical research framework, based on Mauldin and Ruchala's (1999) meta-theory model for accounting information systems (AIS) research, to examine the contingency factors that affect nonprofessional investors' judgments. Specifically, I investigate the effects of hyperlinks and irrelevant financial information on judgments in a financial statement analysis task. I conduct an experiment in which graduate business students, proxies for nonprofessional investors, evaluate a company's financial condition based on either the company's audited financial statements (relevant information) or a combination of the audited financial statements and an unaudited letter to shareholders from the company's management (irrelevant information). The financial statements display poor financial performance; the management letter conveys an optimistic tone with a positive future outlook. Participants view the financial information either on the company's website, on the website using hyperlinks, or in hard-copy format.

This study extends Hodge (2001) in several ways. First, I include a control group that views the financial information electronically and without hyperlinks to isolate any effects due to hyperlink use. Next, a dilution effect is different than the "blending effect" indicated by Hodge (2001). I test whether judgments are less extreme due to the presence of irrelevant information by experimentally manipulating whether participants receive the irrelevant cue. This design will permit isolation of the effect of the additional information. In contrast, all participants in Hodge (2001) received the unaudited

information.¹ This study examines whether judgment differences are affected by hyperlink use, information type, or a combination of both factors.

Results indicate that presentation format affects judgment accuracy and decision time. Participants viewing hard-copy information took the greatest decision time and were the most accurate when making judgments of the company's current financial condition. Participants using hyperlinks took the least amount of decision time. Interestingly, participants using electronic information (without hyperlinks) were less accurate than participants using paper-based information. Overall results suggest that viewing information from a computer screen led to less accurate decisions, but the hyperlinks provided some structure to the task that improved decision performance.

Results of this study have implications for financial disclosure regulation and information system design. Standard setters should be interested in evidence that shows that companies are able to dilute the impact of audited financial statements with other types of financial disclosures, such as an unaudited discussion from management. There are currently limited regulations as to the content of corporate websites and as to auditors' responsibilities to review IFR. Evidence from this study indicates that the presentation format and type of financial disclosures affect investor decision-making and suggests that regulations may be needed for the Internet reporting environment.

Information systems should be designed for efficient and effective use. Results from this study indicate that hyperlink use leads to decreased decision time. Additionally, the hyperlinks design of this study appears to have added some structure to the task that

¹ Interestingly, participants in Hodge (2001) in the hyperlinked condition show a 37% classification error rate; participants in the paper-based condition show a 22% classification rate. So, it appears that both conditions demonstrate a blending effect.

results in improved accuracy when making certain judgments, as compared to viewing information from a computer screen without hyperlinks.

2. THEORY AND HYPOTHESES

Theoretical Research Model

Mauldin and Ruchala (1999) provide a research framework for accounting information systems (“AIS”) research. The framework was developed on four organizing principles: AIS research should have a task focus; AIS system design characteristics depend on task requirements; research on the effects of AIS on task performance should incorporate contingency factors; and the outcome of an AIS is task performance (Mauldin and Ruchala 1999). I adapt Mauldin and Ruchala’s (1999) model for use in this study and the adapted model is shown in Figure 1 (all figures and tables located in the Appendix).

The model provides four dimensions of task characteristics that directly affect AIS task performance and that are of importance to AIS research: mental processes, complexity, task demands, and frequency. The characteristics of the tasks are directly affected by contingency factors, or the context in which the AIS operates. The meta-theory model incorporates three contingency factors that affect task characteristics: cognitive, technological, and organizational. Cognitive contingency factors consist of the components of human information processing involved in task performance. Technological contingency factors represent the specific design characteristics of the AIS that affect the task characteristics, such as the methods used to disseminate information to users, the presentation format of information cues, and the content of the information. Organizational factors include the strategy and structure of the organization and the business environment in which the AIS operates. The bi-directional arrow between cognitive and technological contingency factors in the research model signifies a

reciprocal relationship between the two factors. Individual cognition may affect the design and capabilities of the AIS. Alternatively, AIS technology may have both intended and unintended cognitive effects that are either positive or negative (Mauldin and Ruchala 1999).

This study examines the relationship between specific technological and cognitive contingency factors that influences task characteristics and, ultimately, AIS task performance. Specifically, I examine the effects of presentation format and type of financial disclosure on investors performing a financial statement analysis task using the model provided by Mauldin and Ruchala (1999) to guide the study. I posit that presentation format and type of information will influence the mental processes and complexity of the task, which will affect task performance, measured by information acquisition, decision accuracy, decision time, and dilution effects. Figure 1 depicts the specific contingency factors and task performance measures that will be examined in this study.

Cognitive Overload

Hogarth (1980) provides a three stage model of human information processing: information acquisition, information processing, and decision outcome. Information acquisition involves the search for information from both the task environment and from memory and results in storage of the new information in working memory. Information processing involves the selection of cognitive processing strategies and the evaluation and weighting of information cues to determine a decision outcome. Research suggests that various task and user characteristics affect the manner in which information is

processed. For example, the amount of information available influences information acquisition (e.g., Libby and Lewis 1977; Hogarth 1980). Additionally, information acquisition is affected by cognitive overload (Rose et al. 2004) and presentation formats (Clements and Wolfe 2000; Hodge et al. 2004). Factors that affect the information evaluation process include the relevancy of the information (Nisbett et al. 1981; Hackenbrack 1992; Hoffman and Patton 1997; Shelton 1999) and presentation format of information cues (Maines and McDaniel 2000; Hodge et al. 2004).

Limitations in information processing capacity cause individuals to make decisions that are boundedly rational (Simon 1957). Information acquired during judgment and decision-making is stored and processed in working memory. The capacity of working memory is limited, and these limitations affect how individuals process information during decision-making (Miller 1956; Baddeley 1992; Libby and Trotman 1993).

Cognitive overload refers to the excess burden placed on working memory as a result of limited cognitive processing capacities (Sweller 1988). Cognitive load theory suggests three components to overall cognitive load: intrinsic load, extraneous load, and germane load. Intrinsic cognitive load is caused by the inherent complexity of the task. Extraneous cognitive load is caused by the design and format of the task materials. Germane cognitive load relates to the effort required to process and comprehend the task. Intrinsic load is unchangeable, whereas extraneous and germane load are affected by task design (Sweller et al. 1998; Paas et al. 2003).

Research has shown cognitive overload caused by inefficient and/or ineffective task design (Rose and Wolfe 2000; Rose 2002; Rose et al. 2004). The factors that lead to cognitive overload include information presentation format, information type, and

information load. In order to maintain performance, individuals respond to the task design characteristics with an increase in cognitive effort. However, this increase in cognitive effort often leads to cognitive overload (Paas and van Merriënboer 1994). Cognitive overload is associated with negative effects, such as navigational disorientation (Conklin 1987), decreased learning (Sweller 1988; Tarmizi and Sweller 1988; Sweller et al. 1990; Niederhauser et al. 2000; Rose and Wolfe 2000), and errors during problem-solving (Tarmizi and Sweller 1988; Sweller et al. 1990).

The Effects of Hyperlinks on Investor Judgments

A hyperlink provides a link between a series of inter-connected items in an information system. Hyperlinks allow users to develop individual search strategies for navigation through online information, depending on users' unique interests and goals (Conklin 1987; Boechler 2001). As compared to traditional, paper-based presentations, hyperlinks provide increased flexibility in the amount of information that can be acquired and the method in which it is acquired. Kelton and Yang (2006) report that hyperlinks are commonly used in IFR as a navigational tool.

The flexibility provided by hyperlinks is associated with increases in cognitive effort. Users must perform multiple tasks simultaneously when browsing with hyperlinks, including navigating through the system, reading, understanding, and analyzing the information, and recalling information previously viewed (Conklin 1987; Boechler 2001). Simultaneous performance of these tasks leads to an increase in cognitive effort and, ultimately, cognitive overload (Conklin 1987; Kim and Hirtle 1995; Boechler 2001),

which often results in cognitive problems for the user, such as navigational disorientation (Conklin 1987).

Although some research demonstrates that hyperlink use is associated with decreased accuracy (McKnight et al. 1990), other research suggests that hyperlinks provide structured relationships that may be beneficial to learning (Mao et al. 1996; Niederhauser et al. 2000; Crandall and Phillips 2002). Niederhauser et al. (2000) show that the use of a hyperlinked topic map is associated with increased learning. In contrast, the use of “compare and contrast” hyperlinks has a negative effect on learning.² Niederhauser et al. (2000) use cognitive overload to explain the findings. Participants that use the “compare and contrast” links actively consider navigational choices, increasing cognitive load and experiencing navigational disorientation, which negatively impacts learning. Alternatively, participants that use the topic map experience lower cognitive load since they are not concerned with navigational issues typically associated with hyperlink use.

Accounting research examining the effects of hyperlinks on investor judgments is limited, and research examining website disclosures is primarily descriptive (Ashbaugh et al. 1999; Debreceeny et al. 2002; Ettredge et al. 2002). Hodge (2001) finds that investors using hyperlinks to view financial information tend to blend the information and misclassify unaudited information as audited more often than those viewing paper-based

² The topic map used in Niederhauser et al. (2000) provided a structured outline of the information content of the website including hyperlinks from the topic map to the content. The “compare and contrast” hyperlinks allowed users to access similar information to compare and contrast and alternate back and forth between screens.

information. In addition, investors using hyperlinks provide higher assessments of the credibility of the financial information than investors viewing paper-based information.³

Dull et al. (2003) provide additional evidence of the effects of hyperlinks on financial decisions. Experiment participants viewed electronic financial statements for either a large or a small company in one of two formats: with hyperlinks connecting the financial statement line items to the related footnotes or without hyperlinks. Results for the large company indicate that the use of hyperlinks does not affect investment decisions. For the small company, the use of hyperlinks increases total decision time, increases the amount of information used to make decisions, and affects assessments of the company's future performance.⁴

Bible et al. (2005) examine the effect of hyperlinks on auditor workpaper review. Use of electronic workpapers causes auditors to identify fewer errors than those using paper-based workpapers.

In summary, task design places a burden on an individual's limited cognitive processing capacities. Individuals respond to task design characteristics, such as information presentation format, by increasing cognitive effort, which often leads to cognitive overload (Paas and van Merriënboer 1994). Individuals using hyperlinks experience an increase in cognitive effort leading to cognitive overload (Conklin 1987; Kim and Hirtle 1995; Boechler 2001). Additionally, hyperlinks affect the manner in which investors analyze and integrate information and make financial decisions (Dull et

³ Although results from Hodge (2001) suggest that credibility assessments are significantly correlated with judgments of the company's future earnings potential, differences in earnings potential judgments for the hyperlink and hard-copy conditions are marginal at best.

⁴ Dull et al. (2001) suggest that the inconsistent results between the small and large companies may be due to uncontrolled differences between the companies (i.e., financial statement complexity, financial condition) or due to differences in the design of the hyperlinked footnotes.

al. 2003) and may cause investors to blend information from different sources, which has adverse effects on decision-making (Hodge 2001).

Cognitive overload has a negative effect on information acquisition (Rose et al. 2004). Presentation format affects both the information acquisition (Clements and Wolfe 2000; Hodge et al. 2004) and the information evaluation processes (Maines and McDaniel 2000; Hodge et al. 2004). By increasing cognitive effort and causing cognitive overload, hyperlinks are likely to inhibit information acquisition and affect information evaluation and decision outcomes. In addition, hyperlink use leads to increased decision time (Dull et al. 2003). The cognitive overload experienced by hyperlink users will likely also lead to increased decision time. Formally stated:

H1a: Investors that view hyperlinked financial information will acquire less information than investors that view paper-based financial information.

H1b: Investors that view hyperlinked financial information will make less accurate decisions than investors that view paper-based financial information.

H1c: Investors that view hyperlinked financial information will take more decision time than investors that view paper-based financial information.

The Effects of Relevant and Irrelevant Information

Seminal research indicates that additional information does not always result in higher decision quality, although it often results in increased judgment confidence (Oskamp 1965). The presence of additional information cues combined with individuals'

limited processing capacities leads to cognitive problems and judgment biases, such as dilution effects (Nisbett et al. 1981).

A dilution effect occurs when predictions based on a combination of diagnostic and nondiagnostic information are less extreme than predictions based solely on diagnostic information (Nisbett et al. 1981). Nisbett et al. (1981) examine the impact of nondiagnostic information on social judgments. Diagnostic information is perceived “to be useful for predicting some outcome” and nondiagnostic information is believed “to have little or no value for predicting the outcome” (p. 249). Results of several experiments indicate the occurrence of a dilution effect.

