Testing Human factor tailored information reports for individuals with different cognitive characteristics

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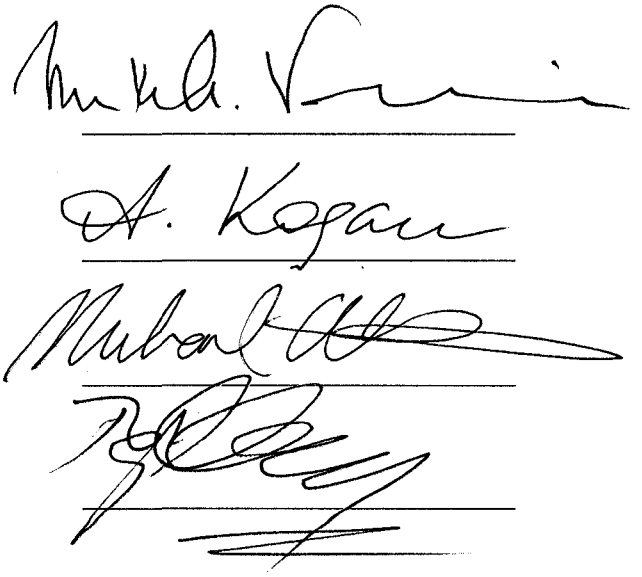

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Abstract of the thesis

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This dissertation reports the results of testing two information presentation structures to produce tailored reports, with MBA students as surrogates for individual investors. The first study results show that individual investors with heuristic characteristics make better investment decisions when they are presented with a summary of numbers and additional information in text, as opposed to presentation formats that provide only numbers. No difference in decision was found for analytic investors, but they felt more satisfied when they received disaggregated numeric information. The result indicates that it is not only numbers what individual investors are looking for, and that the effort that on-line providers put in developing structures to facilitate analysis of quantitative data, should be extended to facilitate access to text disclosures.

The second study compares differences in assessment of companies by analytic and heuristic investors presented with cognitive style tailored information. The information provided was in text format, with one structure organized as a taxonomic representation and the other as a schematic representation. Results show that both analytic and heuristics investors perceived the company more positively when the

information was presented in a matching format, and they felt more confident as well. They were also able to identify the negative perspectives of the company, which were related to difficulties with the collection, getting a better general understanding of the whole situation when the format matched their cognitive style. Decision to invest, on the other hand, was affected by the presentation format, with investors in the schematic representation more willing to invest, but not by the interaction between format and cognitive style. Other effects relating the findings and the current reporting environment are discussed. These results have implications for regulators and companies willing to increase accessibility to their financial information.

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Chapter I - Introduction

The purpose of this dissertation is to test whether reports behaviorally tailored for investors with different cognitive characteristics can enhance their knowledge of a company's financial condition and lead to a more efficient decision-making process.

After an era of paper-based, costly processing and reporting financial information, and partly as a consequence of accounting scandals like Enron, which reduced the credibility in financial statements, different initiatives have been directed to develop a new reporting model. The need for this change has been mentioned by David M. Walker, comptroller General of the United States U.S. General Accounting Office, "Greater transparency in business reporting is needed to help strengthen our economy and protect investors."[1] The AICPA lead the Enhanced Business Reporting Consortium (EBRC), a non-for-profit organization of stakeholders in the business reporting supply chain, trying to "improve the quality and transparency of information companies provide so investors and other key stakeholders can make better informed decisions."[2] The purpose of the EBRC is to shift from a model based primarily on historical information to one which includes performance measures and qualitative information. Although this initiative does not propose the development of tailored reports, it highlights the importance of providing meaningful information, and rather than constraining the information disclosures to specific predetermined reports, it proposes

[1] http://thecaq.aicpa.org/Resources/Enhanced+Business+Reporting/
[2] http://thecaq.aicpa.org/Resources/Enhanced+Business+Reporting/

innovative reporting useful to decision-makers, and tailored reports might help in this process.

The Special Committee on the Enhanced Business Reporting (SCEBR) presents different sample reports that have been developed[3] by different participants in the Consortium. While most of them enhance the existing model, the Galileo initiative (Vasarhelyi and Alles, 2006) presents a reporting model aligned with Sorter's (1969) events model which is novel in a sense that it is not related to the financial reports companies produce today. Sorter asks for reports that "maximize the reconstructability of the events being aggregated" so that "various users may generate information about particular events they are interested in." In alignment with Sorter's events model, the Galileo initiative proposes that "some of the information should be disaggregated to the extent that it allow users to view the granular data or aggregate the data based on a number of given standards, assumptions and estimates." When Sorter's model was presented in 1969, it was not possible to give access to raw data to individual users, which is now facilitated by advances in technology like fast and cheap computers to access databases and the development of portals to access data or reports. Therefore, a limitation for implementation is not the technology, but the manager's desire to disclose. In order to improve the representation of the company's activity, the Galileo initiative proposes a multi-layered report with different levels of aggregation, including "a simplified representation of articulated data" and extractions of footnote data. If the alternatives of reporting presented by Alles and Vasarhelyi (2006) fit the information

[3] http://www.ebr360.org/ContentPage.aspx?ContentPageId=84

preferences of users with different cognitive style, it could be an incentive for managers to differentiate and produce at least some level of tailored reports. These results are important for regulators as well.

The remaining of this chapter presents the motivation for this research. The following chapter presents the theoretical framework and relates it to the existing literature. The research methodology and experimental design are then developed. Finally, the experiment specifics and the results are discussed as well as limitations and conclusions.

Motivation

There are different external users of financial information. Investors are the largest number, and among them, individual investors are a growing proportion. A survey conducted in 2000 by the NYSE (Thompson2002) reports that 43.6% of the country's adults are stockholders, half with family income under 57,000. This survey is not conducted any more, but in 2007 the NYSE estimated the number of individual investors in 90 million (Pellecchia 2007). Investors in general have to analyze a large amount of information when evaluating investment alternatives, and given the limited cognitive capabilities humans have to receive and process information (Miller 1956), they are affected in their decision-making by the amount of information available. However, since analysts know what they are looking for (Bouwman, Frishkoff et al. 1987), the amount of information affects more the decision-making of individual investors. When humans receive more information than that they can efficiently process, or when the

time available for the analysis is less than the amount of time they need, overload occurs (Sheridan and Ferrell 1974; Losee 1989; Wilson 1995). To cope with the amount of information available, previous research found that decision makers need to be selective in the information they choose to analyze (Bouwman, Frishkoff et al. 1987). It is expected that changes in the structure in which the information is presented to users (e.g. level of aggregation, presentation format and type of data) will change their level of uncertainty about the real state of the world (in an investment task, which is the best choice between companies) (Vasarhelyi 1977; Otley and Dias 1982; Vasarhelyi, 1996). If some structure leads to less uncertainty, it is expected that the decision time will be reduced, a better choice will be made, and the individual will be more confident with the decision.

Different behavioral and cognitive characteristics can be considered to determine the attributes of a tailored report. Cognitive style refers to the way in which people process and organize information and arrive at judgments or conclusions based on their observations of the situation (Steers 1988). It is the most studied individual characteristic, and as discussed in the following chapter, the one proposed by scholars in computer user interfaces and cognition to overcome the difficulties found by users of on-line information. This dissertation will refer to cognitive style as the individual characteristic (analytics and heuristics) based on the theory discussed in the following chapter, and its relationship with existing literature.

In this dissertation I propose and test two structures developed to match the cognitive style of users of financial information. They are discussed and reported in

Chapters IV and V. The first of these structures provides information as a summary of numbers and additional text, vs. disaggregated information in numeric format. The second structure is based on presentation formats of text with one structure organized as a taxonomic structure and the other as a schematic structure. The motivation for testing this structure is based on the development of initiatives that promote the increase of text disclosures. In July 2007, the CFA Institute released a Comprehensive Business Reporting Model which "proposes 12 principles to ensure that financial statements disclosures are relevant, understandable, accurate and complete." In its Chapter 4, it extends the concept of a disclosure, by including "all of the captions and display choices in a company's annual report to shareowners or regulatory reporting documents and the letter to shareowners, weather audited or not" and they express that "transparency, consistency and completeness, along with an intention to communicate clearly, must form the basis for disclosure elements wherever they are found." This increase in information, if not properly structured, might produce information overload that other than help, might reduce the quality of the decision (Jacoby, Speller et al. 1974; Malhotra, 1982; Jain et al., 1982). There is evidence in literature that text disclosures are not always considered by decision makers (Casey, 1980; Biggs, 1984; McEwen and Hunton, 1999; Elliot, Hodge et al., 2006), with some of them relating the omission of text disclosures to information overload (Casey, 1980). There is also evidence that users access more text disclosures when facilitating tools are available (Hodge, Kennedy et al., 2004); therefore, if information is presented in a

structure that matches the users' characteristics, it is expected that they will benefit by the facilitating access to all the information.

Finally, is it important and feasible to produce human tailored reports? Since human characteristics were found to be determinant of decision processes comprising information acquisition, analysis and evaluation, if those characteristics are considered when building reporting systems, the decision-making process can be simplified. Given that surveys indicate that online providers such as Yahoo are the most popular source of financial information, followed by corporate web sites (Thompson, 2002), and the development of XBRL, which facilitates the production of different reports at substantially reduced cost, there are great incentives for managers to provide information in a format that facilitates access to information. Rowbottom, Allam and Lymer (2005) suggest that online corporate reporting can be provided in a form that is tailored to meet the information needs of the users. This suggestion is also supported by Chen et al. (2000) "Information systems should and can be designed to accommodate individual differences."

Conclusions

Given that different users with different search strategies, knowledge and cognitive characteristics benefit from data presented in different formats (Benbasat and Dexter, 1985; Larkin and Simon, 1987; Amer, 1991; Ford, Wood et al., 1994; Korthauer and Koubeck, 1994; Chen, Czerwinski et al., 2000; Dunn and Grabski, 2000; Maines and McDaniel, 2000; Kim and Allen, 2002; Peters, Vastjall et al., 2006; Peters, Dieckmann et

al., 2007) as well as from data presented with different levels of aggregation (Ledered and Smith, 1988-1989), and that it is currently possible to use chunks of XBRL tagged documents and present them in a web based format, it is time to study how to produce tailored reports that lead to the best possible decision-making process.

The results of this study have implications for disclosure requirements, not only for regulators, but also for online financial reporting providers.

Chapter II – Conceptual Foundations

This Chapter is directed towards providing a theoretical base for the examination of behavioral factors in human information retrieval and decision-making in an investment setting. It will examine literature to understand the problems users face when dealing with large amounts of data as well. This literature review will support the need of producing information in formants that benefit access and understanding of information. It will also identify the characteristics of the tailored reports. Due to the variety of literature to be considered, this chapter is divided into sections.

In this study, both cognitive characteristics (decision style, information processing and information utilization) and communicational characteristics (perceptions and attitudes) are included, but the main emphasis is on the cognitive characteristics area. Although the test of the reports will be in an on-line setting, and the production of these reports are more likely to be related to computerized reports, other individual characteristics like frustrations, computer fear, and computer attitude (Coovert and Goldstein, 1980; Gilroy and Desay, 1986; Howard, 1986; Howard and Smith, 1986; Rosen and Weil, 1990) are not considered. Experience with computers was found to be inversely correlated with computer anxiety (Ray and Minch, 1990; Rosen and Macguire, 1990).

1. *User characteristics and decision processes*

As discussed in the previous chapter, the analysis of financial statements involves a large amount of data, and individuals have limited cognitive capacity to retrieve and analyze it. According to Mock's model of information, decision and payoff presented in Figure **1** (Mock, 1971), humans look for messages leading to help them understand the state of the world, and take the action that maximize their payoff. If the behavior in the decision process is known, by providing the information in such a way that facilitates knowledge acquisition, the pay off might be increased and the decision making process improved).

Another factor that affects knowledge acquisition is the presence of pieces of information that act as distractors. Dual-process theories are ubiquitous in psychology (Barret, Tugade et al., 2004). A central principle of this theory is that behavior is determined by the interplay of automatic and controlled processing (exogenous and endogenous forms of attention). Exogenous forms of attention are stimulus-driven and are determined by characteristics in the environment (e.g. presentation formats of information). Endogenous forms of attention, on the other hand, are activated by passively paying attention to the representations. Both of these exogenous and endogenous forms of attention can be applied to representations to increase or decrease their level of activation. When the level of activation increases, the accessibility increases as well, and behavior is driven (Barret, Tugade et al., 2004). In a review of literature on attention and performance, Pashler et al. (2001) present research indicating that subjects should have enough motivation to prevent attention

from being captured by distractors, because abrupt-onset distractors impair performance. They present a study by Folk et al. (1992) which found that involuntary attention-capture occurs if and only if distractors have a property that subjects are using to find targets. Folk's theory describes how cognitive goals determine attentional control settings in advance, and at any particular time, the appearance of stimuli matching the setting will capture attention. Therefore, a presentation format suitable to the cognitive characteristics of the user facilitates exogenous attention, increasing accessibility to the information, and requires less endogenous attention to drive behavior.

