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

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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 could have implications for financial disclosure regulation and information system design. Standard setters should be interested in evidence that addresses whether 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 web disclosures. Evidence from this study will also indicate whether the presentation format of Internet disclosures affects investor judgments and may suggest that regulations are needed for the Internet reporting environment.

Keywords: Hyperlinks, irrelevant information, presentation format, dilution effect

I. 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 Internet financial information is displayed: "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 unaudited 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.

Internet financial reporting ("IFR") provides companies with more flexibility as to the type of information disclosed and the presentation format of disclosures, as compared to traditional, paper-based disclosures. 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 hyperlinks, video and audio files, processable file formats, and dynamic graphics (Kelton and Yang 2005). 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 (2005) report the following: approximately 98% of their sample companies provide hyperlinks as a navigational tool within their corporate website; 48% use hyperlinks inside their annual report; 47% provide a hyperlink to EDGAR or 10K Wizard; and 30% use hyperlinks to data on a third-party website. However, 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 (Conklin 1987; Boechler 2001). Simultaneous performance of these tasks places a high cognitive load on 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 load, as compared to those viewing the same paper-based financial information. The increase in cognitive load will cause nonprofessional investors to acquire less information, make less accurate decisions, and take more time making decisions. 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 increased cognitive load.

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; Debreceny 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 CEO (irrelevant information). The financial statements display poor financial performance; the letter to shareholders conveys an optimistic tone with a positive future outlook. Participants view the financial information either on the company's corporate website, on the website using hyperlinks, or in hard-copy format.

Preliminary 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 and were less accurate in their judgments of the company's current financial condition than those viewing hard-copy information. Additionally, participants using hard-copy information demonstrated a greater dilution effect than participants using hyperlinks.

Preliminary results of this study have implications for financial disclosure regulation and information system design. Standard setters should be interested in the preliminary 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. Preliminary evidence from this study indicates that the presentation format of financial disclosures affects 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. Preliminary results from this study indicate that hyperlink use leads to decreased decision time and decreased accuracy. Information system professionals will be encouraged to take precautions with system design to minimize any negative effects caused by hyperlink use.

The remainder of this paper is organized as follows. The next section discusses the theory and hypotheses development. The third section describes the research method and the experiment. The fourth section presents the preliminary results of the study and the final section provides a summary and gives direction for future research.

II. THEORY AND HYPOTHESES

Theoretical Research Model

Mauldin and Ruchala (1999) provide a research framework for examining the contingency factors that affect AIS task performance. 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 as shown in Figure 1.

The meta-theory model incorporates three contingency factors that affect AIS task performance: cognitive, technological, and organizational. Cognitive contingency factors consist of the components of human information processing that influence task performance. Technological contingency factors represent the specific design characteristics of the AIS that affect task performance, 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 interaction between specific technological and cognitive contingency factors that influences investor judgments. 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. Figure 1 depicts the specific contingency factors 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. 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 (Libby and Lewis 1977; Hogarth 1980). Additionally, information acquisition is affected by increases in cognitive load (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 (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 load refers to the burden placed on working memory as a result of these limited cognitive processing capacities (Sweller 1988). Increases in cognitive load are caused by task design and task processing requirements (Rose and Wolfe 2000; Rose 2002; Rose et al. 2004) and Internet browsing using hyperlinks (Conklin 1987; Kim and Hirtle 1995; Boechler 2001). High cognitive load 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 Effect of Hyperlinks on Investor Judgments

A hyperlink provides an automatic 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 (2005) report that hyperlinks are commonly used in IFR as a navigational tool.

The flexibility provided by hyperlinks is associated with increases in cognitive load. 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 places a high cognitive load on the information system user (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 suggest 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.[1] Niederhauser et al. (2000) use cognitive overload to explain the findings. Participants that use the "compare and contrast" links actively consider navigational choices, possibly experiencing navigational disorientation and encountering increased cognitive load, which

[1] The topic map used in Niederhausser 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.

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 has been primarily descriptive (Ashbaugh et al. 1999; Debreceny 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 information. In addition, investors using hyperlinks provide higher assessments of the credibility of the financial information than investors viewing paper-based information.[2]

Dull et al. (2003) provide additional evidence of the effects of hyperlinks on financial decisions. Experiment participants view 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.[3]

In summary, task design and task processing requirements place a burden on an individual's limited cognitive processing capacities. Hyperlink use leads to cognitive overload (Conklin 1987; Kim and Hirtle 1995; Boechler 2001). Additionally, hyperlinks affect the manner in which investors

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

[3] 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.