The dilution effect is explained by a similarity-based inference process (Nisbett et al. 1981; Zukier 1982). Individuals use a representativeness heuristic to judge the likelihood of an event by assessing the similarity between a target and an outcome (Tversky and Kahneman 1974). Decision makers relying upon a representativeness heuristic often make judgments that are most representative of the evidence provided, which often results in decreased accuracy and overconfidence in decisions (Kahneman and Tversky 1973; Tversky and Kahneman 1974). Nondiagnostic (or irrelevant) information can in some situations cause a dilution effect by reducing the perceived similarity between the target and the outcome that is suggested by the diagnostic (or relevant) information (Nisbett et al. 1981; Zukier 1982; Glover 1997; Shelton 1999).

Accounting research suggests that auditors are susceptible to dilution effects when assessing the risk of material misstatement of financial statement account balances (Glover 1997), determining the likelihood of financial statement fraud (Hackenbrack 1992; Hoffman and Patton 1997), and making going concern assessments (Shelton 1999).

Additionally, research indicates that both the existence of and the content of the nondiagnostic information lead to dilution effects (Hackenbrack 1992). Interestingly, Shelton (1999) shows that although individuals are aware that nondiagnostic information is irrelevant, their judgments are still influenced by the nondiagnostic information.

The basis of dilution effect research is that the nondiagnostic information dilutes the influence of the diagnostic information. Thus, any irrelevant cue that weakens the effect of a relevant cue can be expected to cause a dilution effect. Accounting research suggests that investor judgments are affected when financial statements are presented to investors in combination with other types of information, including a letter from a company's president (Kaplan et al. 1990), additional news information (Davis et al. 1994), and pro forma earnings disclosures (Frederickson and Miller 2004). Kaplan et al. (1990) suggest that irrelevant information may be provided in order to manage the impressions of existing and potential investors.

In summary, a dilution effect occurs when judgments based on a combination of relevant and irrelevant information are less extreme than judgments based solely on relevant information (Nisbett et al. 1981). Irrelevant information is associated with an increase in cognitive effort required to process the additional information cue and to determine the relevancy of the information. Due to limited cognitive abilities, individuals often do not follow normative patterns of behavior and adopt processing strategies or heuristics, such as the representativeness heuristic, to reduce cognitive effort (Einhorn and Hogarth 1981; Payne 1982)..

As previously mentioned, the use of hyperlinks may lead to cognitive overload caused by an increase in cognitive effort (Conklin 1987; Kim and Hirtle 1995; Boechler

2001). Investors experiencing cognitive overload due to hyperlink use are more likely to use heuristics to reduce cognitive effort. Therefore, investors viewing hyperlinked financial information are more likely to exhibit a dilution effect when making judgments that include irrelevant information than investors who do not have the additional cognitive load from hyperlink use. Formally stated:

H2: Investors that view hyperlinked financial information will exhibit a greater dilution effect in their earnings performance judgments when viewing both relevant and irrelevant information than investors that view the same paper-based financial information.

3. EXPERIMENT

Participants

Fifty-nine⁵ first year MBA students at a large state university served as participants in the experiment as proxies for nonprofessional investors. The Financial Accounting Standards Board (FASB 1978) describes individual investors as those who have “a reasonable understanding of business and economic activities and are willing to study the information with reasonable diligence.” The FASB (1978) also notes that individual investors’ “understanding of financial information and the way and extent to which they use and rely on it also may vary greatly.”

Graduate business students have frequently been used to proxy for nonprofessional investors (e.g., Maines and McDaniel 2000; Hodge 2001; Elliott 2006). Elliott et al. (2004) find that MBA students who have taken or are enrolled in a financial statement analysis class or have significant work experience are reasonable proxies for nonprofessional investors in experimental accounting research. Additionally, Hodge (2001) suggests that graduate business students have similar characteristics to online traders and uses MBA students to proxy for online traders. Therefore, MBA students are an appropriate proxy for nonprofessional investors in this experiment.

⁵ Sample size was smaller than expected; however, all available full-time MBA students at the University of Tennessee were used in this experiment. The experimental design calls for a minimum sample size of 120 participants (i.e., at least 20 participants in each of the 6 treatment conditions). In order to increase total sample size, I will conduct the experiment with full time MBA students at a different university during the Fall of 2006 and prior to submitting this research for publication at an academic journal.

Design

The experiment used a 3X2 between-subjects design as shown in Table 1. The two independent variables are presentation format and information type. The levels of presentation format are HYPERLINK, ELECTRONIC, and PAPER. The levels of information type are RELEVANT (audited financial statements only) and IRRELEVANT (combination of the audited financial statements and a letter from management). Participants were randomly assigned to one of the six treatment conditions.

Hodge (2001) finds judgment differences between investors that view financial information in a paper-based format compared to those that view the information electronically with hyperlinks. However, Hodge (2001) notes a limitation in his experimental design that precludes identification of how much of the judgment difference is due to presenting the information on a computer screen and how much is due to the use of hyperlinks. Accounting research examining differences between viewing information from paper and on a computer screen is minimal. Galletta et al. (1996) report that MBA students identified fewer spreadsheet errors when the task was performed using a computer screen as compared to those performing the task using paper. In contrast, information systems and ergonomics research indicates no performance differences between reading from a computer screen (without hyperlinks) and reading from paper when the materials have similar design (Gould et al. 1987; Noyes and Garland 2003; Garland and Noyes 2004). This study will extend Hodge (2001) by including a control

group that will view the financial information electronically and without hyperlinks (ELECTRONIC) to isolate any effects due to hyperlink use.

Dependent Variables

Four dependent variables are examined: information acquisition, decision accuracy, decision time, and dilution effect. Information acquisition (RECALL) is assessed using a test of recall. Participants responded to various questions in the post-experiment questionnaire regarding the financial information (see items in Appendix C). RECALL is measured by the percentage of correct answers given.⁶

Decision accuracy (ACCURACY) is assessed in the experimental questionnaire with 3 items: perceptions of the company's current earnings performance, judgments of future earnings potential, and investment decisions (see items in Appendix A).⁷ Items are coded such that lower (higher) scores indicate negative (positive) perceptions of the company's financial condition. Thus, lower (higher) scores indicate less (more) optimistic perceptions of the company's financial condition and, consequently, more (less) accurate decisions.

Seminal research by Oskamp (1965) indicates that the presence of additional information does not always result in higher decision quality, although it often results in increased judgment confidence. In order to explore this notion further, participants'

⁶ Participants in the IRRELEVANT treatment condition responded to a greater number of recall test items than participants in the RELEVANT treatment condition, since they were also tested on recall of the management letter. Measuring RECALL as a percentage (as opposed to the number of correct answers given) allows comparison between the treatment conditions.

⁷ Items adapted from Hodge (2001) and Elliott (2006).

confidence in each of their ACCURACY measures is assessed for additional analysis (see items in Appendix A).⁸

Participants self-reported total decision time. Decision start time was noted prior to examination of the information cues. Stop time was noted after completion of the experimental questionnaire. A dilution effect occurs when judgments based on a combination of relevant and irrelevant information are less extreme than judgments based solely on relevant information (Nisbett et al. 1981). Dilution effects are measured by differences between participants in the RELEVANT condition and participants in the IRRELEVANT condition for judgments of the company's current financial performance and future earnings potential and investment decisions.

Task

Participants completed a simple decision case, including assessing a company's current and future earnings potential to make a financial investment decision. The case involves Advanced Technology Solutions, Inc. ("Advanced" or "the company"), a company in the software, computer, and peripheral equipment sales industry (SIC 5045). This task was selected for several reasons. First, this type of task is common in

⁸ I do not propose a formal hypothesis for testing judgment confidence due to the conflicting findings in accounting research regarding the effects of information type and presentation format on judgment confidence. Davis et al. (1994) find participants that are provided baseline financial information and additional news information are more confident and less accurate in their decisions than participants that are only provided the baseline financial information. In contrast, Reneau and Blanthorne (2001) report no differences in judgment confidence between auditor subjects that view only relevant information and subjects that view both the relevant information and irrelevant distracter information. Additionally, some studies demonstrate a significant difference in judgment confidence due to presentation format (Amer 1991; Anderson and Reckers 1992) while others find no difference in confidence (DeSanctis and Jarvenpaa 1989; Schulz and Booth 1995; Lim et al. 2000).

behavioral accounting research. Second, the financial statements provided to participants are adapted from a real company that has previously filed for bankruptcy.⁹ The financial statements from the year prior to bankruptcy are used in this study. This design allows a “correct” answer to use in evaluating judgment accuracy (i.e., the company is in poor financial condition at the financial statement date). Finally, this study indirectly examines a company’s ability to manage the impressions of its potential and existing shareholders with presentation of irrelevant information. The impact of impression management techniques may be more important and more prevalent during periods of poor financial condition (Kaplan et al. 1990). Thus, task design contributes to the generalizability of this study.

Participants were provided with either audited financial statements (RELEVANT condition) or a combination of the audited financial statements and an optimistic letter from management (IRRELEVANT condition)¹⁰ and viewed the information in one of the three presentation format conditions. After analyzing the financial information, participants completed several tasks, including assessing the current financial condition of the company, judging the company’s future earnings potential, and making an investment decision.

The materials used in this study include instructions for completing the case; background information on Advanced; the information cues; the experimental

⁹ The financials statements were altered to conceal the identity of the company. The financial statements include an unqualified audit opinion. Participants were not informed that the company had subsequently filed for bankruptcy.

¹⁰ The order in which the financial statements and the management letter were presented to participants in the IRRELEVANT treatment condition was randomized. No significant order effects were noted for the dependent variables.

questionnaire; a distracter task; and the post-experimental questionnaire. All materials, except for the information cues, were presented to participants in hard-copy format. Instructions for the HYPERLINK and ELECTRONIC groups included the URL of Advanced's corporate website, where the information cues were viewed. The information cues were identical except for the manner in which they were viewed.

An example of the HYPERLINK condition is presented in Figure 2. The links on the left side of the page allowed participants to alternate between the different components of the audited financial statements and the management letter (in the IRRELEVANT condition). No restrictions were placed on the order in which the information was viewed or the number of times an information cue could be accessed. An example of the web design for the ELECTRONIC condition is presented in Figure 3. Participants in the ELECTRONIC condition were presented with the information cues in a format similar to PowerPoint and did not have use of hyperlinks to navigate the information.¹¹

The information cues are the audited financial statements (Appendix E) and an unaudited letter from management (Appendix D). Each information cue is designed to invoke different responses from participants.¹² Advanced's financial statements indicate

¹¹ Participants' information search strategies may influence decision outcomes (Hunton and McEwen 1997). Hyperlinks promote directional search strategies (Dull et al. 2001) while paper-based presentation promotes sequential search strategies. This experiment was designed such that participants in all experimental conditions have the opportunity to use either search strategy. Each page of the information cues in all presentation format conditions contained a "Table of Contents," which provides the opportunity for directional search strategies, even in the PAPER condition (see Exhibits 1 and 2). Participants in the ELECTRONIC condition can use the "next page" button to directionally access specific information. Participants self-reported the information search strategy used during the task (item 14 in Appendix B). No significant differences ($\chi^2 = 0.713$, $p = 0.70$) were noted among presentation format treatment conditions; therefore, any effect of information search strategy on decision outcomes should be randomized across presentation format treatment conditions.

¹² Designing the information cues so that one is positive and one is negative is crucial to this study. I hypothesize that subjects will exhibit a dilution effect such that the positive management letter will dilute

below average performance, as compared to *Dun & Bradstreet's* key financial ratios for the industry (Hodge 2001). Thus, the financial statements demonstrate unfavorable firm characteristics and should initiate negative perceptions of the company. The management letter contains only irrelevant information, has an optimistic tone, and discusses positive attributes of the company.¹³ Thus, the management letter should initiate positive perceptions of the company.

Procedures

The experiment was conducted during scheduled class time. Participants in the PAPER condition completed the experiment in a separate classroom than participants in the HYPERLINK and ELECTRONIC conditions. The procedures for all experimental conditions differ only as to the manner in which participants viewed the financial information.