Figure 1 - An information economics model of information, information processing, decision, and payoff (Mock 1971)

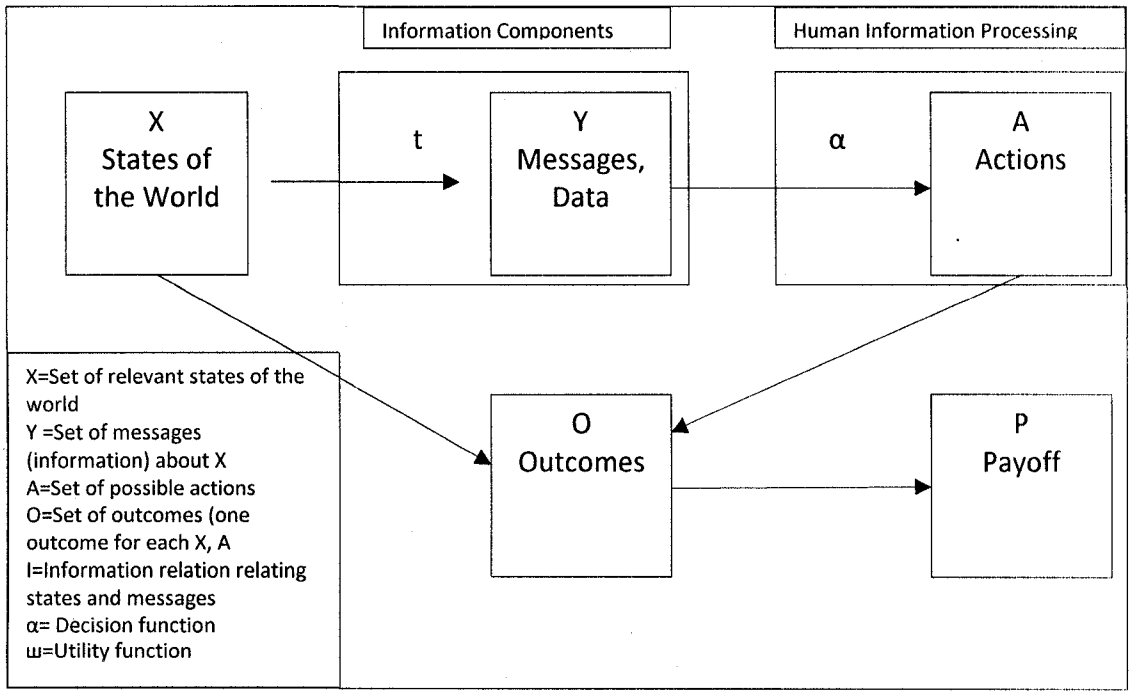

Figure 1- An information economics model of information, information processing, decision, and payoff (Mock 1971)

Different determinants of decision performance have been studied. Libby and Luft (1993) discuss the roles of ability, knowledge, motivation and environment. They say, "characteristics of accounting environments have the capacity to influence judgment performance... by interacting with experience, ability and knowledge," indicating that the benefits of any change in the environment (like facilitating access to information) will be influenced by ability, knowledge and motivation as well. Accounting knowledge was found to be a significant determinant of information retrieval task accuracy by Dunn (1995-1999). Regarding expertise, users with different levels of experience were found to search for different items in financial reports (Bouwman, Frishkoff et al., 1987), and to search for them differently. While novices and non-professionals are sequential in their search (Bouwman, 1982; Hunton and McEwen, 1997), experts are more directive (Bouwman, 1982). Furthermore, a directive search strategy was associated with analysts' earnings forecast accuracy (Hunton and McEwen, 1997). Consequently, these factors have to be included in the evaluation of the environment.

Cognitive Style

The cognitive process involves different variables such as memory, knowledge and experience. There are basic differences in the way people retrieve and process information, and these differences are related to their cognitive style. Cognitive style has been defined as *the way in which people process and organize information and arrive at judgments or conclusions based on their observations of the situation* (Steers 1988). It has been identified as one of the most pertinent factors because it refers to a

user's information-processing habits, representing an individual user's typical mode of perceiving, thinking, remembering, and problem solving (Messick, 1976).

The most studied characteristics of cognitive style have been analytic/heuristic and field dependence/independence. Huysman (1968) described analytic reasoning as follows:

> "This type of reasoning reduces problem situations to a core set of underlying causal relationships. All effort is directed towards detecting these relationships and manipulating the decision variables (behavior) in such a manner that some "optimal" equilibrium is reached with respect to the objectives. A more or less explicit model, often stated in quantitative terms, forms the basis for each decision. Factors not comprised in the model, e.g. because they could not be quantified, are considered only in as far as they may require significantly different course of action than the one suggested by the model solution. Available alternative courses of action are also primarily valued in terms of the significance of their deviation from the model proposed course of action."

He defined heuristic reasoning as follows:

> "A person using this type of reasoning emphasizes workable solutions to total problem situations. The search is for analogies with familiar, solved, problems rather than for a system of underlying causal relationships, which are often illusory. Common sense, intuition and unqualified "feelings" of future developments play an important role to the extent that they consider the totality of the situation as an organic whole rather than built up from clearly identifiable parts. It is extremely difficult, if not impossible, to uncover the mechanisms at work that lead to a decision under heuristic reasoning. If one has to characterize the resulting decision, however, it would be by consistency of the decision with its internal and external environment as opposed to the optimality orientation of the decision of an analytic reasoner."

Huysman points that these two ways of reasoning should be interpreted as ideal types forming the extremes of a cognitive style continuum.

Field dependence/field independence describes the degree to which the surrounding perceptual field influences an individual's perception of information

(Jonassen and Grabowski, 1993)). Field dependant subjects are influenced by the surrounding field, and are easily distracted, while field independent subjects can abstract from the background. Sloman (1996) discusses a distinction between two types of reasoning. One is intuitive, experience based or holistic, while the other is analytic or rule based. Nisbett, Peng et al. (2001) discuss similar characteristics to these groups, and Norenzayan, Smith et al. (2002) found association between field dependence and heuristic reasoning, and between field independence and analytic behavior. Furthermore, these terms have been used interchangeably.

Other related definitions can be found in literature, and they include those of Norenzayan et al. (2002) who defines an analytic mode of thought as

> "characterized by decoupling of the object from its context, assigning the object to categories based on necessary and sufficient features, and a preference for using rules, including the rules of formal logic, to explain and predict the object's behavior"
>
> The holistic mode is "characterized by attention to the context or field as a whole, a concern with relationships among objects and between the field and the object, and a preference for intuitive approaches, as well as dialectical reasoning, which seeks the middle-way between conflicting propositions."

In order to support the adoption of Huysman's definition and the analytics/heuristics dichotomy, as well as to determine what are the characteristics that will define the tailored reports, some other studies are briefly discussed. In the following section studies of cognitive characteristics from different areas are discussed and related to the analytic/heuristic classification. These studies provide similarities between the individual characteristics of the groups and provide the bases for determining what makes a report tailored for analytics and heuristics investors.

Other Cognitive Style Studies

Researchers have proposed and studied different characteristics of cognitive style; however, many of them are common between the groups.

Figure 2 presents an overview of the different classifications with the characteristics that make them similar to the Analytics/Heuristics classification. The remaining of the section presents a discussion on this literature organized by area of study.

Education

The production of reports suited to the cognitive style characteristics in order to increase the payoff as discussed in the previous chapter, is based on the benefits found in education settings with the usage of learning strategies in alliance with those characteristics. Researchers found that the traditional advantage in learning analytic students had over non-analytic, was eliminated by providing other means of education to this second group (Carpenter, McCornack et al., 1978; Abraham, 1985; Ford and Chen, 2001; Jakovljevic, 2003). Different strategies were proposed in the area to match tasks with user capabilities, Messick (1978) mentions:

Challenge match: Uses a mismatch between tasks and user capabilities to force users to change and become more flexible. It requires cognitive abilities to produce the change.

Capitalization match: Proposed by Salomon (1972) who called it "preferential matching." The fundamental of this match is to tailor tasks to match the strength of the

users (e.g. provide tailored interfaces to access the same system, or develop different systems for different users).

Compensatory match: Offsets users' deficiencies by providing mediators, tools or structures the user cannot produce (e.g. providing online assistance to users).

Computer user interfaces

Another prolific research area on cognitive style is the design of computer user interfaces. Chen et al. (2000) present an overview of research related to individual differences in virtual environments. They discuss that technology makes available more channels of communication and new user interfaces that require ability from the user; but although this situation makes individual differences wider, the interfaces are designed with a generic user in mind. They propose to change this compensatory approach and encourage more research to produce interfaces tailored for individuals with different characteristics to facilitate access to information. From the point of view of tasks that require high spatial abilities, they propose to capitalize on abilities of low spatial individuals (heuristics) instead of compensating for their difficulties in constructing mental models.

Other studies in computerized settings support the definitions presented in the previous section. A similar classification of analytics/heuristics is presented by Ford (2000). He studied the distinction between holists and serialists in learning and the implications for interface design. He presents the following definitions: "A holist tends to concentrate on a broad conceptual overview and subsequently fits details into such

an overview. In contrast, a serialist tends to concentrate on local details at early stages. An overall picture tends to be developed relatively late in the learning process." He also finds that holists like field dependents use concept maps or the overview of an underlying structure more often than field independent individuals, which was found in heuristics as well.

When using hypermedia information systems, analytic individuals were found to be more accurate and efficient in their search (Ellis, Ford et al., 1993; Ford, Wood et al., 1994; Korthauer and Koubeck, 1994), , , probably because of the distraction these systems introduce to field dependent (heuristic) individuals. Field dependents were found to explore the hypermedia system in a linear mode, using the back and home buttons, what indicates that they got lost easily.

One of the tailoring differentiation structures to be tested involves providing numeric information to analytics, and a map of highly aggregated numbers in addition to text information to heuristics. This structure is supported by the preferences determined by cognitive style characteristics described in the previous section, and also by studies in psychology and cognition indicating that changes in information format compensate for the lack of skills in handling numeric information. Ellen Peters and her colleagues (Peters, Vastfjall et al., 2006; Peters, Dieckmann et al., 2007) conducted a number of studies among people with more and less skills handling numbers (numeracy skills). They found that the performance for less numerate individuals could be improved by giving them tools that help them read and analyze numeric data. In a health care decision they found that specially for less numerate people, "less is more",

and individuals in this category made better decisions when the presentation format was designed to ease the cognitive burden and highlight the meaning of information (Peters, Dieckmann et al., 2007). Gurmankin, Baron and Armstrong (2004) found that less numerate individuals trusted verbal risk information more than numeric risk information from physicians, while more numerate individuals showed the opposite effect. The inclusion of a summary of numeric data is based on previous research by Rittschof et al. (1994), who found that when subjects read text information after studying a thematic map they recalled more theme related and unrelated text facts and made more correct inferences. They explained their findings within the dual coding framework theory. According to this theory, text and images have different representations in long-term memory. When the learner is able to relate the two representations in some meaningful way, having one code in working memory makes it quicker to activate related information in the other code. Furthermore, according to Rewey et al. (1991) the map construction produces a spatial framework in working memory, which is used to encode the landmarks. Adding to these findings, Allen (1999) found that low spatial individuals performed the best when they used a visual mediator, while high spatial individuals did not need that tool and performed the best without any mediator. This result is associated with heuristics preferring a broad picture and related text, and analytics preferring detailed information.

In managerial accounting settings, analytic and heuristic characteristics were found to determine the type and amount of information used. Vasarhelyi (1977); Benbasat and Dexter (1979) found that high analytic and low analytic subjects asked for different

amounts of data. They also found that when users accessed information that did not match their cognitive style, they used 50% more information than their counterpart in cognitive style characteristics in the same setting. This finding indicates an extra cost for users when they do not have access to a system that meets their characteristics.