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).

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 load, 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 increase 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 causes 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 impact of the diagnostic information. Thus, any irrelevant information cue that weakens the impact of a relevant information 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 nondiagnostic or 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 diagnostic and nondiagnostic information are less extreme than judgments based solely on diagnostic information (Nisbett et al. 1981). 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). The use of heuristics may cause judgments to be susceptible to biases, such as the dilution effect (Tversky and Kahneman 1974).

As previously mentioned, the use of hyperlinks increases cognitive load (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 and are more likely to have biased judgments. 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.

III. EXPERIMENT

Participants

Fifty-nine 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 having "a reasonable understanding of business and economic activities and are willing to study the information with reasonable diligence." The FASB (1978) also notes that individuals 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 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. 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.

Design

The experiment used a 3X2 between-subjects design. The two independent variables are presentation format and information type. The levels of presentation format are "HYPERLINK", "ELECTRONIC" and "PAPER-BASED." 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. Information systems and ergonomics research indicates that there is no difference 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, dilution effect, and decision time. Information acquisition 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.[4]

Decision accuracy is assessed with perceptions of the company's current earnings performance, judgments of future earnings potential, and investment decisions (see items in Appendix A).[5] The items are coded such that lower (higher) scores indicate negative (positive) perceptions of the company's current financial condition and future earnings potential. Thus, lower (higher) scores indicate less (more) optimistic perceptions of the company's financial condition and, consequently, more (less) accurate decisions.

[4] 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. Thus, measuring recall using a percentage (as opposed to the number of correct answers given) allows comparison between the treatment conditions.

[5] Items adapted from Hodge (2001) and Elliott (2004).

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, I also assess subjects' confidence in each of their judgments of the company's financial condition for additional analysis (see items in Appendix A).[6]

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). Dilution effects are measured by the 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.

Participants self-report total decision time. Decision start time is noted prior to examination of the information cues. Stop time is noted after completion of the experimental questionnaire.

Task

Participants completed a simple decision case, including assessment of 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 behavioral accounting research. Second, the financial statements provided to participants are adapted from a real company that has previously filed for

[6] 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).

bankruptcy.[7] The financial statements from the year prior to bankruptcy are used in this study. This design is optimal since a "correct" answer exists 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, the 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) 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 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 Exhibit 1. The links on the left side of the page allowed participants to alternate between the different components of the audited

[7] The financials statements have been altered to conceal the identity of the company. The financial statements include an unqualified audit opinion.

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 was accessed. An example of the web design for the ELECTRONIC condition is presented in Exhibit 2. 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.[8]

The information cues are the audited financial statements and an unaudited letter from management. Each information cue is designed to illicit different responses from participants.[9] Advanced's financial statements indicate 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.[10] Thus, the management letter should initiate positive perceptions of the company (see management letter in Appendix D).

Procedures

[8] Participants' information search strategies may influence decision outcomes (Hunton and McEwen 1997). Hyperlinks promote directional search strategies (Dull et al. 2001) while paper-based information 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 contains a "Table of Contents," which provides the opportunity for directional search strategies, even in the PAPER-BASED condition (see Exhibits 1 and 2). Participants in the ELECTRONIC condition can use the "next page" button to directionally access specific information. Consequently, the effect of search strategy on decision outcome should be randomized among all treatment conditions and will be tested using measures of participants' self-reported search strategies (item 14 in Appendix B).

[9] 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 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)

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

The experiment was conducted during scheduled class time. Participants in the PAPER-BASED 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.

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-BASED 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' 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 will be used to determine whether those using electronic information perceive higher levels of cognitive load than those viewing paper-based information. 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-experimental questionnaire (Appendix C) which assessed the following: (1) information acquisition (RECALL) (2) what information cues the participants actually viewed, (3) if participants were aware of a dilution effect, and (4) report quality perceptions. 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 relevance of each information cue to their decision is measured to determine whether they were aware of the occurrence of a dilution effect (Shelton 1999). 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 perceptions of report quality to include as a covariate in the statistical analyses.