Materials were randomly distributed to participants at the beginning of the experiment. The materials were segregated into three separate envelopes. Prior to beginning the experiment, participants were given brief verbal instructions introducing the task, instructing them to open the envelopes in the specified order, to only open one envelope at a time, and to put all materials back in the original envelope before proceeding to the next envelope. Participants were also instructed to view all information cues provided.

the impact of the negative financial statements. This design also demonstrates methods used by companies to "lessen the blow" of unfavorable financial results by presenting the financial statements with optimistic discussions from management (Kaplan et al. 1990)

¹³The management letter was constructed based on CEO and President letters obtained from a sample of corporate websites.

The first envelope contained background information on Advanced, general instructions for completing the task, either the URL to access the information cues (for the HYPERLINK and ELECTRONIC conditions) or hard-copy versions of the information cues (PAPER condition) and the experimental questionnaire (Appendix A). Participants were instructed to view the information cues and then complete the experimental questionnaire.

The second envelope contained a distracter task (Appendix B) including the following: (1) measures of mental workload; (2) a request for demographic information; and (3) a simple mathematical calculation to clear the contents of working memory. Participants' subjective mental workload is assessed using the NASA Task Load Index (NASA-TLX) (Hart and Staveland 1988). Responses to the NASA-TLX are often interpreted to measure actual cognitive load (Speier and Morris 2003; Gerjets et al. 2004); therefore, the measure is used to determine whether those using hyperlinks perceived higher levels of cognitive load than those viewing paper-based information, as hypothesized. The NASA-TLX measures mental workload using six dimensions – mental demand, physical demand, time demand, performance, effort, and frustration. The index presents all possible pairs of dimensions and asks participants to select which dimension was the greatest source of workload experienced during the task. Participants also score each dimension on a Likert-type scale. The mental workload score is determined for each dimension by multiplying the number of times the dimension is selected among the pairs by the rating on the Likert scale. The dimension scores are summed for a total measure of mental workload.

Participants completed the demographic questionnaire and performed a simple mathematical calculation as a distracter task to clear the contents of working memory and mitigate individual differences in working memory capacity that may affect recall abilities (Conway and Engle 1994; Rose and Wolfe 2000).

The final envelope contained the post-experiment questionnaire (Appendix C) which assessed the following: (1) information acquisition (RECALL); (2) what information cues the participants actually viewed; (3) whether participants were aware of a dilution effect; and (4) perceptions of report quality. Similar to Clements and Wolfe (1997), I gathered self-reported measures of which information cues participants actually read to ascertain whether participants followed instructions and actually viewed each information cue and to also provide some evidence as to the motivation level of participants. Participants' perceptions of the objectivity of the information cues and the relevance of each cue to their decision is measured to determine whether they were aware of the occurrence of a dilution effect (Shelton 1999).

4. RESULTS

Pilot Tests

Several pilot tests were conducted to ensure the appropriateness of the experimental materials. First, multiple expert panels were used to evaluate the relevancy of the relevant and irrelevant information cues to the assessment of the company's financial condition (Hackenbrack 1992; Glover 1997; Hoffman and Patton 1997; Shelton 1999). Participants in the expert panel were provided the financial statements and the management letter and asked to assess the current financial condition and future earnings potential of the company and to make an investment decision. Participants were then asked to judge the relevancy of each information cue to their decisions and to assess how strongly each cue influenced their judgments. The financial statements were considered relevant by all members of the expert panels. Any items in the management letter considered relevant or having any influence on decisions were removed, thereby ensuring that all the information contained in the management letter used in the experiment is irrelevant.

Pilot tests of the experiment were conducted using graduate accounting students. No problems were noted with the experimental materials.

Sample Characteristics

Sample demographics are presented in Table 2. On average, participants were 27 years of age, had completed 2.36 (2.14) accounting (finance) courses, and had less than one year of accounting work-related experience. Approximately 64% of the participants were male. Participants had on average 2.97 years of investing experience and 91.5%

plan to invest in the future. Importantly, 79.7% of the participants have previously conducted a financial statement analysis. As shown in Table 2, participants also appear to have significant experience using the Internet and hyperlinks and tend to use the Internet quite frequently. Thus, participants appear to have the necessary knowledge to complete the experimental task.

Elliott et al. (2004, p. 26) make the following conclusion regarding the appropriateness of using MBA students to proxy for nonprofessional investors:

“Generally, MBA students who have completed the core curriculum and have taken or are enrolled in a financial statement analysis class are probably the best proxy for investors in experimental research that requires acquisition and integration of financial information for the purpose of making investment-related judgments and decisions.”

Based on the demographic information presented in Table 2, participants in this experiment appear to be reasonable proxies for nonprofessional investors.

Statistical tests were performed to ensure randomization between experimental groups. No significant differences between experimental groups were observed for the demographic variables noted in Table 2.

Descriptive Statistics

Table 3 provides descriptive statistics for the dependent variables. Data were analyzed for normality and to identify outliers. Boxplots and histograms were examined for the dependent measures and no extreme outliers were identified.

Manipulation Check

Data were collected in order to determine whether participants were properly motivated and whether they properly attended to the information cues. Specifically, participants were provided a list of the information cues and self-reported which cues they actually read (Clements and Wolfe 1997). On average, participants reported reading 67% of the cues provided. Forty-six percent of participants reported reading the auditors report, 95% read the balance sheet, 83% read the income statement, 86% read the statement of cash flows, 56% read the statement of stockholders' equity, and 42% read the financial statement footnotes. This finding is consistent with research that suggests that most nonprofessional investors either skim or do not read the annual report (Hawkins and Hawkins 1986). Additionally, 52% of participants in the IRRELEVANT condition reported reading the management letter.¹⁴ Although participants were instructed to read

¹⁴ Although this self-reported measure suggests that approximately half (n=14) of the participants in the IRRELEVANT condition did not read the management letter, other data suggests that participants did in fact read the management letter. Of the 29 total participants in the IRRELEVANT condition, 85% correctly answered the recall question regarding whether the management letter was audited (only 2 participants did not respond to this question) and 54% correctly answered the recall question regarding the author of the management letter (only 3 participants did not respond to this question). In addition, all participants responded to the questions measuring the reliability and objectivity of the management letter. Participants in the IRRELEVANT condition were also asked to assess how much weight they placed on information from the financial statements versus information in the management letter. All participants responded to the question; only 17% (n=10) reported that none of their judgment was influenced by the management letter (range of responses was 0-50%). These other measures suggest that participants did in fact read the management letter, although some reported otherwise. Additionally, there was a statistically significant difference ($\chi^2 = 5.811, p = .016$) in whether participants' reported reading the management letter based on the order in which the cues were presented (i.e., whether the management letter was presented before or after the financial statements). Participants that were presented with the financial statements first were more likely to report reading the management letter than those that were presented with the management letter first. However this result does not preclude the finding above regarding participants correctly answering the recall questions. Thus, it appears that the self-reported measure does not completely capture the manner in which the participants attended to the management letter.

all of the information cues provided, it appears that participants chose to only attend to certain components of the audited financial statements.¹⁵

Hypotheses Tests

Discussion of Sample Size and Statistical Power

Statistical power is defined as “the probability of rejecting the null hypothesis when it is false and some specific alternative hypothesis is true”(Lindsay 1993, p. 211). The power of a statistical test of significance is a function of the effect size, level of significance, and sample size. When a test of significance is performed with low statistical power and results indicate non-significance, Lindsay (1993) indicates that results do not necessary imply the absence of a finding and suggests that further research is necessary to increase the power of the test.

Fifty-nine participants were involved in this study and cell sizes ranged from 8 to 11 participants per cell. The sample size of this study is lower than typically recommended for behavioral research; consequently, the low sample size could contribute to low statistical power. Cohen (1988) suggests an acceptable power of 0.80 for tests of significance performed when the critical level of significance is set at 0.05.

Hypothesis One

Taken together, hypothesis one predicts that the cognitive overload caused by the increase in cognitive effort due to hyperlink use will negatively affect investors’ decision

¹⁵ No statistically significant differences in information cues read were noted among the three presentation format treatment conditions.

making processes. Specifically, investors that use hyperlinked financial information will acquire less information (H1a), make less accurate decisions (H1b), and take more decision time (H1c) than investors that view paper-based information. H1 is tested using MANOVA with PRESENTATION FORMAT and INFORMATION TYPE as the independent variables and RECALL, ACCURACY, and DECISION TIME as the dependent variables.¹⁶

The data were tested for the assumptions of multivariate normality and equality of the covariance matrices. Plots of the residuals indicate that the data is normally distributed. Additionally, Box's Test ($F=1.057$, $p=.347$) indicates that the covariance matrices of the dependent variables are equal across groups. Thus, the data appear to satisfy the assumptions for MANOVA.

Together, H1 predicts a significant PRESENTATION FORMAT effect. Results of the MANOVA analysis are presented in Table 4. PRESENTATION FORMAT is significant ($F=2.568$, $p=.009$, observed power=.940¹⁷).

Due to the significant finding in the multivariate analysis, univariate analyses were performed for each dependent variable. Results of univariate analyses are shown in

¹⁶ Several variables suggested by prior research to affect nonprofessional investors' judgments were measured and included in the analysis. Marketing research suggests that perceptions of the quality of an advertisement may affect evaluations of the product featured in the advertisement (MacInnis and Jaworski 1989). Clements and Wolfe (2000) find that individuals' perceptions of the quality of a multimedia annual report positively affect judgments of the quality of the firm. I adapt items used by Clements and Wolfe (2000) to operationalize participants' perceptions of report quality and include as a covariate in the statistical analyses. However, the impact of report quality perceptions on judgments is non-significant. In addition, Elliott et al. (2004) find that work experience, experience conducting financial statement analysis, and accounting/finance coursework affects MBA students' acquisition and integration of financial information when making an investment decision. These measures were also included as covariates in the MANOVA analysis but the effects were found to be non-significant. Finally, participants' information search strategies may influence decision outcomes (Hunton and McEwen 1997). Participants' self-reported information search strategies (see FN 9) were included as a covariate in the MANOVA and the effect was found to be non-significant. Therefore, results including the above mentioned covariates are not reported.

¹⁷ Reported observed power in all results is for the independent variable tested.

Table 5.¹⁸ H1a predicts that investors that view hyperlinked financial information will acquire less information than investors that view paper-based financial information. As shown in Panel A of Table 5, PRESENTATION FORMAT is not significant ($p=.837$).¹⁹ There is no statistically significant difference in information acquisition among presentation format conditions. Thus, H1a is not supported.

H1b predicts that investors that view hyperlinked financial information will make less accurate decisions than investors that view paper-based financial information.²⁰ Decision accuracy was assessed using three measures: judgments of current financial condition, judgments of future earnings potential, and investment decisions. As shown in Panel B of Table 5, PRESENTATION FORMAT is significant ($p=.032$, observed power=0.650) for judgments of the company's current financial condition. However, contrary to the hypothesis, Tukey's post hoc tests indicates no significant differences in decision accuracy between participants in the PAPER condition and the HYPERLINK condition ($p=.183$). Interestingly, Tukey's post hoc tests indicate a significant difference in judgments between participants in the PAPER condition and the ELECTRONIC

¹⁸ Levene's test of equality of error variances was not significant for recall ($p=.816$), judgments of current financial condition ($p=.390$), and judgments of future earnings potential ($p=.963$). Levene's test was moderately significant for investment decisions ($p=.090$) and significant for decision time ($p=.021$). The type I error rate is relatively robust against violations of the assumption of homogeneity of error variances (Sharma 1996). However, alternative tests will be conducted for investment decisions and decision time due to the assumption violations.

¹⁹ The observed power for the univariate test is 0.076, which is well below the recommended power of 0.80 (Cohen 1988). Thus, lack of significance may be attributable to a lack of statistical power.

²⁰ Hodge (2001) found that participants using hyperlinks were more likely to misclassify unaudited information as audited and that the misclassification was associated with higher assessments of the overall credibility of financial information. In conjunction with the test of recall, participants in this study in the IRRELEVANT condition assessed whether the management letter was audited or unaudited. Approximately eighty-two percent of participants correctly identified the management letter as audited. There was no significant difference ($\chi^2=.219$, $p=.896$) in misclassification between the three presentation format conditions. Additionally, misclassification was not significantly correlated (all $p>.10$) with any of the accuracy measures. Contrary to findings from Hodge (2001), participants in this study do not appear to "blend" the unaudited information with the audited information and judgment differences do not appear to be related to misclassification of the management letter as audited.

condition ($p=.027$). As shown in Panel B of Table 5, participants in the PAPER condition were significantly more accurate (mean=2.10) than participants in the ELECTRONIC condition (mean=3.05) in their judgments of the current financial condition of the company.