Figure 2 – Comparison of Cognitive Characteristics Classifications

	Characteristics	
	Analytics	Heuristics
Huysman (1968)	Reduce problem to relationships Model is constructed Optimality orientation of decision	Emphasize workable solutions Search for analogies Consistency of decision with environment
Vasarhelyi (1977)	Prefer quantitative data	Prefer qualitative data
	Analytics	Holistics
Norenzayan et al (2002)	Decoupling from context Preference for rules Attention to objects	Attention to field as whole--Assign causality Intuitive approaches Dialectical reasoning
Sloman (1996)	Rule based	Associative with temporal structure Experience based
	Field Independent	Field Dependent
Jonassen and Grabowski (1993)	Abstract from background	Influenced by surrounding field Get easily distracted
Norenzayan et al. (2002)	Associated with analytic behavior	Associated with heuristic behavior
Ellis et al. (1993) Ford et al. (1994) Korthauer et al. (1994)	More accurate and efficient in their search	Less accurate and efficient probably because of the distractions the systems introduce Explore hypermedia in a linear mode to avoid getting lost
	High Spatial	Low Spatial
Chen (2000)	Construct mental models	Difficulties in constructing mental models
Alan (1999)	Perform better with no visual mediator	Need a visual mediator
	Serialist	Holists
Ford (2000)	Concentrate on details at early stages Overall picture is developed late Don't use concept maps or the overview of an underlying structure	Concentrate on a broad overview Fits detains into the overview later Use concept maps or the overview of an underlying structure
Ford (1995)	Associated with field independent	Associated with field dependents
	High numeraire	Low numeraire
Peters et al. (2006) Peters et al. (2004)	Trust more numeric data	Trust more text data Performance improve with less numbers and text

Figure 2 - Comparison of cognitive characteristics classifications

Conclusions

Different studies have highlighted the importance of producing tailored reports (Chen and Lynch, 1992; Allen, 1999; Chen, Czerwinski et al., 2000; Kim and Allen, 2002; Rowbotton, Allarm et al., 2005). Some of them specifically suggest that these reports would facilitate its usage by individuals with different cognitive characteristics (Chen, Czerwinski et al., 2000). The development of the world-wide-web and new languages like XBRL, makes it possible to produce those reports at substantially reduced cost.

The literature indicates that individuals with heuristic characteristics prefer to get an overview of the information rather than to go into details (Ford, Wood et al., 1994; Ford, 2000; Peters, Vastfjall et al., 2006; Peters, Dieckmann et al., 2007), which might be due to the loss of attention produced by the presence of additional information with similar characteristics as the one they are looking for (Pashler, Johnston et al., 2001; Feldman Barret, Tugade et al., 2004) They also prefer information in text format (Vasarhelyi, 1996), and since they get easily lost or distracted (Ellis, Ford et al., 1993; Allen, 1999(), the overview could act as a map to help them understand any related information. On the other hand, analytic users prefer highly disaggregated data to build their own models of reality, giving preference to numeric data over text (Vasarhelyi 1996). Also, studies in psychology show that individuals who are not comfortable working with numbers improve their performance when information is presented in text format, or when numerical information is limited to only the most important concepts (Peters, Dieckmann et al., 2007).

These characteristics are important behavioral factors when considering users accessing on-line financial information given the amount of information and its presentation. As access to information and disclosure becomes cheaper, and with the development of continuous reporting tools that improve the quality of the data reducing the risk of litigation, it is expected that in the future more information will be available. It is important to develop tools that rather than confuse users, makes them comfortable and help them in their decision making process. While a structure presenting disaggregated information to build their own model of reality would help analytic users, a summary of numeric information acting as a map of the financial information, plus text disclosures, could help heuristics to relate the information and complete their mental model easily. Therefore, these will be the elements considered in the first structure to be tested and discussed in Chapter V.

2. The problem of information overload

When evaluating structures to facilitate access to financial statements, the problem of information overload has to be considered due to the amount of information available. Experimental studies from marketing and psychology suggest that reasoning decreases when large amounts of information are provided. In a study that tested if more product information was better for consumers facing a purchase decision, Jacoby et al. (1974) found that, while consumers do feel more satisfied and less confused with more information, they actually make poorer purchase decisions. Malhotra (1982); and Malhotra et al. (1982) found, in different marketing experiments, that consumers face

information overload when they have to evaluate over 10 attributes; furthermore, psychological studies suggest that there is a limit after which the observer will begin to make more and more errors as the amount of information is increased (Garner, 1953; Pollack, 1953). These findings are relevant because investors and analysts usually ask for more disaggregated information but the final decision might not be enhanced with this addition.

Different definitions of information overload have been given in psychology and information science (Sheridan and Ferrell, 1974; Losee, 1989; Wilson, 1995). All of them refer both to the amount of information retrieved and the time available for processing and understanding it. Some scholars relate information overload to human behavior and they perceive it as a limitation of human capacity for storing and handling information (Sheridan and Ferrell, 1974; Losee, 1989; Wilson, 1995). Others associate it with limitations in technological developments (Maes, 1994). In the first group, Losee (1989) defines information overload as "The receipt of more information than is needed or desired to function effectively and further the goals of an individual or organization." This definition considers only the amount of information, while Sheridan and Ferrell (1974) include speed of delivery as a factor of overload, and define it as information received at such a rapid rate that it cannot be assimilated. Wilson (1995) incorporates an economic perspective of information utilization. His analysis is based on the fact that although it is expected that rational behavior make people use all available relevant information, there are some pieces of information that are not used in the decision process. He distinguishes between information omitted because of information

overload, and information omitted consciously, and argues that information omitted due to overload occurs because the mere presence of more information than an individual could possibly assimilate, absorb and synthesize, engenders feelings in individuals that the task of finding the information is an onerous one. The danger then is that the information discarded is the most useful while only the irrelevant is considered, and that the difficulties to sort out the appropriate information lead to anxiety, stress, alienation, and potentially dangerous errors of judgment (Heylighen, 2002). Wilson mentions the additional problem of not using information because of the failure to find it. In a financial statement analysis setting the selection process leads to text disclosures frequently disregarded (Casey, 1980; Biggs, 1984; McEwen and Hunton, 1999). While quantitative information is frequently aggregated to facilitate analysis, almost no effort has been made to aggregate or structure qualitative information to facilitate its analysis, therefore, structures that facilitate overcome overload and involve text disclosures have to be developed. The second structure tested and discussed in Chapter VI will address presentation formats of text suitable to analytics and heuristics. The importance of finding suitable presentation formats is due to the fact that information format was added to information quantity and quality as a cause of overload by Ho and Tang (2001).

In the psychology literature, Miller (1956) concludes his empirical study saying that "the span of absolute judgment and the span of immediate memory impose severe limitations on the amount of information that we are able to receive, process, and remember." Also, that "By organizing the stimulus input simultaneously into several

dimensions and successively into a sequence or chunks, we manage to break (or at least stretch) this informational bottleneck."

Other scholars believe that information overload is caused by the limitations of computer hardware and software, and that it may be solved as specific technology such as intelligent agents advances. They suggest that automatic techniques are needed to transform overloaded and unprocessed information into useful information (Maes, 1994)

Besides the information systems and psychology areas, the problem of information overload has been addressed by management and accounting researchers. Chervany and Dickson (1974) in a simulated decision management setting, found that given data summarized through descriptive statistics, decision makers made higher quality decisions than those receiving the same information in standard format, but they had less confidence in the quality of their decision and took longer to make the decision. Benbasat and Dexter (1979) found that traditional accounting systems should produce as good results as the events approach (from the point of view of managers facing an inventory decision). They found that traditional accounting reports generated faster decisions with the same quality of results. Since the first study found that users with summarized data took longer to make the decision; and the second that traditional accounting systems, which represent summarized data, took less time, the contradictory results may probably be due to the nature of the task.

3. Schematic and taxonomic representations

The literature review in this section has the purpose to look for a relationship between schematic and taxonomic representations to cognitive style, as a mean to develop tailored structures that help understand and include text information in the decision process. The section assigned to hypotheses development in Chapter VI presents the arguments for believing that schematic representations would be more suitable for heuristics and taxonomic representations would be more suitable for analytics. The remaining of this section presents the definitions and characteristic of these representations.

Frederick (1991) describes how knowledge is organized in memory comparing a taxonomic organization and a schematic organization. A taxonomic organization is a hierarchical structure based on classification of features. The bookkeeping process simplifies business events by aggregating data into accounts; this aggregation is based only on class membership, which constitutes a taxonomic structure.

A schematic representation of knowledge is a hierarchy where components are linked by relationships among class members. McCarthy (1979-1982) built an accounting model based on the notion of entity and relationships (REA). The emphasis is on the semantic expressiveness of the data model (degree to which elements of the reality match elements of the model), and it does not include elements of double-entry bookkeeping like debits and credits. Dunn and Grabski (2000) proved empirically that REA models are more semantically expressive than traditional DCA (Debit-Credit-

Account) models. In a structure following business processes, for example sales from ordering to payment, class members are linked by the different events involved in the process, which conforms a schematic representation. Frederick (1991) found that auditors freely recalled more controls when such controls were organized by transaction. Figure 3 illustrates a schematic representation, while Figure 4 illustrates a taxonomic representation.

Figure 3 – Schematic representation

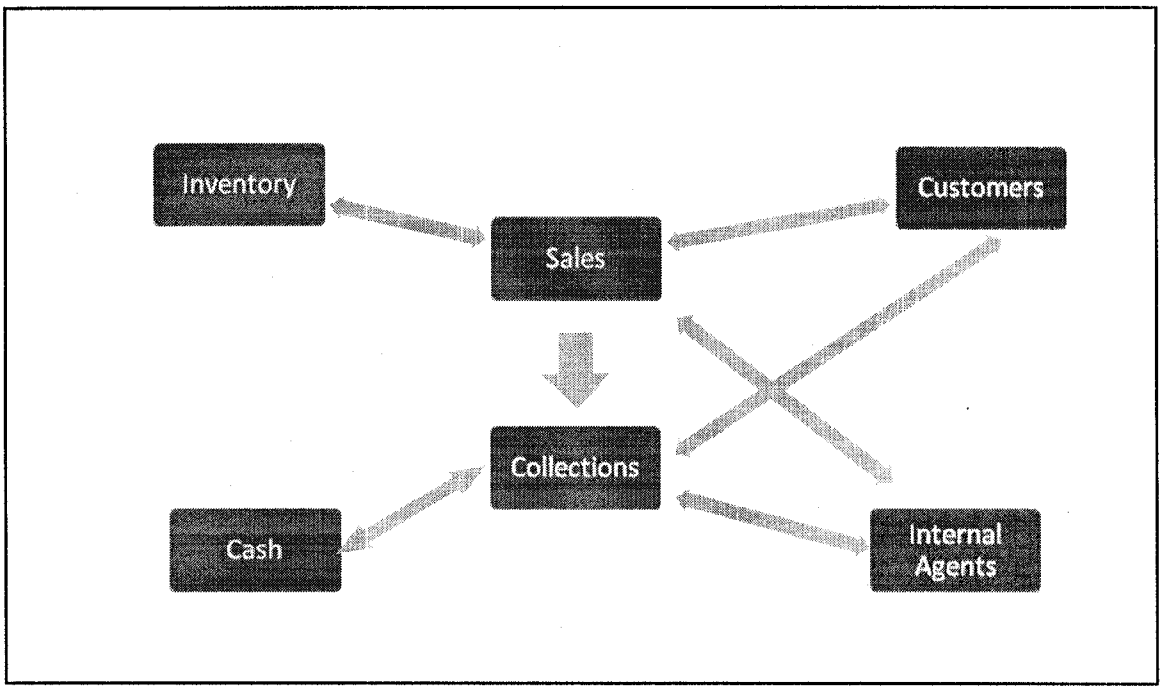

Figure 3 A schematic representation of knowledge is linked by temporal and/or spatial relationships (Frederick1991)

Figure 4 – Taxonomic representation

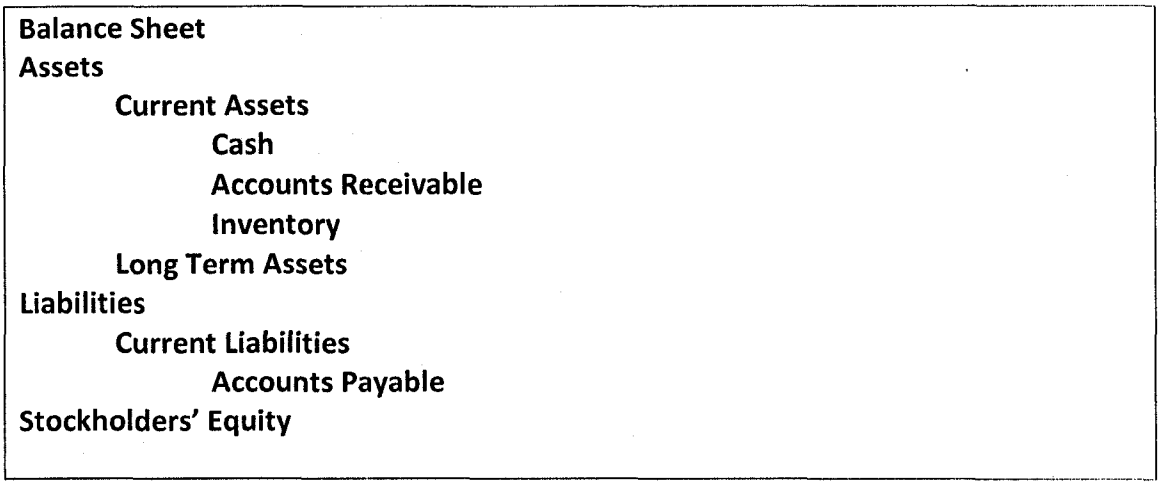

Figure 4 A taxonomic organization is a hierarchical structure based on classification of features (Federick 1991)

According to Shank's theory (1990), when the information is organized around related events people process information more effectively because this organization helps them build a story. Therefore, by organizing the story, they are more able to process the information and derive their conclusions from it.