IV. 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). The financial statements were considered relevant by all members of the expert panels. Any items in the management letter considered relevant were removed from the experimental materials ensuring that all information contained in the letter is considered irrelevant.

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

Preliminary Results

Preliminary 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 and were less accurate in their judgments of the company's current financial condition than those viewing hard-copy information. Participants using hard-copy information demonstrated a greater dilution effect than participants using hyperlinks.

V. SUMMARY AND CONCLUSIONS

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. Preliminary results from this study indicate 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. This study will provide empirical evidence to address this issue. This study also contributes to the dilution effect research with preliminary evidence that technology and presentation format influence the dilution effect demonstrated by nonprofessional investors.

Preliminary 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 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). Preliminary evidence from this study indicates that the presentation format of financial disclosures affects 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. Preliminary results from this study indicate that system design affects decision time and decision accuracy. Information system professionals will be encouraged to take precautions with system design to minimize any negative effects of hyperlink use.

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.

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 2005), 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 preliminary 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 financial information – 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. Similarly, future research could examine information search strategies to determine which information investors actually view and rely upon when making an investment decision.

APPENDIX A
EXPERIMENTAL QUESTIONAIRRE

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.

On the following items 1-15, for each pair of titles listed in the right column, circle the ***one title*** in ***each pair*** that represents the more important contributor to workload for the tasks you previously performed. Titles and meanings for each item are presented below in the left column:

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?

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.

7. Mental Demand

Low High

8. Physical Demand

Low High

9. Time Demand

Low High

10. Performance

Low High

11. Effort

Low High

12. Frustration

Low High

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.

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 QUESTIONAIRRE[11]

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 _____

[11] 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 _____
   Balance Sheet _____
   Income Statement _____
   Statement of Cash Flows _____
   Statement of Stockholders' Equity _____
   Financial Statement Footnotes _____
   Letter from Management _____

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

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

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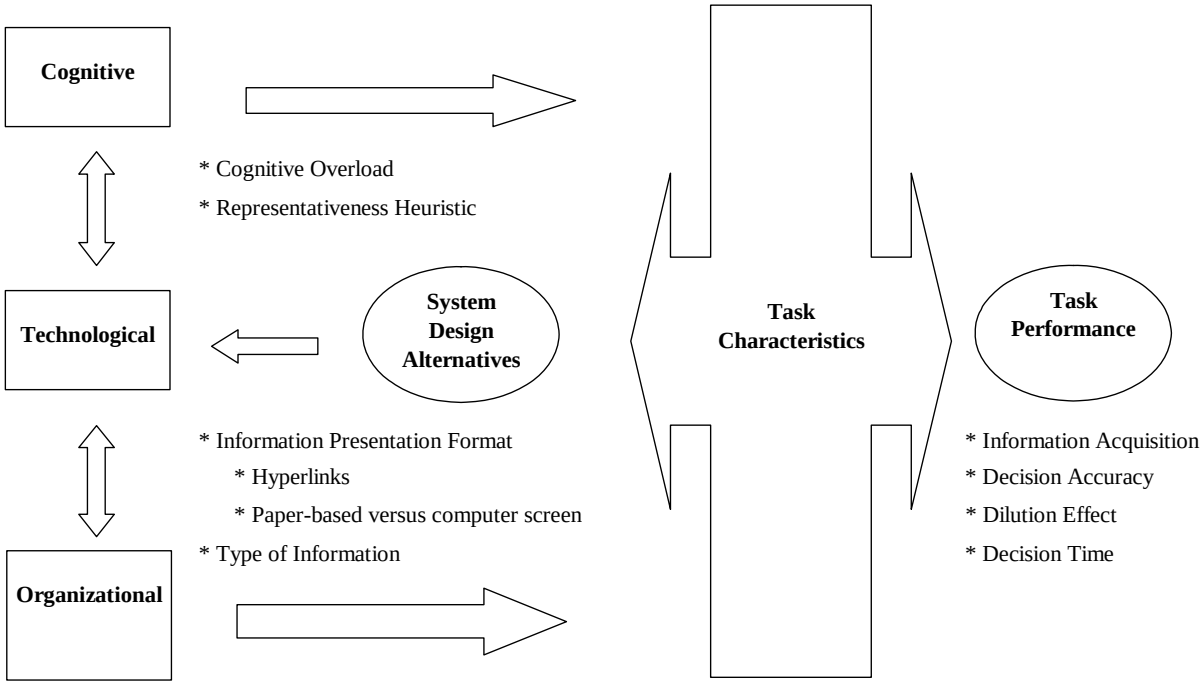
FIGURE 1
RESEARCH MODEL