As shown in Panel C of Table 5, PRESENTATION FORMAT is not significant ($p=.133$) for judgments of the company's future earnings potential. PRESENTATION FORMAT is also not significant ($p=.212$) for participants' investment decisions (Panel D of Table 5).²¹ There appears to be no significant differences in decision accuracy between participants in the PAPER condition and the HYPERLINK condition using judgments of the future earnings potential and investment decisions to assess decision accuracy. H1b is not supported.²²

H1c predicts that investors that view hyperlinked financial information will take more decision time than investors that view paper-based financial information. As shown in Panel E of Table 5, PRESENTATION FORMAT is significant ($p=.003$, observed power=0.885).²³ Tukey's post hoc tests indicate a significant difference in decision time between participants in the PAPER condition and the HYPERLINK condition ($p=.004$). However, as indicated in Panel E of Table 5, results are in the opposite direction than

²¹ Due to normality concerns with participants' investment decisions (see footnote 16), a transformation was performed by taking the square root of the dependent measure (Johnson and Wichern 1988). Levene's test was not significant for the transformed variable ($F=1.855$, $p=.118$). ANOVA results using the transformed variable were statistically similar to those reported in Panel D of Table 5. Thus, results appear to be robust to violations of the assumptions of normality.

²² The observed power of the tests of future earnings potential and investment decision are 0.411 and 0.323, respectively, which are well below the recommended power of 0.80 (Cohen 1988). Thus, lack of significance may be attributable to a lack of statistical power.

²³ Nonparametric tests were also performed due to concerns with violations of normality (see footnote 16). Kruskal-Wallis test also indicates a significant difference ($\chi^2 = 11.49$, $p=.042$) in decision time among the treatment groups.

hypothesized. Participants in the PAPER condition took significantly more decision time (mean=6.86) than participants in the HYPERLINK condition (mean=4.41).

Additionally, Tukey's post hoc tests indicates a significant difference in decision time between participants in the PAPER condition and the ELECTRONIC condition ($p=.025$). Participants in the PAPER condition took significantly more decision time (mean=6.86) than participants in the ELECTRONIC condition (mean=5.00) (Table 5, Panel E). No significant differences in decision time were noted between participants in the ELECTRONIC condition and the HYPERLINK condition ($p=.700$).

Hypothesis Two

Hypothesis two (H2) posits that investors that view hyperlinked financial information will exhibit a greater dilution effect than investors that view paper-based financial information. A dilution effect occurs when predictions based on a combination of relevant and irrelevant information are less extreme than predictions based solely on relevant information (Nisbett et al. 1981). Thus, H2 predicts a significant interaction between PRESENTATION FORMAT and INFORMATION TYPE for participants' judgments of the company's current financial condition and future earnings potential and investment decisions. As shown in Panels B and C of Table 5, judgments of participants in the IRRELEVANT condition appear to be less extreme (i.e., diluted) than participants in the RELEVANT condition. For judgments of the company's current financial condition (Panel B, Table 5), participants in the HYPERLINK condition exhibit an average dilution effect of 0.21 and participants in the PAPER condition exhibit an

average dilution effect of 0.39.²⁴ For judgments of the company's future earnings potential (Panel C, Table 5), participants in the HYPERLINK condition exhibit a average dilution effect of 0.81 and participants in the PAPER condition exhibit and average dilution effect of 1.30. Based on these descriptive statistics, it appears that participants in this study did in fact exhibit a dilution effect. Contrary to H2, the dilution effect is greater for participants in the PAPER condition than in the HYPERLINK condition.

H2 is formally tested using MANOVA with PRESENTATION FORMAT and INFORMATION TYPE as the independent variables and the ACCURACY measures as the dependent variables, as shown in Table 6.²⁵ The interaction between PRESENTATION FORMAT and INFORMATION TYPE is not significant ($p=.483$). Thus, H2 is not supported.²⁶

Participants in the IRRELEVANT condition were asked to judge the objectivity of the management letter and to assess the relevancy of the management letter to their judgments of the company's financial performance. Participants responded to these questions using a 7-point scale anchored on (1) Not Very Objective and (7) Very Objective and (1) Not Very Relevant and (7) Very Relevant. Mean responses for objectivity and relevancy were 2.90 and 2.31, respectively. Overall, participants did not perceive the management letter as objective or relevant to their decision making. Additionally, participants were asked to report how much weight they placed on

²⁴ As previously mentioned, dilution effect is measured by differences in judgments between participants in the IRRELEVANT and RELEVANT conditions.

²⁵ Box's Test indicates no significant differences ($p=.270$) in the covariance matrices of the dependent variables across groups.

²⁶ The observed power of the test of the significance of the interaction is 0.349, which is well below the recommended power of 0.80 (Cohen 1988). Thus, lack of significance may be attributable to a lack of statistical power. The results were unchanged when the analysis was performed using only those participants in the IRRELEVANT condition who self-reported reading the management letter ($n=15$).

information from the financial statements versus information in the management letter. On average, participants reported that approximately 90% of their judgments were based on the financial statements and approximately 10% was based on the management letter. Consistent with findings from Shelton (1999), participants appear to be unaware of the dilution effect. Although participants' reported that the management letter was irrelevant to their decisions and assigned a relatively small weight to the information contained in the management letter, descriptive statistics show that decisions were affected by the management letter through a dilution effect.

Additional Analysis

Analysis of Cognitive Load

Prior research suggests that hyperlink use may lead to cognitive overload (Conklin 1987; Kim and Hirtle 1995; Boechler 2001). Participants completed the NASA-TLX as a proxy for actual cognitive load experienced while completing the experimental task (Speier and Morris 2003; Gerjets et al. 2004). Table 7 presents the descriptive statistics for the cognitive load measure by experimental treatment condition. Participants in the HYPERLINK condition reported a lower level of cognitive load (mean=825.00) than participants in the PAPER condition (mean=929.32). In fact, participants in the PAPER condition on average tended to report the highest level of cognitive load of all three of the PRESENTATION FORMAT treatment conditions.²⁷ Although prior research suggests that hyperlink use leads to increased cognitive load, it appears that participants

²⁷ ANOVA results indicate no statistically significant differences in cognitive load among the PRESENTATION FORMAT treatment conditions ($F=1.013$, $p=.370$). Analysis of the six dimensions of the NASA-TLX score also indicated no significant differences between presentation formats.

using hyperlinks in this study reported lower levels of cognitive load than participants using paper-based information.

Decision Confidence

Research suggests that the presence of additional information often results in increased judgment confidence (Oskamp 1965). However, research on the effects of information type (e.g., Davis et al. 1994; Reneau and Blanthorne 2001) and presentation format (e.g., DeSanctis and Jarvenpaa 1989; Amer 1991; Anderson and Reckers 1992; Schulz and Booth 1995; Lim et al. 2000) on judgment confidence is mixed. In order to explore this notion further, participants' confidence in each of their judgments of the company's financial condition was measured for additional exploratory analysis. Responses from each of the three measures were summed for a total confidence score. ANOVA results indicate no significant effect of PRESENTATION FORMAT ($F=.955$, $p=.391$) or of INFORMATION TYPE ($F=1.424$, $p=.238$) on decision confidence. Additionally, there was no significant correlation between judgment confidence and the ACCURACY measures. Thus, it appears that presentation format and information type did not affect decision confidence in this study.

Need for Evaluation

Jarvis and Petty (1996, p. 172) note the following: “*evaluation*, defined as the assessment of the positive and/or negative qualities of an object, is assumed to be among the most pervasive and dominant human responses.” Individuals with a greater need to evaluate have a greater tendency to participate in evaluative responding (Jarvis and Petty

1996) and may be less affected by differences in presentation format. The Need to Evaluate Scale (NES)(Jarvis and Petty 1996) was used to measure each participant's need for evaluation (items 1-16 in Part II of Appendix C)²⁸ in order to conduct additional exploratory analysis as to whether decisions made by participants with a greater need to evaluate are less likely to be affected by presentation format.

The effect of participants' need to evaluate was tested using MANOVA with PRESENTATION FORMAT and INFORMATION TYPE as the independent variables and the ACCURACY measures as the dependent variables. Participants' responses on the NES were included as a covariate in the analysis and an interaction between NES and PRESENTATION FORMAT was also included to test for a moderating effect.²⁹ Multivariate results indicate a significant interaction between PRESENTATION FORMAT and NES (Wilks' Lambda $F=4.461$, $p=.001$); univariate analysis indicates that the interaction is moderately significant for the earnings potential judgment ($F=2.425$, $p=.099$). Thus, need for evaluation appears to moderate the impact of presentation format on judgments of future earnings potential. In order to explore this finding further, participants were classified as either high NES or low NES based on a median split (median NES = 51). An ANOVA was performed with the earnings potential judgments as the dependent variable and PRESENTATION FORMAT and the median split of the

²⁸ See Jarvis and Petty (1996) for a detailed discussion on the development and validation of the NES.

²⁹ Participants' responses to the 16 items of the NES were summed to obtain a total NES score (Jarvis and Petty 1996). The following items were reversed scored: 2, 5, 6, 8, 14, and 16.

NES scores as the independent variables. NES and the interaction between PRESENTATION FORMAT and NES were both not significant.³⁰

Need for Cognition

Need for cognition refers to an individual's tendency to undertake and enjoy effortful cognitive tasks (Cacioppo and Petty 1982). Investors with a high need for cognition may be less affected by differences in presentation format. The Need for Cognition Scale (NCS) (Cacioppo and Petty 1982) measured each participant's need for cognition (items 17-34 in Part II of Appendix C)³¹ to conduct additional exploratory analysis as to whether decisions made by participants with a greater need for cognition are less likely to be affected by presentation format.

The effect of participants' need for cognition was tested using MANOVA with PRESENTATION FORMAT and INFORMATION TYPE as the independent variables and the ACCURACY measures as the dependent variables. Participants' responses on the NCS were included as a covariate in the analysis and an interaction between NCS and PRESENTATION FORMAT was also included to test for a moderating effect.³² Multivariate results indicate a moderately significant effect of NCS (Wilks' Lambda $F=2.362$, $p=.083$); univariate analysis indicates that the effect of NCS is significant for judgments of current financial condition ($F=4.898$, $p=.032$) and earnings potential

³⁰ Lack of statistical significance could be attributed to an overall lack of power, as discussed previously. Observed power for the test of NES and the interaction between presentation format and NES was 0.064 and 0.17, respectively.

³¹ See Cacioppo and Petty (1982) for a detailed discussion on the development and validation of the NCS.

³² Participants' responses to the 18 items of the NCS were summed to obtain a total NCS score (Cacioppo and Petty 1982). The following items were reversed scored: 19, 20, 21, 23, 24, 25, 28, 32, and 33.

judgment ($F=5.641$, $p=.022$). Thus, need for cognition appears impact judgments of current financial condition and future earnings potential.

5. SUMMARY

Discussion and Conclusions

Task design and task processing requirements place a burden on an individual's limited cognitive processing capacities. Prior research suggests that hyperlink use leads to cognitive overload (Conklin 1987; Kim and Hirtle 1995; Boechler 2001). Increases in cognitive load are associated with negative effects, such as navigational disorientation (Conklin 1987), decreased learning (Sweller 1988; Tarmizi and Sweller 1988; Sweller et al. 1990; Niederhauser et al. 2000; Rose and Wolfe 2000), errors during problem-solving (Tarmizi and Sweller 1988; Sweller et al. 1990), and lower recall (Rose et al. 2004).

Accounting research examining the effects of hyperlinked financial information is limited. Studies have shown that hyperlinks affect the manner in which investors analyze and integrate information and make financial decisions (Dull et al. 2003) and cause investors to blend information from different sources, which has adverse effects on decision-making (Hodge 2001). This study builds upon prior research by examining the effects of hyperlinks and irrelevant information on nonprofessional investors' judgment and decision-making. Hyperlink use is proposed to cause an increase in cognitive load that will negatively affect investors' decision making processes. Specifically, the study's hypotheses state that investors using hyperlinked financial information will acquire less information, make less accurate decisions, and take more decision time than investors viewing paper-based information. Additionally, investors experiencing cognitive overload due to hyperlink use are posited to be more likely to use heuristics to reduce cognitive effort and, consequently, are more likely to have biased judgments. Therefore,

this study hypothesizes that investors viewing hyperlinked financial information are more likely to exhibit a dilution effect when making judgments that include irrelevant information than investors who do not have the additional cognitive load from hyperlink use.