Kopp and O'Donnell (2005) posit that memory works by storing information in a memory index. When new information arrives, the mind consults an index, which provides a link to memory structures that store the knowledge needed to understand the information. They found that the schematic organization may be a more effective framework for organizing internal control evaluation tasks. Metcalfe Eich (1982) presents a model of how people associate pairs of items, store the associations in memory and use that cue to evoke recall. She explains that people do not take ideas and passively store them in memory. On the contrary, they seem to be altering and mentally transforming what was given. When the items are similar to one another, the retrieved

items are systematically transformed from their encoded form, which means that when they are familiar with the information, they associate directly the information to retrieve to the information stored in memory.

Finally, Larkin and Simon (1987) discuss the advantages of localization, grouping together information that is used together in decision-making. They found that presentation formats that group cues together require less cognitive effort than presentation formats that require search or computation of elements.

The literature discussed in this section can be summarized under two important concepts. First, it indicates that a structure that relates a story is easier to understand and generates more knowledge. Therefore, it is expected that a presentation format of text disclosures organized as a story will be more beneficial than text disclosures presented in any other format.

The second concept refers to the importance of providing information in a structure that can be related to stored knowledge, so that the association between new knowledge and the information stored in memory is direct. Since investors are used to looking at charts of information in a taxonomic structure, their organization of information in memory might be related to that taxonomy, and they might find more beneficial a taxonomic representation of text disclosures than any other representation.

In this dissertation, these two structures, taxonomic and schematic representations, will be tested and related to the cognitive style of investors. The following chapter presents the Hypotheses development, while Chapter IV and V present the studies

performed to test the hypotheses. Chapter VI presents conclusions and directions for future research.

Chapter III – Hypotheses Development

Previous chapters have introduced the main objectives of this research. The main conceptual factors and literature related to the subject matter have also been discussed. Hypotheses are concerned with the relationship between cognitive style and performance in a decision-making situation. The concepts of cognitive style and analytic and heuristic reasoning were discussed in detail in Chapter II. Based on the cognitive style characteristics, and the amount of information that has to be considered in an investment decision, whose implications were discussed, I propose two structures and perform two studies to understand how presentation formats affect users with different cognitive characteristics. These structures are developed based on Messick's (1978) discussion leading to overcome the limitations in learning of users due to their cognitive characteristics. Specifically, I propose a structure based on the capitalization match (tailored so that the strengths of the subjects facilitate the task) because it does not require ability to learn or adapt; therefore, any investor can access an on-line provider website and intuitively analyze the information they need for decision making. Participants are randomly assigned to the presentation format, while the assignment to the cognitive style type is determined after performing and Analytic/Heuristic test that will be described in Chapter IV (Figure 5).

Figure 5 - Proposed structures and their relationship with cognitive style

	Structure 1	Structure 2
Heuristics	Not Matching	Matching
Analytics	Matching	Not Matching

Figure 5 Proposed structures and their relationship with cognitive style

Based on the descriptions provided by Huysman (1968) for analytics and heuristics, the general hypothesis using the Analytics/Heuristics dichotomy is stated in alternative form as follows:

Hypothesis: In a setting of analyzing financial statements data, individual investors in the high and low spectrum of the cognitive style characteristics continuum (analytics and heuristics) assigned to a structure that match their cognitive style characteristics will outperform analytics and heuristics assigned to a structure that does not match their cognitive style characteristics.

The variables defining performance will be different in each study because they depend on the task and the design of the each experiment, and will be described within the context of those studies.

Specific Hypotheses related to the first study

According to the discussion in Chapter II, which is summarized in Figure 2, analytics have been characterized in literature as individuals who prefer to build their own models in quantitative terms (Huysman, 1968; Sloman, 1996; Norenzayan, Smith et al., 2002). Therefore, a structure that provides disaggregated quantitative data is appropriate for

them because it provides the tools to build the model that supports their decision. Heuristics, on the other hand, have been characterized as individuals who seek for workable solutions to total problem situations (Huysman, 1968), and who prefer qualitative data (Vasarhelyi, 1977). Their characteristics were found associated to those of field dependent, who pay attention at a field as a whole and get easily distracted (Nisbett, Peng et al., 2001). Field dependents have been found to share characteristics of holists as well (Ford, 2000). Given this interdependence, and that holists were found to benefit with a concept map or the overview of an underlying structure, providing heuristics with a summary of numeric information and a complement of text (the format they prefer) to extend the information they have, could help them extend the big picture and obtain the information they need for decision making.

Given this analysis, in the first study I ask the general question if individual investors are interested in information provided in text format, and test if information presented as a summary of numbers with text, benefits investors with heuristic cognitive characteristics, while information presented only as disaggregated numbers benefits investors with analytic cognitive style. The first question tries to relate the lack of effort in facilitating access to text disclosures, to the belief that users of financial information prefer it to be quantitative. If there are users interested in reading text, the need to produce structures to facilitate access to text will become apparent. The second question intends to observe if individual investors with specific cognitive characteristics make different decisions when presented with information in numeric or text format. If they do, it will indicate the need to produce reports in different formats.

In this study, participants are presented with an investment choice decision, and are assigned randomly to one of the two described structures (see Figure 5) (a) a report that matches analytics cognitive style, and (b) a report that matches heuristics cognitive style, After evaluating Analytic/Heuristic questionnaire they were classified into those groups as well. It is expected that both analytics and heuristics will make the right decision (pick the company that is better) when the information is provided in a format that matches their cognitive style. Therefore, the interaction between cognitive style and the received structure is expected to determine the difference in company selection.

H1: In an investment choice decision, individual investors in the high and low spectrum of the cognitive style characteristics continuum (analytics and heuristics) will make a better choice when the information is presented in a format that matches their cognitive style than when the information is presented in a format that does not match their cognitive style.

It is also expected that investors will be more confident when they make the decision based on information provided in a format that matches their cognitive style.

H2: In an investment choice decision, individual investors in the high and low spectrum of the cognitive style characteristics continuum (analytics and heuristics) will be more confident with their decision when they receive information in a format that matches their cognitive style than when they receive information in a format that does not match their cognitive style.

Specific hypotheses related to the second study

The second study is designed to test if organizing text disclosures around a schematic and a taxonomic representation, knowledge is facilitated and decision-making enhanced for analytic and heuristic individuals.

The literature discussed in Chapter 2 refers to Shank's theory (1990) stating that when the information is organized around related events people process information more effectively because this organization helps them build a story. Therefore, by organizing the story, they are more able to process the information and derive their conclusions from it. Supporting this theory, Bartlett and Chandler (1995) found that shareholders are more likely to focus on the narrative-based account of the company's financial performance. According to this theory, it is expected, therefore, that investors receiving a summary of text disclosures as a narrative (schematic representation), will get better knowledge than investors receiving the summary in a taxonomic structure.

Although researchers found that the president's letter is the text information most widely read (Lee and Tweedie, 1975; Courtis, 1982), many studies found that both the president's letter and the MD&As are not easy to read or require that readers have college level skills (Schroeder and Gibson, 1990). Jones and Shoemaker (1994) review 68 studies which analyze narratives found in annual reports (letters to shareholders, footnotes, or management discussion and analysis, court cases, statements of auditing standards, tax regulations and text books). Half of these studies consider readability, and its purpose is to assess the textual complexity of the messages. Given the difficulties

in readability found in the studies, and given that investors are used to looking at financial statements in a taxonomic structure, rather than presenting the information as a story, a summary of text disclosures expressed as a list of items usually found in a chart of accounts, might facilitate its interpretation.

Hypothesis one, therefore, has no direction and is expressed in null form:

H1a: Investors will assess a company similarly when a summary of text disclosures is presented as a schematic representation or as a taxonomic representation

H1b: Investors will acquire similar knowledge when a summary of text disclosures is presented as a schematic representation or as a taxonomic representation.

H1c: Investors will have the same confidence in their assessments when a summary of text disclosures is presented as a schematic representation or as a taxonomic representation

H1d: Investors will spend the same time looking at text disclosures when a summary is presented as a schematic representation or as a taxonomic representation

Cognitive Style

Given the definitions presented in Chapter II, individuals with analytic reasoning build a model of reality in quantitative terms, and include the factors that cannot be quantified only if those factors may change significantly the course of action (Huysman, 1968). These individuals might have their memory structures organized in terms of the components of their model. If text disclosures are organized around the same

categories, their cognition process might be enhanced because they are able to associate the text information with a familiar taxonomic structure, facilitating the relation of quantitative terms to qualitative data. Therefore, if they are presented with a hierarchical structure of text disclosures based on the taxonomy used in financial statements, they might find it easier to include those factors in the model. On the other hand, if they are presented with a narrative based on processes, they might find it more difficult to relate that information to their model based on financial statements taxonomies.

On the other hand, individuals with heuristic reasoning base their analysis in causal relationships and consider the situation as a whole (Huysman, 1968). They might have their memory structures organized around a schema, and by receiving information in a story line description, their cognitive process might be facilitated. With the taxonomic representation, on the other hand, they need to relate and compute elements in memory, which requires more cognitive effort.

Given the characteristics of the described structures and the characteristics that determine analytic and heuristic cognitive style, I expect that investors will acquire and assess financial information differently when it is presented in a format that matches their cognitive characteristics, because they will get different knowledge and they will relate it differently to their previous knowledge.

H2a: Analytic and heuristic investors will acquire more knowledge when a summary of text disclosures is presented in a format that matches their cognitive characteristics (schematic representation for heuristics and taxonomic representation

for analytics) than when it is presented in a format that does not match their cognitive characteristics

H2b: Analytic and heuristic investors will assess the financial information in text format differently when it is presented in a format that matches their cognitive characteristics than when it is presented in a format that does not match their cognitive characteristics

When individuals receive information they process and store it in a structure that facilitates their cognition (Kopp and O'Donnell, 2005), therefore, if that information is presented in a format that facilitates this process, no difference in knowledge acquired between analytics and heuristics is expected, when they are presented with information in their matching condition.

H3a: There will be no difference in the knowledge acquired by analytic and heuristic investors when a summary of text disclosures is presented in a format that matches their cognitive characteristics

H3b: There will be no difference in the assessment of financial information in text format between analytic and heuristic investors when such information is presented in a format that matches their cognitive characteristics

Since investors will find it easier to understand the information when it is presented in a structure that matches their cognitive characteristics, by facilitating the association between new and previous knowledge, it is expected that they will feel more confident when the information is presented in a matching format.

H4: Analytic and heuristic investors will feel more confident with their assessments when text disclosures are presented in a format that matches their cognitive characteristics, as opposed to a format that does not match their cognitive characteristics.

H5: There will be no difference between analytics and heuristics' confidence in their assessments when text disclosures are presented in a format that matches their cognitive characteristics.

Conclusions

This chapter presented the general hypothesis to be tested in this dissertation, and the specific hypotheses related to the structures developed. The hypotheses related to the first structure compare an investment choice decision when analytics and heuristics are presented with a format that match their cognitive style as opposed to a format that does not match their cognitive style. It is hypothesized that when they are presented with a format that match their cognitive style, they will make a better choice and will be more confident with the decision.