EXHIBT 1
EXAMPLE OF HYPERLINK/IRRELEVANT CONDITION

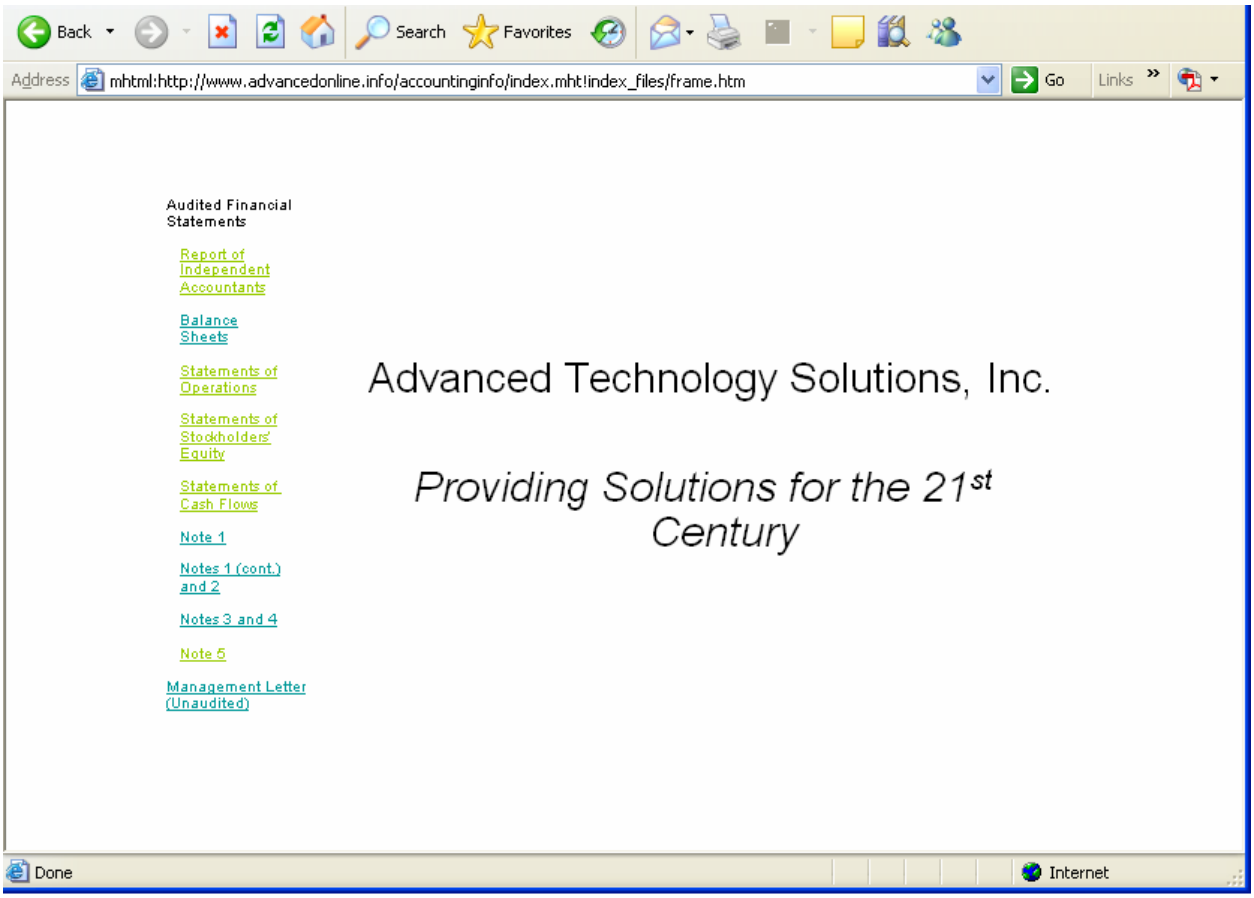


EXHIBIT 2
EXAMPLE OF ELECTRONIC/IRRELEVANT CONDITION