Results of this study suggest that presentation format affects nonprofessional investors' information processing and decision outcome but does not affect information acquisition. Specifically, no significant differences in information acquisition were noted among the presentation format treatment conditions. The accuracy of participants' judgments of the current financial condition of the company was significantly affected by presentation format. However, results were unexpected. There was no significant difference in decision accuracy between participants using hyperlinks and those using paper-based financial information. Interestingly, participants using electronic financial information were significantly less accurate than those using paper-based information. Results suggest that viewing information from a computer screen led to less accurate decisions, but the hyperlinks provided some structure to the task that improved decision performance.

Additionally, results suggest that presentation format significantly affects decision time, although results were in the opposite direction than hypothesized. Participants using paper-based financial information took significantly more decision time than participants using hyperlinks and participants using electronic information. Thus, viewing financial information on a computer (both with and without hyperlinks) led to more efficient decision-making. It appears that the use of a computer screen to view financial information led to a trade-off between effort and accuracy – participants using electronic

financial information took less decision time but were also less accurate in their judgments of the current financial condition of the company than those using paper-based financial information.

Finally, presentation format had no significant effect on the dilution effect. Although all participants appear to exhibit a dilution effect, there was no difference among the presentation format treatment conditions.

Additional analysis of measures of cognitive load provides some insight into the findings. Contrary to expectations, participants using paper-based financial information appear to have experienced the highest level of cognitive load, while participants using hyperlinked information tended to report the lowest level of cognitive load. Some research suggests that the negative cognitive effects typically associated with hyperlink use may be minimized by the appropriate structure and design of the hypertext system (McDonald and Stevenson 1996; Niederhauser et al. 2000). Results from this study suggest that the hyperlinks provided structure to the task that led to lower cognitive load, a reduction in decision time, as compared to the paper and electronic conditions, and improvements in decision accuracy. Tripp and Roby (1990, p. 120) noted the following: “If mental resources are engaged by navigational tasks, and if those same resources are needed for learning, it would be logical that achievement should suffer to the extent that navigation is demanding.” It appears that the hyperlink design used in this study actually minimized navigational disorientation and cognitive load and led to more efficient decision-making.

Results of this study differ, to some extent, from prior research. Contrary to findings in Hodge (2001) and Bible et al. (2005), the use of hyperlinks did not significantly

negatively influence the decision outcomes of participants in this study. Alternatively, hyperlinks appear to provide some structure to the task that improved performance, as compared to the electronic condition, and improved efficiency in completing the task, as compared to the paper condition. Differences in findings may be attributable to several factors, including differences in the design of the hyperlink systems used in the experiments, differences in the tasks and the complexity of the information cues used in the experiments, and differences in the time period during which each study was conducted.

Results from this study also contrast findings from prior literature that suggest that hyperlink use leads to cognitive overload and, consequently, negatively affects performance (Conklin 1987; Kim and Hirtle 1995; Boechler 2001). Prior research also suggests no performance differences between reading from a computer screen (without hyperlinks) and reading from paper when the materials have similar design (Gould et al. 1987; Noyes and Garland 2003; Garland and Noyes 2004), while results from this study show differences in judgments and decision time between participants in the paper and electronic conditions.

Advances in technology and changes in technology usage and acceptance over time may explain some of the differences in the results, as noted above. Prior research suggesting that hyperlink use is associated with cognitive overload and negative performance outcomes was conducted primarily during the late 1980's and the 1990's when the Internet was considered a relatively new technology. Thus, participants in these experiments probably had less experience using the Internet and hyperlinks than participants in this study, potentially causing them to be more susceptible to cognitive

overload from hyperlink use. In contrast, participants in this study reported having significant experience using the Internet and hyperlinks.

Technology changes at a rapid pace. Specifically, advances in Internet technologies have allowed new and alternative presentation formats for financial information, such as XBRL and video and audio files. Continuous research is needed to understand how these changes in presentation formats and changes in users' experience with technologies affect users of accounting information systems.

Contributions

This study contributes to both research and practice. First, I use Mauldin and Ruchala's (1999) meta-theory model of AIS research to organize the theoretical discussion and to develop the hypotheses. Thus, this study contributes to AIS research by applying the AIS research model to one specific task. Next, this study contributes to the presentation format literature through examination of the effects of hyperlinks and results suggesting that hyperlinks affect the search associated with analyzing financial information.

Accounting research has not shown whether reading financial information on a computer screen is the same as reading paper-based financial information. Results from this study suggest that the electronicness of financial information leads to lower decision accuracy. This study also contributes to the dilution effect research since nonprofessional investor judgments appear to be diluted by unaudited, optimistic discussions from a company's management.

Results of this study have implications for financial disclosure regulation and information system design. Standard setters should be interested in evidence that indicates that companies appear to be able to dilute the impact of audited financial statements with other types of financial disclosures, such as an unaudited discussion from management. There are currently limited regulations as to the content of corporate websites and as to auditors' responsibilities to review Internet financial disclosures. Regulatory bodies have noted concerns with the quality of web financial information and the format in which information is displayed on the web (FASB 2000). Results of this study indicate that the presentation format and type of financial disclosures affects investor decision-making and suggests that regulations may be needed for the Internet reporting environment.

Limitations and Future Research

This study is subject to several limitations, which are also areas for future research. First, I limit the amount of information participants receive to make their earnings performance and investment judgments. The amount of information available on corporate websites varies widely, making this experimental setting less complex and potentially reducing the generalizability of this study. However, a less complex environment may bias against finding results, since cognitive overload would be more likely to occur in a more complex environment with additional items of hyperlinked information. Future research should examine any potential interactive effects of information overload and cognitive overload during hyperlink use.

Second, I use graduate business students as proxies for nonprofessional investors. These students' characteristics and judgments may not reflect those of actual investors. Future research should examine whether hyperlinks have similar effects on professional investors and others in different decision environments, such as auditors using electronic workpapers and information system professionals.

Although I attempt to randomize the effect of information search strategies in the experimental design, search techniques may have some unintended effects on participant judgments. Future research could examine this issue and determine whether investors view more or less information with differing search strategies when using hyperlinks, as compared to when using paper-based information.

Although participants were instructed to read all of the financial cues, self-reported measures indicate that participants did not attend to all of the information cues provided. I do not know whether participants only attended to specific information cues due to pre-established decision models and how (if at all) this affected the results. Future research could examine nonprofessional investors' information search strategies to obtain a more accurate assessment of which information investors actually view and rely upon when making an investment decision and how information choice influences decision outcomes.

This study examines the effect of a specific type of hyperlink used for navigational purposes. Although research reports that this design is common among current IFR practices (Kelton and Yang 2006), results may not be generalizable to other hyperlink designs. Future research should examine the effects of other Internet presentation formats, such as pop-up windows, processable documents, and dynamic graphic images.

Despite these limitations, this study provides evidence of the effects of irrelevant information and hyperlinks on nonprofessional investors and provides a foundation for future research.

Users of Internet financial reporting have the option of viewing financial information electronically or printing the information and viewing it in paper-based format. Future research could examine the influence of presentation format choice and whether users choose the most effective and efficient format to view financial disclosures.

The content of IFR varies widely providing potential and existing investors several options regarding what information to view when analyzing the financial condition of a company and making an investment decision. This study examines two types of disclosures – audited financial statements and an unaudited letter from management. Future research could examine the effects of other types of information frequently provided on corporate websites, such as webcasts, financial news releases, and stock price data.

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APPENDIX

APPENDIX A
EXPERIMENTAL QUESTIONNAIRE

The following questions refer to the financial information for Advanced Technology Solutions, Inc. Please circle one response for each of the following questions on the scale provided. ***You may refer to the financial information while answering these questions.***

1. Advanced Technology Solution's current financial condition is

Very Weak							Very Strong
1	2	3	4	5	6	7	

2. How confident are you in your judgment of Advanced's current financial condition?

Not Very Confident							Very Confident
1	2	3	4	5	6	7	

3. Advanced's earnings potential over the next three years is most likely to

Weaken							Strengthen
1	2	3	4	5	6	7	

4. How confident are you in your judgment of Advanced's earnings potential over the next three years?

Not Very Confident							Very Confident
1	2	3	4	5	6	7	

5. Assume you have \$5,000 to invest in a stock. How much of the \$5,000 would you invest in Advanced?

Nothing at All							The Entire Amount
1	2	3	4	5	6	7	

6. How confident are you in your investment decision?

Not Very Confident

Very Confident

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Please note the current time using the clock at the front of the room _____.

You have completed this phase of the case study. Please return these materials to the original envelope, close your Web browser, and proceed to the next envelope. Please do not use your computer for the remaining phases of this case study.

APPENDIX B

DISTRACTER TASK

Part I: I would like to know about the workload you experienced during this task.

Following the box below you will be presented with a series of pairs of items or titles. You will be asked to choose which of these items was more important to your experience of workload in the task that you just performed. Titles and meanings for each item are presented below:

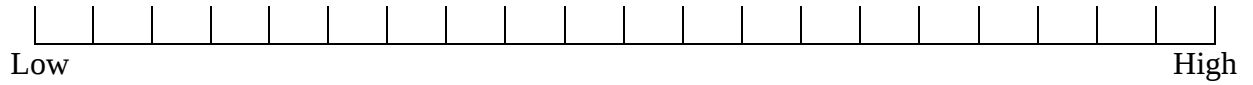
Title	Description
Mental Demand	How much mental and perceptual activity was required (e.g. thinking, deciding, calculating, remembering, looking, searching, etc)? Was the task easy or demanding, simple or complex, exacting or forgiving?
Physical Demand	How much physical activity was required (e.g. pushing, pulling, turning, controlling, activating, etc.)? Was the task easy or demanding, slow or brisk, slack or strenuous, restful or laborious?
Time Demand	How much time pressure did you feel due to the rate or pace at which the tasks occurred? Was the pace slow and leisurely or rapid and frantic?
Performance	How successful do you think you were in accomplishing the goals of the task? How satisfied were you with your performance in accomplishing these goals?
Effort	How hard did you have to work (mentally and physically) to accomplish your level of performance?
Frustration Level	How insecure, discouraged, irritated, stressed and annoyed versus secure, gratified, content, relaxed and complacent did you feel during the task?

On the following items 1-15, for each pair of titles listed, circle the *one title* in *each pair* that represents the more important contributor to workload for the tasks you previously performed.

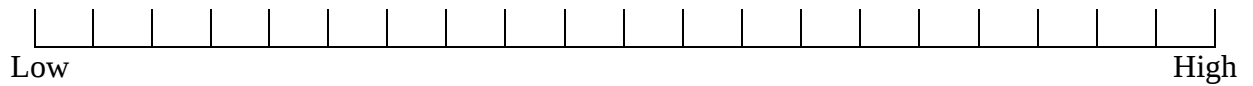
1. Effort or Performance
2. Time Demand or Effort
3. Performance or Frustration
4. Physical Demand or Performance
5. Time Demand or Frustration
6. Physical Demand or Frustration
7. Physical Demand or Time Demand
8. Time Demand or mental Demand
9. Frustration or Effort
10. Performance or Time Demand
11. Mental Demand or Physical Demand
12. Frustration or Mental Demand
13. Performance or Mental Demand
14. Mental Demand or Effort
15. Effort or Physical Demand

For questions 16-21, place an “X” on each scale at the point that matches your experience during this task. Consider each scale individually.