There are two sets of hypotheses related to the second structure. The first one tests the differences between a taxonomic and a schematic representation without consideration of cognitive style. Shank's theory (1990) states that when the information is organized around related events people process information more effectively because this organization helps them build a story. Therefore, by organizing the story, they are more able to process the information and derive their conclusions from it. Bartlett and

Chandler (1995) found that shareholders are more likely to focus on the narrative-based account of the company's financial performance, which supports Shank's theory. However, although researchers found that the president's letter is the text information most widely read (Lee and Tweedie, 1975; Curtis, 1982), many studies found that both the president's letter and the MD&As are not easy to read or require that readers have college level skills (Schroeder and Gibson, 1990). To facilitate access to information, since investors are used to looking at financial statements in a taxonomic structure, information could be presented as a summary of text disclosures expressed as a list of items they could find in a chart of accounts. Therefore, the purpose of this set of hypotheses is to test if there is an advantage in presenting a summary of text disclosures in a schematic or in a taxonomic structure.

The second set of hypotheses relates the presentation format of text disclosures to cognitive style. Given that individuals with analytic reasoning build a model of reality in quantitative terms, and include the factors that cannot be quantified only if those factors may change significantly the course of action (Huysman, 1968), they might have their memory structures organized in terms of the components of their model. If text disclosures are organized around the same categories, their cognition process might be enhanced because they are able to associate the text information with a familiar taxonomic structure, facilitating the relation of quantitative terms to qualitative data. Therefore, if they are presented with a hierarchical structure of text disclosures based on the taxonomy used in financial statements, they might find it easier to include those factors in the model. On the other hand, if they are presented with a narrative based on

processes, they might find it more difficult to relate that information to their model based on financial statements taxonomies. On the other hand, individuals with heuristic reasoning base their analysis in causal relationships and consider the situation as a whole (Huysman, 1968). They might have their memory structures organized around a schema, and by receiving information in a story line description, their cognitive process might be facilitated. With the taxonomic representation, on the other hand, they need to relate and compute elements in memory, which requires more cognitive effort. Given these characteristics, the second set of hypotheses test if analytics and heuristics acquire and assess financial information differently, and if they are more confident when the information is presented in a format that matches their cognitive style as opposed to a format that does not match their cognitive style.

Finally, the differences between analytics and heuristics in their matching conditions are tested. This test is looks for differences in performance between analytics and heuristics. It is not expected that there will be any, because by receiving information in a structure that matches their cognitive style, they are expected to gain and assess knowledge similarly. In education settings, it was found that cognitive style matching structures leveled the field for heuristics who did not perform as well as analytics.

Variable definitions will be included in Chapters V and VI, since they are specific for each study. Chapter IV presents the methodology and Chapter VII conclusions.

Chapter IV - Methodology

The subject matter was selected by examination of the literature and by visualizing new challenges due to changes in the reporting model, as discussed in Chapter II. Based on the cognitive style characteristics, and the amount of information that has to be considered in an investment decision, whose implications were discussed, I propose to perform two studies to understand how different information formats affect users with different cognitive characteristics. These structures are developed based on Messick's suggested alternatives leading to overcome the limitations in learning of users due to their cognitive characteristics. Specifically, I propose a structure based on the capitalization match (tailored so that the strengths of the subjects facilitate the task) because it does not require ability to learn or adapt; therefore, any investor can access an on-line provider website and intuitively analyze the information they need for decision making. In the first study, I propose to test if individual investors are interested in information provided in text format, and if this format benefits users with specific cognitive characteristics. The first question intends to relate the lack of effort in facilitating access to text disclosures, to the belief that users of financial information prefer information in numeric format. If there are users interested in reading text, the need to produce structures to facilitate access to text will become apparent. The second question intends to observe if individual investors with specific cognitive characteristics make different decisions when presented with information in numeric or text format. If they do, it will indicate the need to produce reports in different formats.

In terms of qualitative disclosures, it is also important to study and determine the best structures to organize the data to facilitate analysis and knowledge. The second study was designed to test if organizing text disclosures around a schematic or a taxonomic representation, knowledge is facilitated and decision-making enhanced for analytic and heuristic individuals.

Vasarhelyi (1973) classifies the factors related to the methodological process in the following three areas:

a. Circumstantial factors: Those factors over which the researcher has little control, and therefore the research has to be adapted to those circumstances (resource limitations such as computer labs, time available, funds and available subjects).

b. Technical factors: Those factors in which the methodological decision process is influenced by the technical characteristics of the possible alternatives (or techniques) available.

c. Choice factors: Those factors in which there are no clear technological or technical differences between the possible research paths and the researcher's subjective selection.

Chapter I discussed the reasons and focus of this research. Therefore, this chapter will justify the reasons for following the methodology chosen for this study. The potential alternatives are survey studies, field studies, information theoretic studies and laboratory studies, being the last one the chosen. Experiments have been used to

compare performance in different studies. Kerlinger and Lee (2000) mention that the ideal of science is the controlled experiment, and include as advantages of an adequate experimental design the possibility of controlling for extraneous independent variables, generalizability, and internal validity. The following sections will describe methodological aspects of the study.

Model

The model used to test the hypotheses is based on Libby and Luft (1993) (Figure 6). Libby and Luft discuss the roles of ability, knowledge, motivation and environment as determinants of decision performance.

They say, "characteristics of accounting environments have the capacity to influence judgment performance... by interacting with experience, ability and knowledge." Accounting knowledge was found to be a significant determinant of information retrieval task accuracy by Dunn (1995-1999(; hence, in order to control for this, individuals with similar levels of sophistication were invited to participate. The following criteria were established to pre-screen subjects:

1. Had knowledge on financial statement analysis, and

2. Were MBA students.

The first criterion was determined because of the nature of the task. Since individual investors belong to heterogeneous groups, MBA students have usually been a proxy for them. When the behavior of on-line investors is to be analyzed, the fact that these

students are familiar with computers besides having knowledge of finance and accounting makes them more similar to the target group. Different scholars have studied the similarity between students as surrogates (Cunningham, Anderson et al., 1974; Ashton and Kamer, 1980; Elliott, Hodge et al., 2006), the MBA students in this study belong to the population that Elliott et al. (2006) found that acquire and integrate information like non-professional investors.

Figure 6 – Model (Based on Libby and Luft (1993)

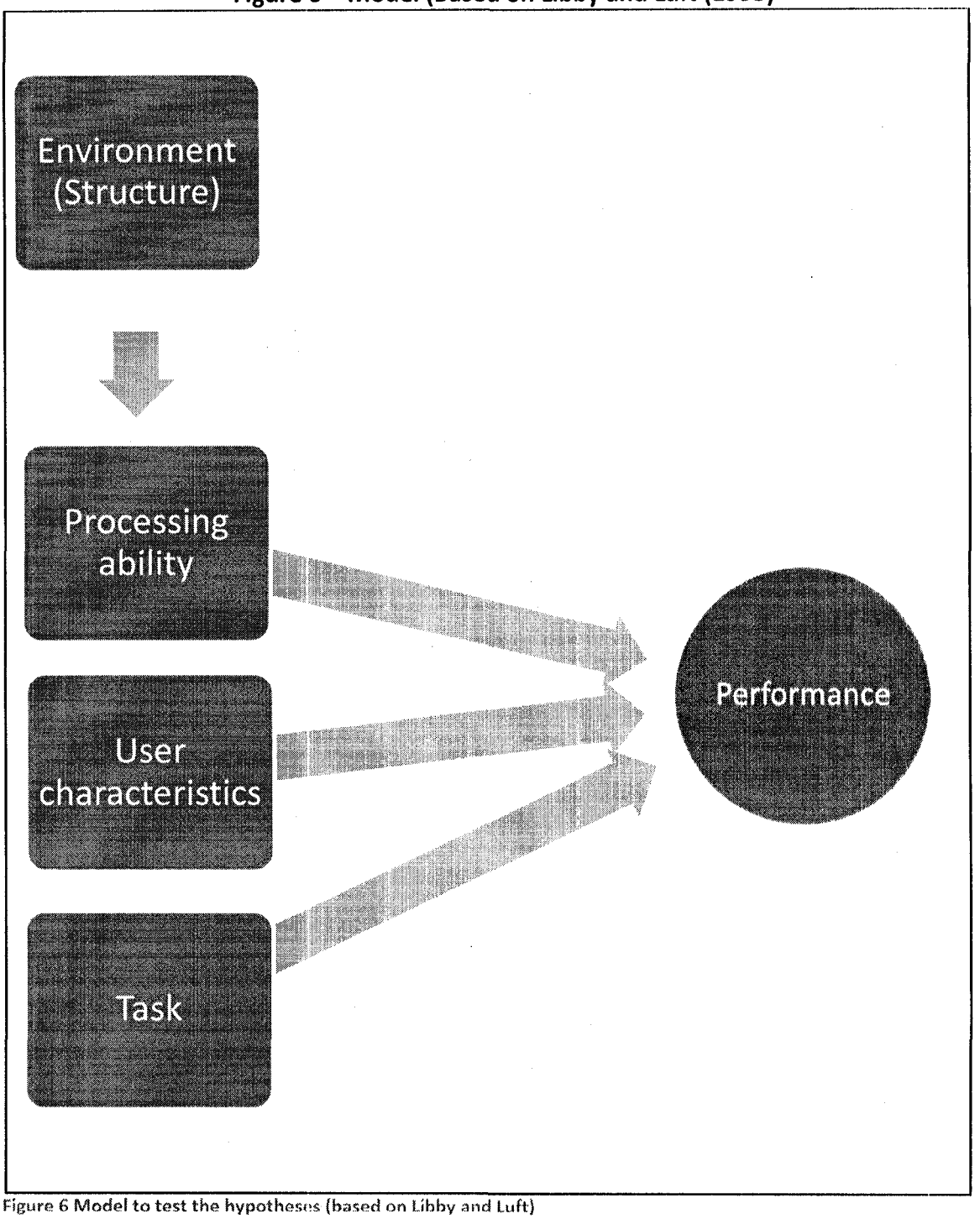

Figure 6 Model to test the hypotheses (based on Libby and Luft)

Methodological Aspects of Cognitive Style

The problem of classifying individuals according to their cognitive style is complex. Previous studies (Huysman, 1968; Vasarhelyi, 1973) used the following instruments: the coin and pitcher tests, the Atlas test, the Meyers-Briggs indicator test, a self assessment form, and a heuristic/analytic questionnaire. The following subsection will discuss the validation of the analytic/heuristic questionnaire that was selected as a measure, while this subsection concentrates on related methodological issues. The selection of the classification device to utilize was not an easy decision. Some of them were discarded due to feasibility factors. The Atlas test requires 40 minutes to 2 hours for complexion, using such a time consuming test could produce fatigue in the participants who had to perform the assigned experimental task after the classification test. The Meyers-Briggs indicator also requires at least fifty minutes for completion and was found to be correlated with the other tests (Huysman, 1968; Vasarhelyi, 1973); therefore, these tests were discarded for this study.

Vasarhelyi (1973) designed a questionnaire based on the assumed characteristics of analytic and heuristic individuals, and tested it twice. Since all the instruments were correlated, he used a self assessment test because it took less time to complete. Since Vasarhelyi's test was created thirty years ago, its vocabulary needed to be updated. Although the content of the questions was not changed, and only the wording, the new questionnaire was tested as described in the following subsection.

Two alternatives were considered for the administration of the test. One involved the pre-screening subjects and only taking extremes on the scale, and the other

involved accepting the full range on the Analytics/Heuristics scale. The first one would limit the study to individuals with strict characteristics of analytic and heuristic behavior and would probably lead to more discriminatory results, but it would require the pre-administration of the Analytics/Heuristics questionnaire, its grading and selection of extreme subjects; therefore, the number of participants would be reduced, and they would have to be available in two different opportunities, which would reduce the availability of subjects as well. On the other hand, it would have the additional disadvantage of limiting the research to a less representative sample; hence, a non-selective design was selected.

Validation of the Analytics-Heuristics questionnaire

An experiment was designed to test the questionnaire using the coin and pitcher tests used by Huysman (1968) which have require 20 minutes and are described in Appendix B. The coin test is a sorting task, using familiar stimuli to test concept formation and basic arithmetical abilities. It asks subjects, given a set of identical to the eye coins and a balance, to determine what is the minimum number of times the coins have to be weighted to find the only one that is heavier. The pitcher test asks to measure a specific number of quarts from a tank with gallons of wine, using two pitchers with known capacity in quarts.