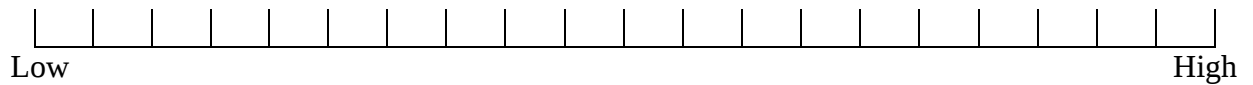
16. Mental Demand



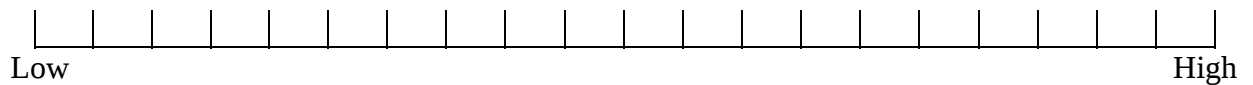
17. Physical Demand



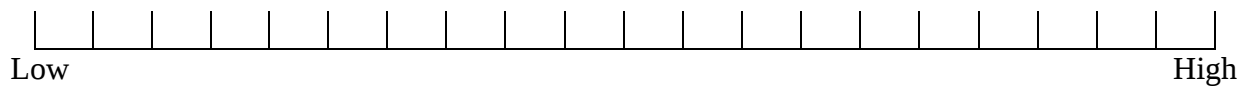
18. Time Demand



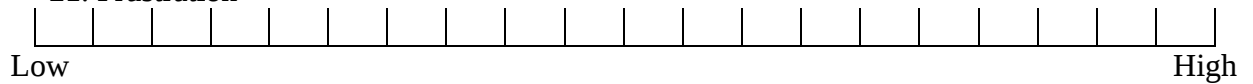
19. Performance



20. Effort



21. Frustration



PART II: Please answer each of the following questions.

1. What is your age? _____
2. What is your gender: (circle one): Male Female
3. How many accounting courses have you completed? _____
4. How many finance courses have you completed? _____
5. How many years of accounting work experience do you have? _____
6. Do you currently own investments in debt or equity securities? Yes No
7. How many years have you been investing in debt or equity securities? _____
8. Do you plan to invest in debt or equity securities in the future? Yes No
9. Have you previously conducted a financial statement analysis on a real company? Yes No
10. Would your judgments about the financial condition of a firm be affected by whether the financial information was presented in traditional paper format or on the computer via a hyperlinked document?

_____ Yes, my judgments would be affected by the presentation format.

_____ No, my judgments would not be affected by the presentation format.

11. How much experience do you have with the Internet?

No Experience

A Lot of Experience

1	2	3	4	5	6	7
---	---	---	---	---	---	---

12. How frequently do use the Internet?

Very Infrequent

Very Frequent

1	2	3	4	5	6	7
---	---	---	---	---	---	---

13. How much experience do you have using Hyperlinks?

No Experience							A Lot of Experience	
1	2	3	4	5	6	7		

14. Please circle which statement most represents the manner in which you read the financial information in this study.

- a. I performed a sequential reading of the financial information. In other words, I read the financial information in the order in which it was presented.
- b. I performed a directive reading of the financial information. In other words, I read the financial information in a specific order that I selected – not in the order in which it was presented.

15. When viewing the financial information, did you have to use the scroll bar to be able to view all of the information on your computer screen?

_____ Yes, I used the scroll bar in order to view all of the information on my computer screen.

_____ No, I did not use the scroll bar.

PART III: Please perform the following mathematical calculations in your head without taking notes or using scratch paper.

- 1. Subtract the number 13 from the number 467 _____
- 2. Subtract the number 13 from your answer to #1 above _____
- 3. Subtract the number 13 from your answer to #2 above _____

APPENDIX C
POST-EXPERIMENT QUESTIONNAIRE³³

Part I: The following questions refer to the case information you previously reviewed. Please provide one response to each of the following questions.

1. Were the **Financial Statements** audited or unaudited?

Audited	Unaudited
1	2

2. Was the **Management Letter** audited or unaudited?

Audited	Unaudited
1	2

3. For the year ended December 31, 2004, the company reported

Net Loss	Net Income
1	2

4. From December 31, 2003 to December 31, 2004, what was the change in the company's total assets (check one answer)?

Increased from 2003 to 2004 _____
Decreased from 2003 to 2004 _____
No change from 2003 to 2004 _____

5. From December 31, 2003 to December 31, 2004, what was the change in the company's revenue (check one answer)?

Increased from 2003 to 2004 _____
Decreased from 2003 to 2004 _____
No change from 2003 to 2004 _____

³³ Questionnaire is for the IRRELEVANT treatment condition. Questionnaire for the RELEVANT condition is identical except for the exclusion of all items pertaining to the management letter.

6. The management letter was from which executive of the company (check one answer)?

President _____
Vice President _____
Chief Executive Officer _____
Chief Operating Officer _____

7. Please check which of the following information cues you actually reviewed:

Auditor's Report _____ Statement of Stockholders' Equity _____
Balance Sheet _____ Financial Statement Footnotes _____
Income Statement _____ Letter from Management _____
Statement of Cash Flows _____

8. How relevant were the **Financial Statements** to your judgments of Advanced's financial performance?

Not Very Relevant Very Relevant

1	2	3	4	5	6	7
---	---	---	---	---	---	---

9. How relevant was the **Management Letter** to your judgments of Advanced's financial performance?

Not Very Relevant Very Relevant

1	2	3	4	5	6	7
---	---	---	---	---	---	---

10. I believe the **Financial Statements** are

Not Very Objective Very Objective

1	2	3	4	5	6	7
---	---	---	---	---	---	---

11. I believe the **Management Letter** is

Not Very Objective Very Objective

1	2	3	4	5	6	7
---	---	---	---	---	---	---

12. In making your judgments of Advanced's financial performance, how much weight did you place on information from the financial statements versus information in the management letter (*weights must add up to 100%*)?

Financial Statements _____ %
 Management Letter _____ %

13. How would you rate the overall quality of the company's financial reports?

Very Low Quality							Very High Quality	
1	2	3	4	5	6	7		

14. How would you rate the overall design of the company's financial reports?

Very Low							Very High	
1	2	3	4	5	6	7		

15. How would you rate the creativity of the company's financial reports?

Very Low							Very High	
1	2	3	4	5	6	7		

16. How would you rate the layout quality of the company's financial reports?

Very Low Quality							Very High Quality	
1	2	3	4	5	6	7		

Part II: Please rate the extent to which each of the following items is characteristic of you by circling one response on each of the following scales.

1. I form opinions about everything.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

2. I prefer to avoid taking extreme positions.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

3. It is very important to me to hold strong opinions.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

4. I want to know exactly what is good and bad about everything.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

5. I often prefer to remain neutral about complex issues.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

6. If something does not affect me, I do not usually determine if it is good or bad.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

7. I enjoy strongly liking and disliking new things.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

8. There are many things for which I do not have a preference.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

9. It bothers me to remain neutral.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

10. I like to have strong opinions even when I am not personally involved.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

11. I have many more opinions than the average person.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

12. I would rather have a strong opinion than no opinion at all.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

13. I pay a lot of attention to whether things are good or bad.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

14. I only form strong opinions when I have to.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

15. I like to decide that new things are really good or really bad.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

16. I am pretty much indifferent to many important issues.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

17. I would prefer complex to simple problems.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

18. I like to have the responsibility of handling a situation that requires a lot of thinking.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

19. Thinking is not my idea of fun.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

20. I would rather do something that requires little thought than something that is sure to challenge my thinking abilities.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

21. I try to anticipate and avoid situations where there is a likely chance I will have to think in depth about something.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

22. I find satisfaction in deliberating hard and for long hours.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

23. I only think as hard as I have to.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

24. I prefer to think about small, daily projects to long-term ones.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

25. I like tasks that require little thought once I've learned them.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

26. The idea of relying on thought to make my way to the top appeals to me.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

27. I really enjoy a task that involves coming up with new solutions to problems.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

28. Learning new ways to think doesn't excite me very much.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

29. I prefer my life to be filled with puzzles that I must solve.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

30. The notion of thinking abstractly is appealing to me.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

31. I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

32. I feel relief rather than satisfaction after completing a task that required a lot of mental effort.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

33. It's enough for me that something gets the job done; I don't care how or why it works.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

34. I usually end up deliberating about issues even when they do not affect me personally.

Extremely Uncharacteristic	Somewhat Uncharacteristic	Uncertain	Somewhat Characteristic	Extremely Characteristic
1	2	3	4	5

APPENDIX D IRRELEVANT INFORMATION

Advanced Technology Solutions, Inc. Management Letter

To Our Current and Potential Shareholders:

Advanced Technology Solutions enters 2005 well positioned and confident:

- We have the team and commitment it takes to prevail.
- We are strategically well positioned for a changing market.
- We are confident that our market and product strategy is on target for continued growth.
- We remain confident in the strategic direction and opportunity for our Company.
- We are optimistic about the level of positive reception we are receiving from customers on our new product platforms.
- We have one of the strongest and most cohesive teams in our industry, and the team required to drive our Company to a leadership position.

Additionally, our Company has experienced significant changes during 2004 that have dramatically improved the foundation of our Company.

- We have implemented a management rotation program to strengthen the knowledge and experience of our management team.
- We appointed Dave Johnson to the position of Chief Internal Auditor. An industry leader with more than 20 years experience, Dave will help lead the Company to the next level of performance.
- We modified the Company's management compensation package to better reflect our increased emphasis on achieving budgeted targets.
- We have automated the periodic counts of our physical inventory to ensure accuracy in the individual perpetual inventory records.

Let there be no doubt about our dedication to success. Advanced knows how to anticipate market trends, provide solutions that answer real needs, and deliver them with compelling timing and cost performance. I look forward to the future growth of our company. Thank you for your continuing support.

Sincerely,
John Parker
Chief Executive Officer
March 15, 2005

APPENDIX E

RELEVANT INFORMATION³⁴

REPORT OF INDEPENDENT ACCOUNTANTS

To the Board of Directors and Stockholders of
Advanced Technology Solutions, Inc.:

We have audited the accompanying consolidated balance sheets of Advanced Technology Solutions, Inc. as of December 31, 2004 and 2003, and the related consolidated statements of operations, stockholders' equity, and cash flows for the three years ended December 31, 2004. These financial statements are the responsibility of the Company's management; our responsibility is to express an opinion on these financial statements based on our audits.

We conducted our audits in accordance with auditing standards generally accepted in the United States of America. These standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements, assessing the accounting principles used and significant estimates made by management, and evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for our opinion.

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the consolidated financial position of Advanced Technology Solutions, Inc. as of December 31, 2004 and 2003, and the consolidated results of its operations and its cash flows for the three years ended December 31, 2004, in conformity with generally accepted accounting principles.

BIG FOUR ACCOUNTING FIRM LLP

Dallas, Texas
February 15, 2005

³⁴ Each page of the financial statements used in the experiment contained a "table of contents" that allowed participants to utilize a directional information search strategy (see additional discussion in footnote 10). See figures 2 and 3 for examples of the table of contents. The table of contents was removed from the financial statements presented here in order to comply with University dissertation format guidelines.

ADVANCED TECHNOLOGY SOLUTIONS, INC.
CONSOLIDATED BALANCE SHEETS
(in thousands)

	December 31,	
	2004	2003
<u>ASSETS</u>		
<u>Current Assets:</u>		
Cash and cash equivalents	22,995	65,642
Short-term investments	66,506	69,178
Accounts receivable, net	5,992	34,924
Inventories	10,143	67,954
Other current assets	35,713	62,312
Total current assets	141,349	300,010
Property and equipment, net	61,475	93,456
Goodwill	431,742	419,064
Other assets	26,178	53,817
Total assets	660,744	866,347
<u>LIABILITIES AND STOCKHOLDERS' EQUITY</u>		
<u>Current Liabilities:</u>		
Accounts payable	81,204	143,477
Short-term debt	13,122	13,538
Other	8,184	9,539
Total current liabilities	102,510	166,554
Long-term debt	488,140	477,500
Other long-term liabilities	56,631	84,756
Total liabilities	647,281	728,810
<u>Stockholders' Equity</u>		
Common stock	5,374,271	5,310,678
Accumulated other comprehensive loss	(26,017)	(25,274)
Accumulated deficit	(5,334,791)	(5,147,867)
Total stockholders' equity	13,463	137,537
Total liabilities and stockholders' equity	660,744	866,347

The accompanying notes are an integral part of these consolidated financial statements.

ADVANCED TECHNOLOGY SOLUTIONS, INC.
CONSOLIDATED STATEMENTS OF OPERATIONS
(in thousands)

	Year Ended December 31,		
	2004	2003	2002
Revenue	125,629	227,533	278,010
Cost of revenue	121,298	279,809	110,716
Gross profit (loss)	4,331	(52,276)	167,294
Operating expenses:			
Selling, general and administrative	158,202	218,359	169,041
Impairment of goodwill	-	2,689,857	-
Amortization of intangibles	12,993	1,153,637	1,010,152
Total operating expenses	171,195	4,061,853	1,179,193
Loss from operations	(166,864)	(4,114,129)	(1,011,899)
Other income (expense), net:			
Interest and other income (expense)	(347)	23,246	25,872
Interest expense	(19,713)	(27,091)	(21,518)
Net loss	(186,924)	(4,117,974)	(1,007,545)

The accompanying notes are an integral part of these consolidated financial statements.

ADVANCED TECHNOLOGY SOLUTIONS, INC.
CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY
(in thousands)

	Common Stock	Accumulated Other Comprehensive Loss	Accumulated Deficit	Total Stockholders' Equity
Balance at December 31, 2001	88,241	-	(22,348)	65,893
Issuance of Common Stock	5,099,484	-	-	5,099,484
Unrealized loss on investments	-	(8,685)	-	(8,685)
Net loss	-	-	(1,007,545)	(1,007,545)
Balance at December 31, 2002	5,187,725	(8,685)	(1,029,893)	4,149,147
Issuance of Common Stock	122,953	-	-	122,953
Unrealized loss on investments	-	(16,589)	-	(16,589)
Net loss	-	-	(4,117,974)	(4,117,974)
Balance at December 31, 2003	5,310,678	(25,274)	(5,147,867)	137,537
Issuance of Common Stock	63,593	-	-	63,593
Unrealized loss on investments	-	(743)	-	(743)
Net loss	-	-	(186,924)	(186,924)
Balance at December 31, 2004	<u>5,374,271</u>	<u>(26,017)</u>	<u>(5,334,791)</u>	<u>13,463</u>

The accompanying notes are an integral part of these consolidated financial statements.

ADVANCED TECHNOLOGY SOLUTIONS, INC.
CONSOLIDATED STATEMENTS OF CASH FLOWS
(in thousands)

	Year Ended December, 31		
	2004	2003	2002
Cash flows from operating activities:			
Net loss	(186,924)	(4,117,974)	(1,007,545)
<i>Adjustments to reconcile net loss to cash provided by operating activities:</i>			
Amortization of intangibles	12,993	1,153,637	1,010,152
Depreciation	46,783	38,921	14,156
Impairment of goodwill	-	2,689,857	-
Accounts receivable, net	27,178	61,453	(80,948)
Inventories	48,777	(50,747)	(12,532)
Accounts payable	(62,273)	78,012	75,291
Other	4,979	(51,199)	(20,401)
Net cash used in operating activities	(108,487)	(198,040)	(21,827)
Cash flows from investing activities:			
Purchase of property and equipment	(13,531)	(60,829)	(66,967)
Investments, net	1,519	330,150	(372,288)
Other	19,972	(41,397)	(22,491)
Net cash provided by (used in) investing activities	7,960	227,924	(461,746)
Cash flows from financing activities:			
Proceeds from issuance of Common Stock, net	37,774	10,750	37,731
Proceeds from issuance of debt	-	-	486,443
Other	20,106	(6,229)	(23,252)
Net cash provided by financing activities	57,880	4,521	500,922
Net increase (decrease) in cash and cash equivalents	(42,647)	34,405	17,349
Cash and cash equivalents at beginning of period	65,642	31,237	13,888
Cash and cash equivalents at end of period	22,995	65,642	31,237

The accompanying notes are an integral part of these consolidated financial statements.

ADVANCED TECHNOLOGY SOLUTIONS, INC.
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

Note 1—Organization and Summary of Significant Accounting Policies:

The Company and liquidity

Advanced Technology Solutions Inc. (“Advanced” or the “Company”) was incorporated in Delaware in 1996. Advanced is a leading provider of advanced telecommunications networking equipment that enables carriers and service providers to rapidly deploy high-speed access and services to the Internet and corporate networks.

To date, the Company has funded its operations largely through the issuance of debt and equity securities. However, the Company has incurred substantial losses and negative cash flows from operations since inception and has an accumulated deficit of \$5.3 billion at December 31, 2004. Management expects operating losses and negative cash flows to continue for at least the next 6 to 12 months. Management believes that its current cash, cash equivalent, and short-term investment balances are adequate to last for the next 12 months. However, failure to generate sufficient revenue, potentially raise additional capital, restructure debt, or reduce discretionary spending could have a material adverse effect on the Company’s ability to achieve its intended longer term business objectives.

Principles of consolidation

The consolidated financial statements include the financial statements of Advanced and its wholly owned subsidiaries. All significant intercompany transactions and accounts have been eliminated.

Revenue recognition

Sales and related costs are recognized as incurred.

ADVANCED TECHNOLOGY SOLUTIONS, INC.
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS – (Continued)

Goodwill and intangible assets

On January 1, 2002, the Company adopted SFAS No. 142, Goodwill and Intangible Assets. Under SFAS 142, goodwill must be tested for impairment annually and whenever events or circumstances occur indicating that goodwill might be impaired. SFAS 142 also requires purchased intangible assets other than goodwill to be amortized over their useful lives, unless these lives are determined to be indefinite. In accordance with SFAS 142, the Company ceased amortizing goodwill with a net carrying value of \$400.7 million as of January 1, 2002, including \$12.6 million of acquired workforce intangibles previously classified as purchased intangible assets.

Note 2—Acquisitions:

On March 8, 2002, the Company and Siara Systems, Inc. (“Siara”) completed their merger. In connection with the merger, the Company issued 57,388,818 shares of its common stock and options and warrants to purchase 5,295,038 shares of its common stock.

On September 28, 2002, the Company closed the acquisition of Abatis Systems Corporation (“Abatis”). In connection with the acquisition of Abatis, the Company issued 1,632,978 shares of its common stock, a subsidiary of the Company issued 2,440,526 exchangeable shares, which holders may exchange for shares of its common stock on a one-for-one basis at any time, and the Company issued options to purchase 1,162,188 shares of its common stock.

In September 2003, the Company completed its acquisition of Merlin Systems Corporation (“Merlin”). In connection with the acquisition of Merlin, the Company issued approximately 3.5 million shares of its common stock.

ADVANCED TECHNOLOGY SOLUTIONS, INC.
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS – (Continued)

Note 3—Goodwill and Purchased Intangible Assets:

Upon adoption of SFAS 142 on January 1, 2002, the Company performed a transitional impairment analysis on goodwill and no impairment charge was required. In addition, the Company performed an annual impairment test, and no impairment charge was required. The Company expects to perform its annual impairment test in the second quarter of every year. If there is a significant decrease in the Company's business in the future, the Company may be required to record impairment charges in future periods.

As a result of the sustained decline in the Company's business and reduced forecasts for future periods, the Company performed an impairment review of goodwill and other intangibles in the third quarter of 2003. Based on a discounted cash flow analysis, the Company recorded an impairment charge of \$2.7 billion related to goodwill during the third quarter of 2003. This reduction resulted from the then recent sustained decline in market capitalization and uncertain near-term outlook for the Company's business, consistent with the telecommunications industry.

Note 4 – Inventory:

Inventories consist of the following (in thousands):

	December 31,	
	2004	2003
Raw materials and work in process	3,775	22,257
Finished assemblies	6,368	45,697
	<u>\$ 10,143</u>	<u>\$ 67,954</u>

ADVANCED TECHNOLOGY SOLUTIONS, INC.
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS – (Continued)

Note 5 – Property and Equipment:

Property and equipment, net, consists of the following (in thousands):

	December 31,	
	2004	2003
Machinery and computer equipment	108,789	106,847
Furniture and fixtures	18,832	20,462
Leasehold improvements	16,524	21,651
	144,145	148,960
Less accumulated depreciation	(82,670)	(55,504)
	<u>\$ 61,475</u>	<u>\$ 93,456</u>

TABLE 1. EXPERIMENTAL DESIGN

<i>PRESENTATION FORMAT</i>	<i>INFORMATION TYPE</i>	
	Relevant	Irrelevant
Hyperlink		
Electronic		
Paper		

TABLE 2. SAMPLE CHARACTERISTICS**Panel A**

	Mean	Standard Deviation	Min	Max
Age	27.31	4.11	22	39
Accounting Courses Completed	2.36	1.37	1	7
Finance Courses Completed	2.14	2.13	0	10
Years Accounting Work Experience	0.17	0.53	0	2
Years Investing Experience	2.97	4.85	0	25
Internet Experience ^a	6.41	0.83	3	7
Internet Usage ^b	6.66	0.92	1	7
Hyperlink Experience ^c	5.88	1.66	1	7

Panel B

	n	%
Gender		
Female	21	35.6
Male	38	64.4
Plan to Invest in Debt or Equity Securities in the Future		
Yes	54	91.5
No	5	8.5
Conducted a Financial Statement Analysis on a Real Company		
Yes	47	79.7
No	12	20.3

a - Participants' Internet experience was measured using a 7-point scale anchored by
(1) No Experience and (7) A lot of Experience

^b - Participants' Internet usage was measured using a 7-point scale anchored by
(1) Very Infrequent and (7) Very Frequent

^c - Participants' hyperlink experience was measured using a 7-point scale anchored by
(1) No Experience and (7) A lot of Experience

TABLE 3. DESCRIPTIVE STATISTICS

Measure	Mean	Standard Deviation	Min	Max
Recall ^a	0.79	0.18	0	1
Accuracy				
Current Financial Condition ^b	2.61	1.19	1	5
Future Earnings Potential ^c	3.38	1.39	1	6
Investment Decision ^d	1.76	1.09	1	5
Decision Time ^e	5.51	2.37	2	14

^a - Recall measured as the percentage of correct answers given

^b - Current financial condition assessed using a 7-point scale anchored by (1) Very Weak and (7) Very Strong

^c - Future earnings potential assessed using a 7-point scale anchored by (1) Weaken and (7) Strengthen

^d - Participants assessed how much they would invest in the company using a 7-point scale anchored by (1) Nothing At All and (7) The Entire Amount

^e - Total decision time is self-reported and measured in minutes

TABLE 4. MANOVA RESULTS – HYPOTHESIS ONE

Source	F^a	Sig
PRESENTATION FORMAT	2.568	0.009
INFORMATION TYPE	1.712	0.150
FORMAT*TYPE	0.632	0.783

^a Wilks' Lambda

TABLE 5. UNIVARIATE ANALYSES – HYPOTHESIS ONE

Panel A: Recall (H1a)

ANOVA Results

Source	Type III Sum of Squares	df	MS	F	Sig.
Model	0.168	5	0.034	1.000	0.427
PRESENTATION FORMAT	0.012	2	0.006	0.178	0.837
INFORMATION TYPE	0.131	1	0.131	3.895	0.054
FORMAT*TYPE	0.026	2	0.013	0.380	0.686
Error	1.751	52	0.034		

Treatment Means (Std. Dev.)

Presentation Format	Information Type		Main Effects
	Relevant	Irrelevant	
Hyperlink	0.83 (0.25)	0.73 (0.15)	0.78 (0.21)
Paper	0.84 (0.17)	0.70 (0.19)	0.77 (0.19)
Electronic	0.83 (0.17)	0.78 (0.16)	0.80 (0.16)
Main Effects	0.83 (0.19)	0.74 (0.17)	

TABLE 5, CONTINUED

Panel B: Judgments of Current Financial Condition (H1b)

ANOVA Results

Source	Type III Sum of Squares	df	MS	F	Sig.
Model	13.271	5	2.654	2.018	0.091
PRESENTATION FORMAT	9.648	2	4.824	3.668	0.032
INFORMATION TYPE	0.016	1	0.016	0.012	0.912
FORMAT*TYPE	3.412	2	1.706	1.297	0.282
Error	68.384	52	1.315		

Treatment Means (Std. Dev.)

Presentation Format	Information Type		Main Effects
	Relevant	Irrelevant	
Hyperlink	2.67 (1.50)	2.88 (1.25)	2.76 (1.35)
Paper	1.91 (0.94)	2.30 (0.82)	2.10 (0.89)
Electronic	3.40 (1.17)	2.70 (1.16)	3.05 (1.19)
Main Effects	2.63 (1.33)	2.61 (1.07)	

TABLE 5, CONTINUED

Panel C: Judgments of Future Earnings Potential (H1b)

ANOVA Results

Source	Type III Sum of Squares	df	MS	F	Sig.
Model	19.233	5	3.847	2.212	0.067
PRESENTATION FORMAT	7.286	2	3.643	2.095	0.133
INFORMATION TYPE	5.791	1	5.791	3.330	0.074
FORMAT*TYPE	5.926	2	2.963	1.704	0.192
Error	90.422	52	1.739		

Treatment Means (Std. Dev.)