A simpler test proposed by Vasarhely (1973) was evaluated as well. In this test, participants were presented with the characteristics of individuals with analytic and heuristics cognitive style, as described by Huysman, and they were asked to rate

themselves. The range of this self-rating scale is from 1 to 4. It was administered after the questionnaire to avoid effects in the responses produced by individuals knowing what was being measured. The heuristics/analytics questionnaire and the self-evaluation form are described in Appendix A.

The validation test was performed with undergraduate students at Rutgers the State University of New Jersey, who completed the questionnaire and the self-assessment test. A discussion of the results of these tests and the data analysis is presented in Appendix C. However, as the results have methodological significance in the following sections, a summary will be presented here. Pearson correlations between the tests indicate that the Analytic/Heuristic Questionnaire is significantly correlated with the Self Assessment test. It is also correlated with the coin test. Table 1 presents the correlation between four tests that were performed to classify individuals according to their cognitive characteristics. Since there are only 6 subjects in the coin test, a non-parametric Kendall and Spearman's test is performed with similar results. A non-parametric test for the difference of means (Mann-Whitney) of the score of the questionnaire, and the self assessment test, was performed between subjects assigned to the analytics and heuristics categories. The means were significantly different indicating a good discriminating power of the questionnaire (Table 2). Given these results, the Analytic/Heuristic Questionnaire was used to discriminate participants according to their cognitive characteristics.

TABLE 1

Correlation between measures of Analytic/Heuristic Cognitive Style

	A/H Questionnaire	Coin Test	Pitcher Test	Self Assessment	A/H Rating
A/HQuest	1.00				
Coin Test	.832* (.04)	1.0000			
Pitcher Test	.434 (.282)	.917 (.083)	1		
SelfAssessment	-0.516* (0.049)	-.655 (.158)	.504 (.203)	1.00	
A/HRating	-.831* (.00)	-.926** (.008)	-.178 (.674)	.645** (.009)	1.0000

This table presents the correlation between four tests that were performed to classify individuals according to their cognitive characteristics.

Table 1 - Correlation between measures of Analytic/Heuristic cognitive style

TABLE 2

Difference in means A/H questionnaire and A/H self assessment test between classified groups

	A/HQuestionnaire		A/HSelfAssessment	
	Analytics (29)	Heuristics (31)	Analytics (29)	Heuristics (29)
Mean	2.2238	1.6987	0.3793	0.6897
Std. Dev	0.1884	0.1307	0.5614	0.4706
Sig. (2 tailed)	.000		.002	

Table 2 - Difference in means A/H questionnaire and self assessment test between classified groups

Summary and Conclusions

This chapter introduced the general methodology and some issues related to classification of participants according to their cognitive style. Since this dissertation involves two structures tested in different experiments, the design, variables definition and other specific methodological issues, as well as the results and conclusions for each of them, are included in the following two chapters. In both studies, structures developed based on the literature discussed in Chapter II, so that they conform to

Messick's definition of capitalization match and challenge match, were produced and tested. Chapter V presents a study testing reports with aggregated numeric information plus additional information in the form of text, versus reports providing all the information in numeric format. Chapter VI presents a study testing a schematic representation versus a taxonomic representation of text.

Chapter V – Investor's Cognitive Characteristics and the Preference for Text Disclosures

This chapter reports one of the studies conducted to test the hypotheses described in Chapter III. The specific, variables, methodology, analysis and results related to the study will be discussed.

Research Design

Messick (1978) proposes different strategies to match individual differences with the task. One of them is challenge match, which involves giving users a task that does not suit them to force them change and become more flexible. Another strategy is capitalization match, which assigns a task to match the strength of the users. The capitalization match strategy was selected because it does not require any cognitive ability to perform efficiently; therefore, it does not require training or adaptation.

The experiment manipulates the information structure (matching or not matching) for analytic and heuristic users. Participants were assigned randomly to one of the treatment conditions, and all of them received equivalent information although it was presented in different formats according to the designed structures. The two structures created and tested to match Analytics and Heuristics' cognitive style (Figure 7) are based on the literature review in Chapter II. Structure 1 is designed to match analytic users, which were found to prefer information in numeric format (Vasarhelyi, 1977), with no

aggregation so that they can produce their own models (Huysman, 1968). Regarding the level of disaggregation and format, it was presented in the familiar financial statements format, with all the accounts listed without aggregation. Additional information was provided in the form of additional charts with numbers. Structure 2 presents users with aggregated data and extractions of text disclosures. This structure matches the heuristic cognitive style since the literature indicates that individuals with heuristic characteristics prefer to get an overview of the information rather than to go into details (Ford, Wood et al., 1994; Ford, 2000; Peters, Vastfjall et al., 2006; Peters, Dieckmann et al., 2007), which might be due to the loss of attention produced by the presence of additional information with similar characteristics as the one they are looking for (Pashler, Johnston et el., 2001; Feldman Barret, Tugade et al., 2004) They also prefer information in text format (Vasarhelyi, 1996), and since they get easily lost or distracted (Ellis, Ford et al., 1993; Allen, 1999), the overview could act as a map to help them understand any related information.

Figure 7

Proposed structures and their relationship with cognitive style

	Structure 1 (disaggregated no text)	Structure 2 (aggregated with text)
Heuristics	Not Matching	Matching
Analytics	Matching	Not Matching

Figure 7 Proposed Structures and their relationship with cognitive characteristics

Since one of the structures has information in test format and the other in numeric format, the information in both of them is not exactly the same. One concern was that

one of the structures could be more informative than the other. In order to test that factor, I used the answers to the recall questions in the last questionnaire presented to the subjects as a measure of informativeness. Those questions had a right or wrong answer; hence, a score could be calculated based on the answers. If participants in both structures got similar scores, this would mean that the informativeness of the structure was similar. Those questions asked which company capitalized more R&D, if there was any difference in the expected income for the following year, if there was any difference in the possibility to pay future debts by the companies, and if there was any difference in the possibility to collect money from their customers in the future. A t test indicates that both structures provided the same information since there is no difference in the scores ($p = .745$).

Information available to subjects

The methodology applied requires decisions to be made about the information usage and decision process of the subjects in different treatment conditions during the experiment. To examine the proposed hypotheses, information has to be gathered for different group of participants classified according to their cognitive characteristics. The methodology developed involves the acquisition of information through questionnaires administered on-line and unobtrusive measures. The questionnaires, as well as the case materials are included in "Appendix to Chapter V - The case and questionnaires".

Written questionnaires

Participants received three questionnaires. The first one was the Analytics/Heuristics Questionnaire described in Chapter IV to determine their cognitive style.

After finishing the first questionnaire, they were presented with the cases and given another questionnaire intended to examine information utilization, and they were asked to select one of the companies for investment, how would they allocate $1000 dollars if they could invest in any or both of them, and how confident they were with the decision. The case materials could be accessed while answering the questions, but the questions were presented one at a time and after submission of the answer they could not be accessed again. After the selection was done, they were asked to complete two direct searches in order to make them look specifically for information that would discriminate the companies. These questions were included to test if after looking at this specific information, investors would pick the best company.

The third questionnaire included recall questions related to the information read and analyzed in the investment decision task as well as demographics. The answers to the recall questions were used to determine the informativeness of the instruments, as will be discussed in the following sections.

Figure 8 describes the experimental design by summarizing the administration of these instruments.

Figure 8 Experimental Design

Step	Description	Explanation
1	Subject procurement	Search for participants in MBA program
2	Reception and instructions	Participants are placed in a computer lab and given introductory explanations
3	Analytic/Heuristic Questionnaire	Participants respond to questions in the first questionnaire
4	Case	Participants read the instructions and the case
5	*Second Questionnaire*	Participants respond with access to financial *information*
6	Third Questionnaire	Participants respond to recall questions and demographics with no access to the case
7	Debriefing	Participants are given an overview of the objectives of the Experiment

Figure 8 Study 1 - Experimental Design

Unobtrusive measures

Unobtrusive measures were included in the instruments (Webb, Campbell et al., 1966). They were built into the interface and recorded all documents accessed, time and duration. These workable, credible components of inquiry (Webb and Weick, 1979) were included as an alternative to self reporting measures, and were considered when evaluating differences in information usage by participants with different cognitive characteristics presented with matching and not matching structures.

Decision Problem

The decision problem was intended to simulate a real investment decision, allowing a wide range of solutions. In order to specify the decision problem several requirements existed:

1. Presence of qualitative and quantitative data
2. Possible solutions by different approaches
3. Realistic problem
4. Realistic data

Task Setting

Participants in different conditions were presented with annual financial statements in different formats. The presentation formats were suited for analytic and heuristic users as described in the previous sections. Participants had to analyze two companies (i.e. A and B). The information for the case was adapted from a real company, and modified to appear like information of two companies. Questions were extracted from previous research (Hodge, Kennedy et al., 2004) and accounting textbooks. The information in the main charts was similar for both companies, since they had the same proportion between assets and liabilities (both current and long term), and between sales and expenses, dealing similar profitability and solvency ratios. The additional information presented in the form of text or additional charts was discriminating, showing that Company B was worse than A. The discriminating information was included in the

matching/non matching presentation in order to identify if the matching structure helped identify the better choice. The factors that made Company B worse than Company A were extracted from previous research (Hodge, Kennedy et al., 2004) and textbooks, and are related to B having financial problems due to a large debt to be paid, with difficulties in collection because the main client went into bankruptcy. Since B is not expending in the activity, for example in research and development of new software, it is not expected that they will increase their sales by the development of new products, and the bankruptcy of the main client will produce a reduction in sales. Company A, on the other hand, has no difficulties in collecting or paying its debt, and is generating new products.

The information of the companies was the same for all the treatment conditions; however, the companies were labeled differently.

Experimental environment

The experiment was performed in a computer lab, with each individual working independently. Participants were not allowed to interact and had to complete the task before leaving the lab. Participants had the researcher's assistance in case they had problems with the program.

Measurement of Variables

To test the first hypothesis, which states that investors in the matching condition make a better choice than investors in the non matching condition, the experimental task asks

participants to evaluate two companies and decide how to invest $1000 dollars in either or both of them. The choice of this task was made in order to have a decision problem realistic and motivational, and that required use of financial information as well.

As described in the previous section, both companies were similar when information in the main charts was analyzed, and the discriminating information that indicated a preference for A was included in the text and additional charts. To determine which company was better for investment, the discriminating factors were chosen and evaluated by two judges who decided that Company A was better than Company B. As part of a pilot test to find any problems with the questionnaires and the material to be analyzed, six PhD students in Rutgers the State University of New Jersey, were asked to look at the financial data and decide which company was better. All of them decided that A was better than B. This measure was checked within the experiment as well and will be described under manipulation.

In this setting, decision making performance was measured with the proportion of the money invested in the worst company (Company B), and by the proportion of participants in each experimental condition that selected the worst company (B). Since the main information was similar, the selection of the best company or the investment of the whole amount in the best company, required investors to capture the information in the matching or not-matching conditions and incorporate it in their decision process. Investment decisions depend on different factors including individual preferences and risk; for example, given two alternatives of investment, a risk averse investor might not find one of them more appealing because it does not reach their

safety threshold. Therefore, if the information is retrieved and processed, it is expected that the amount invested in A will be higher than the amount invested in B, although some investors would feel indifferent with the alternatives.

The second hypothesis states that investors in the matching condition will be more confident with the decision. Confidence was measured with a 7 point Likert-scale where 1 is not confident at all and 7 is very confident.

To measure information utilization, unobtrusive measures were taken by the system in terms of information accessed, order and duration. The measure was calculated using the weighted usage score presented by McEwen and Hunton (1999) calculated as follows: For each subject, the items accessed, the order of access, and the time spent to analyze each item was collected. The order selection of a document was calculated as the order in which the document was accessed divided by number of total accesses, subtracted from 1 so that higher numbers indicate an early access or preference. Then, the weight was calculated as the time spent in each document (proportion of total time). An additional measure was calculated as priority time, considering the information accessed in the top 50% of the time, because that measure excludes the involuntary clicks that lead to documents that are not considered or clicks to documents that were only skimmed, and the information accessed later when they were performing the direct search.

Experiment

An experiment was conducted with 40 students in the Professional Accounting concentration of the MBA program in Rutgers University.