Presentation Format	Information Type		Main Effects
	Relevant	Irrelevant	
Hyperlink	2.44 (1.33)	3.25 (1.04)	2.82 (1.24)
Paper	3.00 (1.48)	4.30 (1.34)	3.62 (1.53)
Electronic	3.70 (1.34)	3.50 (1.27)	3.60 (1.27)
Main Effects	3.07 (1.44)	3.71 (1.27)	

TABLE 5, CONTINUED

Panel D: Investment Decisions (H1b)

ANOVA Results

Source	Type III Sum of Squares	df	MS	F	Sig.
Model	5.240	5	1.048	0.867	0.509
PRESENTATION FORMAT	3.863	2	1.932	1.598	0.212
INFORMATION TYPE	0.043	1	0.043	0.035	0.852
FORMAT*TYPE	1.164	2	0.582	0.482	0.620
Error	62.846	52	1.209		

Treatment Means (Std. Dev.)

Presentation Format	Information Type		Main Effects
	Relevant	Irrelevant	
Hyperlink	1.89 (1.05)	1.63 (0.92)	1.76 (0.97)
Paper	1.27 (0.65)	1.70 (0.82)	1.48 (0.75)
Electronic	2.10 (1.60)	2.10 (1.29)	2.10 (1.41)
Main Effects	1.73 (1.17)	1.82 (1.02)	

TABLE 5, CONTINUED

Panel E: Decision Time (H1c)

ANOVA Results

Source	Type III Sum of Squares	df	MS	F	Sig.
Model	71.118	5	14.224	2.919	0.021
PRESENTATION FORMAT	62.298	2	31.149	6.393	0.003
INFORMATION TYPE	0.014	1	0.014	0.003	0.957
FORMAT*TYPE	7.306	2	3.653	0.750	0.478
Error	253.382	52	4.873		

Treatment Means (Std. Dev.)

Presentation Format	Information Type		Main Effects
	Relevant	Irrelevant	
Hyperlink	4.33 (2.24)	4.50 (1.41)	4.41 (1.84)
Paper	7.27 (3.32)	6.40 (1.65)	6.86 (2.63)
Electronic	4.60 (1.35)	5.40 (2.32)	5.00 (1.89)
Main Effects	5.50 (2.76)	5.50 (1.95)	

^a See variable definitions in Table 3

TABLE 6. MANOVA RESULTS - HYPOTHESIS 2

Source	F^a	Sig
PRESENTATION FORMAT	2.551	0.024
INFORMATION TYPE	1.395	0.255
FORMAT*TYPE	0.921	0.483

^a Wilks' Lambda

**TABLE 7. COGNITIVE LOAD BY TREATMENT CONDITION
MEANS (STANDARD DEVIATIONS)**

Presentation Format	Information Type		Main Effects
	Relevant	Irrelevant	
Hyperlink	767.78 (332.30)	889.38 (195.11)	825.00 (275.28)
Paper	880.91 (225.17)	977.73 (198.02)	929.32 (212.77)
Electronic	898.33 (207.92)	918.33 (163.25)	908.33 (181.64)
Main Effects	851.21 (255.55)	933.39 (183.68)	

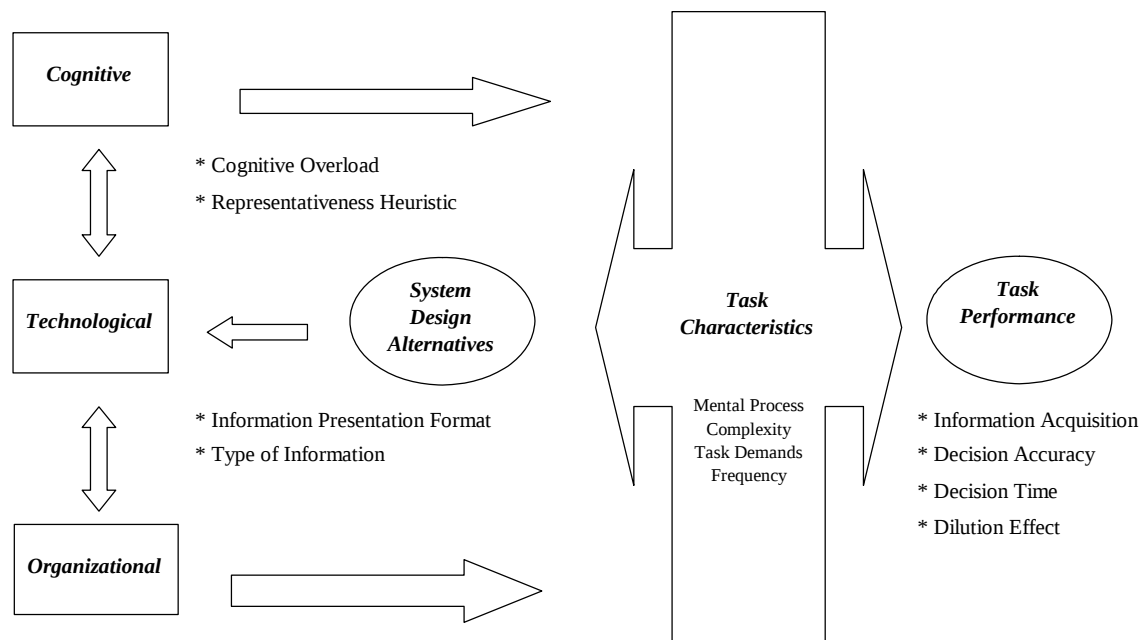


FIGURE 1
RESEARCH MODEL^a

^a Research model adapted from Mauldin and Ruchala (1999).

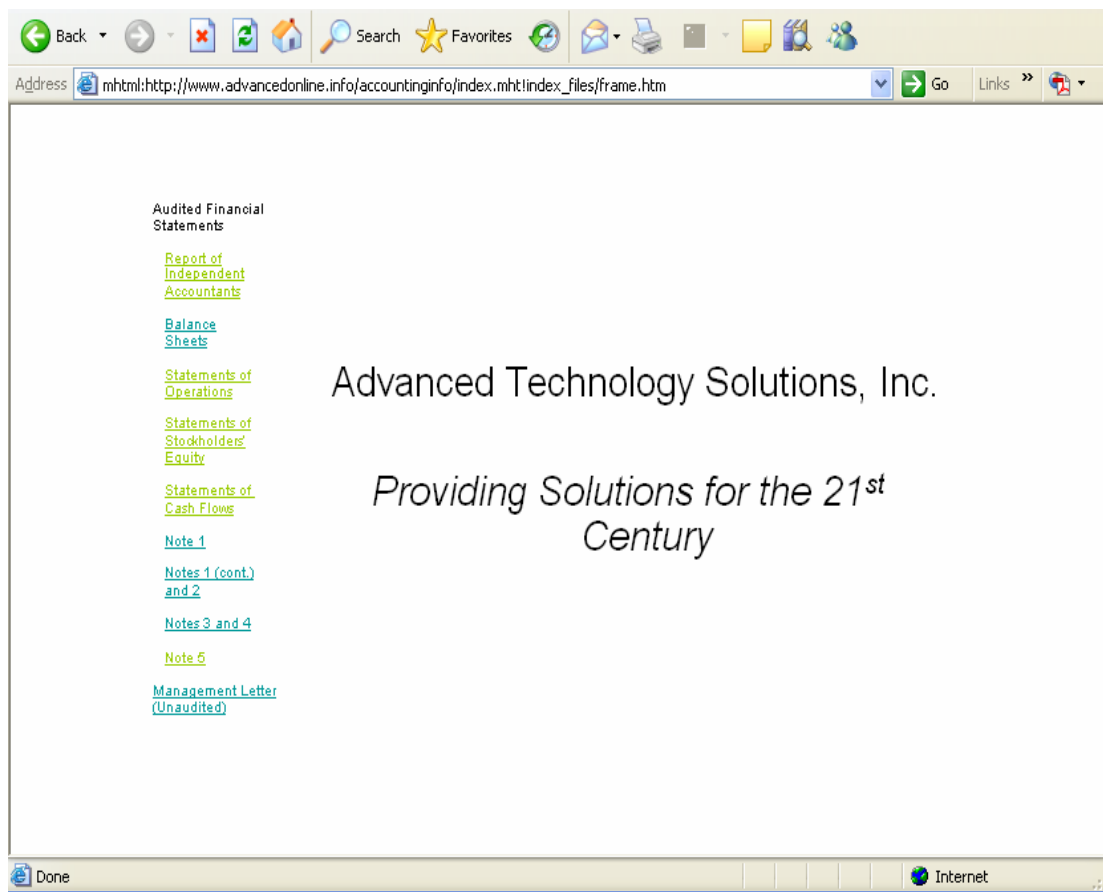


FIGURE 2
EXAMPLE OF HYPERLINK/IRRELEVANT CONDITION

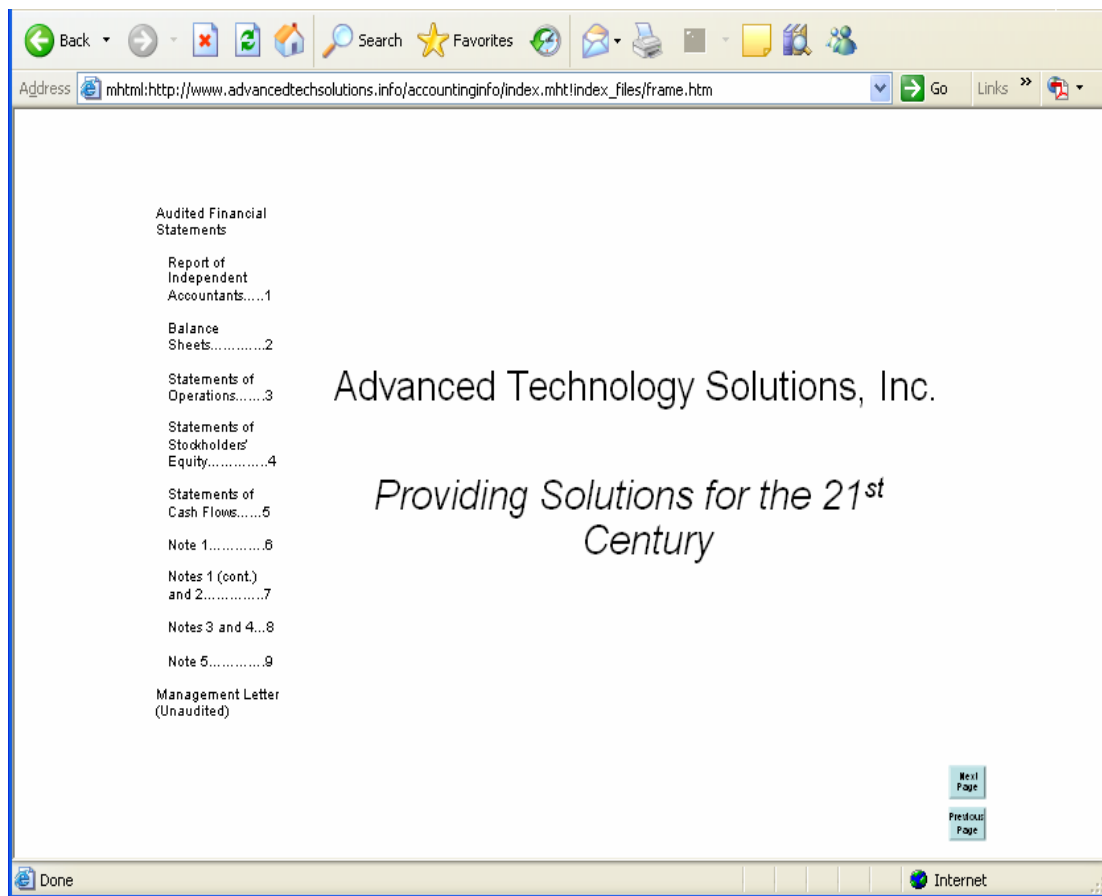


FIGURE 3
EXAMPLE OF ELECTRONIC/IRRELEVANT CONDITION

VITA

Andrea Seaton Kelton was born in Cross Lanes, WV. She graduated from James Madison University in 1997 with a Bachelor of Business Administration in Accounting and then completed a Masters of Science in Accounting, with a concentration in Accounting Information Systems, from James Madison University in 1998. Following four years with KPMG LLP, she attended the University of Tennessee and received a Ph.D. in Business Administration in 2006. Andrea will join the faculty at the University of South Florida in Tampa, FL in August 2006 as an Assistant Professor of Accounting.