Table 3 presents demographic information about the participants. 29% have experience as individual investors, 68% have looked at financial information in providers like yahoo finance, and 87% have evaluated a company for investment purposes. 71% of participants plan to invest in the future, with only 10% planning to use the services of a broker. 31% plan to decide the investment entirely by themselves.

Table 3
Descriptive Statistics: Means (Std Deviations) of Select Variables and Demographics

	N	Mean (Standard Deviation)
Age	39	29 (6.321)
Gender	39	46% male
# Accounting Courses	39	3.46 (1.699)
# Finance Courses	39	2.28 (2.721)
Invested in stocks	38	29%
Experience investing (years)	38	1.13 (2.28)
Web-Searched for F/S	38	68%
Plan to invest in the future	38	71%
Work Experience (years)	38	4 (3.495)
Evaluated a Company for investment purposes	39	87%
Plan to invest exclusively through a broker's service	39	10%
Plan to decide investment exclusively by themselves	30	31%

This table presents details of number of subjects, age, gender, number of accounting and finance courses passed, if they invested in stocks at least once, number of years investing, if they searched for financial statements on line, if they plan to invest in stocks in the future, number of years of work experience, if they evaluated a company for investment purposes before, if they plan to invest exclusively through a broker, and if they plan to decide the alternative of investment exclusively by themselves.
Table 3 Demographics

Information in Table 4 shows that there is no difference in the composition of the treatment groups in terms of the variables determining knowledge, ability and experience.

Table 4
Difference in means between treatment groups in terms of measures of knowledge, ability, and experience

	Structure 1		Structure 2				
	Mean	Std.Dev.	Mean	Std.Dev	t-test for Equality of Means		
N	18		21		T	Df	Sig. (2-tailed)
Age	28	5.628	30	6.796	-1.1909	37	0.2413
GenderCode	0.444	0.511	0.476	0.512	-0.1932	37	0.8479
EvalCompanies	0.882	0.332	0.857	0.358	0.6570	37	0.8250
AccCourses	3.500	1.618	3.429	1.805	0.7260	37	0.8980
FinanceCourse	1.944	0.873	2.524	3.642	-0.6580	37	0.5147
IndInvestor	0.240	0.437	0.333	0.483	-0.6490	37	0.5210
Yearsinvest	1.120	2.667	1.143	1.982	-0.0330	37	0.9060
Webinfo	0.650	0.493	0.714	0.463	-0.4330	37	0.5085
PlanInvest	0.710	0.470	0.714	0.463	-0.0550	37	0.7558
PlanResearch	1.722	0.575	1.810	0.680	0.4290	37	0.6704
PlanBuy	1.556	0.616	1.667	0.730	-1.2810	37	0.2080
WorkExp	4.000	3.240	4.000	3.768	0.0000	37	1.0000
Motivation	5.530	0.943	4.900	1.895	1.2380	37	0.2240
Difficulty	5.120	1.409	5.190	1.662	-0.1440	37	0.8870

GenderCode: 1 if male, 0 if female
EvalCompanies: 1 if evaluated companies at least once, 0 if no
AccCourses: Number of Accounting Courses passed
FinanceCourse: Number of Finance Courses passed
IndInvestor: 1 if invested in stocks at least once, 0 if no
Yearsinvest: Number of years investing
Webinfo: 1 if searched for financial information on line
PlanInvest: 1 if plan to invest in stocks in the future
PlanResearch: 1 if plan to research for investments alone, 3 if plan ask a broker exclusively, 2 if both
PlanBuy: 1 if plan to buy stocks alone, 3 if plan to buy stocks through a broker, 2 if both
WorkExp: Number of years of work experience

Table 4 Difference in means between treatment groups in terms of measures of knowledge, ability, and experience

Manipulation of variables

The experiment tests two structures and provides the same information in both. To assess if participants perceived correctly if the information was presented as aggregated information with a summary of text or disaggregated information with no text, before

leaving the lab, they were asked if they received any information in text format. Those in the aggregated condition answer affirmatively. That result was checked with the logs and confirmed that all had clicked in the link for additional information in text format. Participants in the disaggregated condition answered negatively.

In order to assess if participants would consider company B as being worse than company A independently of their evaluation, two tasks were included at the end of questionnaire 2 directing the search to information that would indicate which company was worse; and at the end of Questionnaire 3 they were asked once again in which company they would not invest. The answer to this question indicated that 71% of the participants preferred to invest in company A (the best) independently of the cognitive style, the matching condition or the presentation format, validating the fact that given the information they had, they perceived Company A as better than Company B.

Results

Hypotheses testing – H1

Hypothesis 1 predicts that individual investors presented with information in a format that matches their cognitive characteristics will make a better choice than investors presented with information in a format that does not match their cognitive characteristics. The choice decision is measured by two variables. The amount invested in the worst company (B) and the percentage of investors in the group who picked the worst company.

Table 5 Panel A presents descriptive statistics for the dependent variable: amount invested in the worst company. Panel B presents the ANOVA with Cognitive Style, Structure and the interaction of these two variables, which is the factor to be tested. Panel C reports the hypothesized contrast (Matching vs. Not-matching). Panel D presents descriptive statistics for the dependent variable: percentage of investors in the group who picked the wrong company. Panel E presents the ANOVA with Cognitive Style, Structure and the interaction of these two variables, which is the factor to be tested. Panel F reports the hypothesized contrast (Matching vs. Not-matching). Although investors in the matching condition invested less money in the worst company, and the proportion of investors who picked the worst company is lower when they are presented with reports that match their cognitive characteristics, the difference is not statistically significant.

Table 5
Effect of Presentation Format on Investment Decisions of Analytics and Heuristics

Panel A: Amount invested in B

	Structure 1 (disaggregated no text)	Structure 2 (aggregated with text)
Heuristics	Not Matching n = 11 522.73 (273.78)	Matching n = 8 356.25 (198.99)
Analytics	Matching n = 10 475 (240.65)	Not Matching n = 10 440 (260.13)

Panel B: Amount invested in B Analysis of Variance

Source of variance	df	F-Statistic	p-value
Intercept	1	125.721	.000
Cognitive Style	1	.051	.823
Structure	1	1.586	.216
Structure * Cognitive Style	1	.675	.417
Error	35		
Total	39		

Panel C: Hypothesized Contrast Matching vs. Not-Matching (H1)
Amount Invested in B – Matching vs. Not-Matching groups

	Matching n = 18	Not Matching n = 21
Percentage invested In B	422.22 (225.06)	483.33 (263.79)

Dependent Variable	df	t-Statistic	p-value
Amount invested in B	37	-.781	.220

Panel D: Percentage of Participants who picked the wrong company

	Structure 1 (disaggregated no text)	Structure 2 (aggregated with text)
Heuristics	Not Matching n = 11 7 = 63.64%	Matching n = 8 2 = 33.33%
Analytics	Matching n = 10 5 = 50%	Not Matching n = 10 5 = 50%

Table 5
Effect of Presentation Format on Investment Decisions of Analytics and Heuristics (cont.)

Panel E: Analysis of Variance

Source of variance	df	F-Statistic	p-value
Intercept	1	33.105	.000
Cognitive Style	1	.120	.731
Structure	1	1.389	.247
Structure * Cognitive Style	1	1.389	.247
Error	35		
Total	39		

Panel F: Hypothesized Contrast Matching vs. Not-Matching (H1)
Percentage of participants who picked the wrong company – Matching vs. Not-Matching groups

	Matching n = 18	Not Matching n = 21
Percentage invested In B	7 = 39%	12 = 57%

Dependent Variable	df	χ^2-Statistic	p-value
Percentage of investors who picked B	1	1.293	.208

Table 5 - The effect of Matching structures on investment decisions
Participants made a decision about how much of $1,000 to invest in Firm A and Firm B. The dependent measures are the amount invested in Firm B, and the proportion of investors who picked company B, which was the worst one.
An F-test for unequal variances is not significant for the contrast reported in Panels C and F. In Panel C, the planned contrast that does not assume equal variances yields a not significant p-value. Consistent with directional prediction, p-value for Panel C is one-tailed. In Panel F, the panned contrast is not significant.

Given that the effect of the matching structure seems to have affected more heuristics than analytics (see Figure 9), a separate analysis is presented in Table 6 and Table 7. Due to the fact that the number of observations is small, non-parametric tests are reported.

Figure 9 – Average amount invested in the worst company

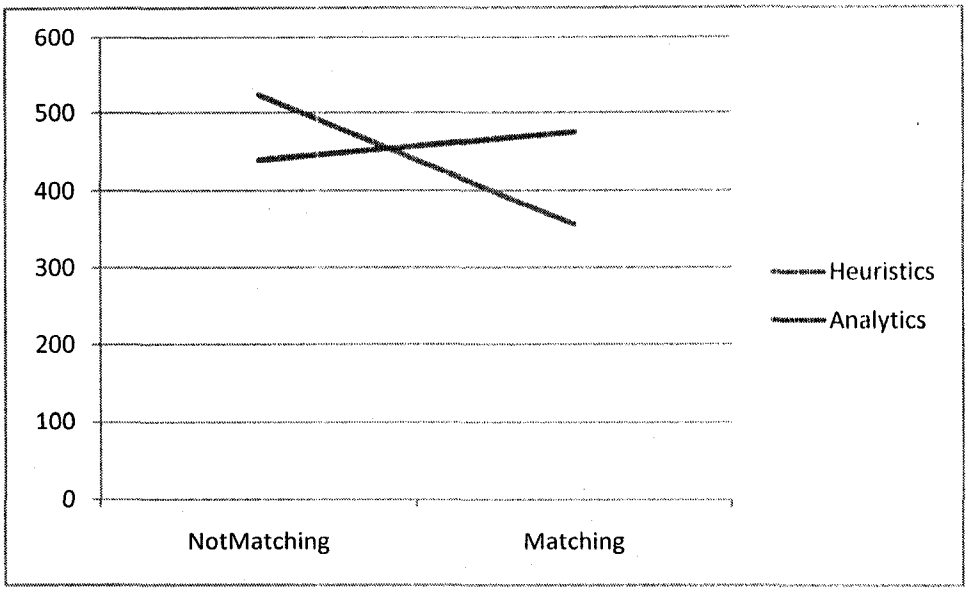

Figure 9 - Average amount invested in the worst company
Difference in mean amount invested in the worst company by participants in the matching and not matching condition. There is no difference in the Analytics behavior, but the Heuristics made a better decision in the matching group.

Heuristic Investors

Table 6 shows the results for heuristic users. Participants in the matching group invested an average of $356.25 in the worst company, while participants in the not matching group invested $522.73. This result indicates a better choice for Heuristics in the matching condition. A Mann-Whitney Wilcoxon test shows that this result is significant (p=.05). The second variable chosen to measure quality of the decision is the percentage of participants who picked the worse company (Company B). 64% of participants in the non-matching condition selected the worst company vs. 25% in the matching condition (sig .048). These results support H1 for heuristic investors.

Table 6
Choice for Heuristic Participants

Panel A: Amount invested in B

	Structure 1 (disaggregated no text)	Structure 2 (aggregated with text)
Heuristics	Not Matching n = 11 522.73 (273.78)	Matching n = 8 356.25 (198.99)

Panel B: Amount invested in B Analysis of Variance

Source of variance	df	F-Statistic	p-value
Intercept	1	59.407	.000
Matching Heuristic	1	2.131	.160
Error	17		
Total	19		

Panel C: Hypothesized Contrast Matching vs. Not-Matching (H1)
Amount Invested in B – Matching vs. Not-Matching heuristics
Dependent Variable
Amount invested in B Exact Sig. .05

Panel D: Percentage of Participants who picked the wrong company

Heuristics	Structure 1 (disaggregated no text) Not Matching n = 11	Structure 2 (aggregated with text) Matching n = 8
Company A (best)	4 = 36.36%	6 = 75%
Company B (Worst)	7 = 63.64%	2 = 25%

Panel E: Analysis of Variance

Source of variance	df	F-Statistic	p-value
Intercept	1	15.291	.001
Matching Heuristic	1	2 905	.100
Error	17		
Total	19		

Table 6
Choice for Heuristic Participants (cont.)

Panel F: Hypothesized Contrast Matching vs. Not-Matching Heuristics (H1)
Percentage of heuristic participants who picked the wrong company – Matching vs. Not-Matching groups

Dependent Variable	df	χ^2-Statistic	p-value
Percentage of investors who picked B			
Pearson Chi-Square			

Table 6- Choice Heuristic Participants
Participants made a decision about how much of $1,000 to invest in Firm A and Firm B. The dependent measures are the amount invested in Firm B, and the proportion of investors who picked company B, which was the worst one.
An F-test for unequal variances is not significant for the contrast reported in Panels C and F. The planned contrasts yield a significant p-value. Consistent with directional prediction, p-values are one-tailed.

Analytic Investors

Table 7 presents the results for analytic users. Participants in the matching group invested an average of $475 in the worst company, while participants in the not matching group invested $440. This result indicates no difference in choice between analytics in the matching or not matching condition. The second variable chosen to measure quality of the decision is the percentage of participants who picked the worse company (Company B). There is no difference in the percentage of individuals who picked the worst company in the matching and not matching condition (50%). Hence, H1 is not supported for analytic investors.

Table 7
Choice for Analytic Participants

Panel A: Amount invested in B

	Structure 1 (disaggregated no text)	Structure 2 (aggregated with text)
Analytics	Matching n = 10 475 (240.65)	Not Matching n = 10 440 (260.13)

Panel B: Amount invested in B Analysis of Variance

Source of variance	df	F-Statistic	p-value
Intercept	1	66.667	.000
Matching Analytics	1	.098	.758
Error	18		
Total	20		

Panel C: Hypothesized Contrast Matching vs. Not-Matching (H1)
Amount Invested in B – Matching vs. Not-Matching analytics

Dependent Variable	
Amount invested in B Exact Sig.	.398

Panel D: Percentage of Participants who picked the wrong company

Analytics	Structure 1 (disaggregated no text) Matching n = 10	Structure 2 (aggregated with text) Not Matching n = 10
Company A (best)	5 = 50%	5 = 50%
Company B (Worst)	5 = 50%	5 = 50%

Panel E: Analysis of Variance

Source of variance	df	F-Statistic	p-value
Intercept	1	18.000	.001
Matching Analytics	1	.000	1.000
Error	18		
Total	20		

Table 7
Choice for Analytic Participants (cont.)

Panel F: Hypothesized Contrast Matching vs. Not-Matching Analytics (H1)
Percentage of heuristic participants who picked the wrong company – Matching vs. Not-Matching groups

Dependent Variable	df	χ^2-Statistic	p-value
Percentage of investors who picked B			
Pearson Chi-Square			

Table 7 Choice Analytic Participants
Participants made a decision about how much of $1,000 to invest in Firm A and Firm B. The dependent measures are the amount invested in Firm B, and the proportion of investors who picked company B, which was the worst one.
An F-test for unequal variances is not significant for the contrast reported in Panels C and F. The planned contrasts yield a non-significant p-value. Consistent with directional prediction, p-values are one-tailed.

Hypotheses testing - H2

The second Hypothesis predicts that investors in their matching condition will be more confident with the decision than investors in the non-matching condition. The measure is the answer to a 7-Point Likert scale question (1=not at all 7=very confident). Table 8 Panel A presents descriptive statistics for the dependent variable: confidence. Panel B presents the ANOVA with Cognitive Style, Structure and the interaction of these two variables, which is the factor to be tested. Panel C reports the hypothesized contrast (Matching vs. Not-matching). The analysis of variance reported in Panel B indicates that the variability in confidence is produced by the structure of the information rather than by the interaction between cognitive style and presentation format (sig .031). Disaggregated data with no text generated more confidence than aggregated with a summary of text.

Given that the difference in confidence is higher for analytics than for heuristics, and that disaggregated information matches the cognitive style of analytics, a separate test for analytics and heuristics is reported in Table 9 and Table 10.

Table 8
Effect of Presentation Format on Confidence in the Decisions of Analytics and Heuristics

Panel A: Confidence

	Structure 1 (disaggregated no text)	Structure 2 (aggregated with text)
Heuristics	Not Matching n = 11 3.818 (1.601)	Matching n = 8 3.375 (1.302)
Analytics	Matching n = 10 4.700 (1.494)	Not Matching n = 10 3.200 (.789)

Panel B: Confidence Analysis of Variance

Source of variance	df	F-Statistic	p-value
Intercept	1	303.275	.000
Cognitive Style	1	.665	.420
Structure	1	5.027	.031
Structure * Cognitive Style	1	1 .487	.231
Error	35		
Total	39		

Panel C: Hypothesized Contrast Matching vs. Not-Matching (H2)
Confidence – Matching vs. Not-Matching groups

	Matching n = 18	Not Matching n = 21
Confidence	4.111 (1.530)	3.524 (1.289)

Dependent Variable	df	t-Statistic	p-value
Confidence	37	1.030	.100

Table 8 – Effect of presentation format and cognitive style on confidence
Participants were asked how confident they were with their decision.
An F-test for unequal variances is not significant for the contrast reported in Panel C, indicating that the change in confidence is originated by the structure, with disaggregated data with no text providing more confidence than aggregated with text. Consistent with directional prediction, p-value for Panel C is one-tailed.

Analytic Investors

Table 9 presents the results for analytic investors. Panel A presents descriptive statistics for the dependent variable: confidence. The mean reported confidence in the decision in the matching structure was 4.7, while in the not-matching structure it was 3.2. Panel B presents the ANOVA for the matching condition of analytics, indicating that the variance is produced by the presentation format, generating more confidence the matching structure. Panel C reports the hypothesized contrast (Matching vs. Not-matching), with confidence being significantly higher in the matching condition (sig .007). Hence, for analytic investors H2 is supported.

Table 9
Effect of Presentation Format on Confidence in the Decisions of Analytics

Panel A: Confidence

	Structure 1 (disaggregated no text)	Structure 2 (aggregated with text)
Analytics	Matching n = 10 4.700 (1.494)	Not Matching n = 10 3.200 (.789)

Panel B: Confidence Analysis of Variance

Source of variance	df	F-Statistic	p-value
Intercept	1	312.050	.000
Matching Structure	1	11.250	.012
Error	18		
Total	20		

Panel C: Hypothesized Contrast Matching vs. Not-Matching (H2)
Confidence – Matching vs. Not-Matching Analytics

Dependent Variable	df	t-Statistic	p-value
Confidence	18	2.807	.007

Table 9 - Effect of presentation format and cognitive style on confidence for analytics
Participants were asked how confident they were with their decision.
An F-test for unequal variances is significant for the contrast reported in Panel C. Consistent with the directional prediction; p-value for Panel C is one-tailed.

Heuristic Investors

Table 10 presents the results for heuristic investors. Panel A presents descriptive statistics for the dependent variable: confidence. The analysis of variance in Panel B shows that the presentation format did not affect the level of confidence of heuristic investors. Panel C reports the hypothesized contrast (Matching vs. Not-matching), with no significant results; hence, a presentation format that match the cognitive characteristics of heuristics did not generate more confidence than a presentation

format that does not match those characteristics. H2 is not supported for Heuristic Investors

Table 10
Effect of Presentation Format on Confidence in the Decisions of Heuristics

Panel A: Confidence

	Structure 1 (disaggregated no text)	Structure 2 (aggregated with text)
Heuristics	Not Matching n = 11 3.818 (1.601)	Matching n = 8 3.375 (1.302)

Panel B: Confidence Analysis of Variance

Source of variance	df	F-Statistic	p-value
Intercept	1	108.607	.000
Matching Structure	1	.412	.529
Error	17		
Total	19		

Panel C: Hypothesized Contrast Matching vs. Not-Matching (H2)
Confidence – Matching vs. Not-Matching Analytics

Dependent Variable	df	t-Statistic	p-value
Confidence	17	-.664	.258

Table 10 - Effect of presentation format and cognitive style on confidence for heuristics
Participants were asked how confident they were with their decision.
An F-test for unequal variances is not significant for the contrast reported in Panel C. Consistent with the directional prediction; p-value for Panel C is one-tailed.

Additional analysis - Information usage

The analysis of the logs shows that participants in the study used more additional information when the structure presented them with aggregated data and text. Since the disaggregated structure included more information in the main charts, in order to access the information necessary for their analysis, investors in the aggregate structure needed to look for information in text.

Table 11 Panel A displays descriptive statistics for the percentage of additional to total information used by investors in each structure. In the aggregated condition (Structure 2), 21% of the total information accessed was additional in text, while in the disaggregated condition (Structure 1) only 8% was additional in charts. This result is significant (two tailed .001).

Table 11
Analysis of Proportion of Additional to Total Information by Cognitive Style and Structure of Information Analyzed

Panel A: Mean (Standard Deviation)

Structure	N	Mean (Standard Deviation)
Disaggregated (numbers)	21	.0793 (.06391)
Aggregated (with text)	18	.2069 (.155570)
t = 2.332		sig .001

Panel B: Analysis of Variance

Between Subjects	DF	F	p
Analytic / Heuristic	1	.593	.446
Structure I / Structure II	1	10.861	.002*
Interaction A/H*Structure I/II	1	.205	.654
Adjusted R Squared = .195			

Table 11 - Analysis of Proportion of Additional to Total Information
Panel A presents the comparison of means between the proportion of additional to total information accessed in the Disaggregated Structure (which involves only numbers) and the Aggregated Structure (which includes text). The difference between the means is significant.
Panel B presents the results of an analysis of variance where the presentation Structures vary between subjects, as well as the cognitive style. The interaction between structure and cognitive style is also reported.

Previous research found that heuristics prefer information in text format while analytics prefer information in numeric format (Vasarhelyi, 1996). The proposed and tested structures for analytics and heuristics were based on those findings. The following analysis looks at information utilization by both analytics and heuristics, to

determine if there is a difference in the access to text information according to the investors' cognitive style. Access to information was measured with the score developed by Hutton and McEwen (1999) and discussed in the previous chapter. Since the last two questions of the questionnaire were directed to look at specific information, only the top 50% of the time access was considered for this evaluation. The first part of the study involved a spontaneous search of information for investment purposes. Results show Heuristics looked at more additional text information than Analytics (as expected) during this priority time. A chi square test shows that this result is significant (Table 12).

Table 12
Analysis of Information Accessed in the Priority Time by Structure of Information Analyzed

Panel A – Mean (Standard Deviation)

Structure	N	Mean (Standard Deviation)
I. Disaggregated (numbers)	21	.2857 (.46291)
II. Aggregated (with text)	18	.8889 (.32338)

Panel B – Number of Participants who accessed Additional Text Information in their Priority Time by Cognitive Style

	LookedText	Not Looked Text	Total
Heuristics	7	1	8
Analytics	3	7	10
Total	10	8	18

Chi-Square Test	Value	Significance
Pearson	5.951	.015
Continuity Correction	3.850	.050
Likelihood Ratio	6.485	.011
Fisher's Exact Test		.023

Table 12- Access to information in priority time
Panel A presents the proportion of participants who looked at additional information in the priority time in both presentation structures.
Panel B presents the results of a Chi-Square test showing that heuristics looked at additional text information in their priority time while analytics did not. This result is significant at .001

Conclusions

The result of this study does not support the hypothesis that investors in general would make a better investment choice when presented with information in a format that matches their cognitive style as opposed to a format that does not match their cognitive style. However, the results support the hypothesis in the heuristics group, indicating that heuristics make better decisions when the presentation format matches their cognitive style, while analytics are not affected in the decision by the presentation

format. Studies in education found that tailored representations affected more the behavior of heuristics than analytics because the last group had more skills to adapt to the structures received, and the first one compensated their difficulties in learning with a presentation format matching their cognitive style (Carpenter, McCornack et al., 1978; Abraham, 1985; Ford and Chen, 2001; Jakovljevic, 2003). Given that it is generally assumed that numeric information is more valuable for investors, which is evidenced by on-line providers of financial information giving preference to charts, this result indicates that some investors would rather receive less numeric data and a summary of text disclosures. This conclusion is also supported by the fact that heuristic investors looked more at additional text disclosures than analytic investors. Therefore, it is necessary to create structures to facilitate access to text disclosures without having to go over the SEC filing, as it is required currently.

On the other hand, even when analytics did not change their investment decision with the presentation format, they felt more confident with their decision when the presentation format matched their cognitive characteristics. A possible explanation for this result is the effect of overload in the matching structure for analytics. In marketing, Jacoby et al. 1974, found that while consumers do feel more satisfied and less confused with more information, they actually make poorer purchase decisions. The implications of this result is that at least for this level of sophistication of users, the availability of raw data might increase satisfaction without modifying the decision.

Chapter VI – The use of taxonomic and schematic structures in text disclosures

This study was developed to test if individuals with different cognitive style characteristics acquire knowledge and evaluate companies differently when information is presented using taxonomic or schematic structures.

Methodology

Research Design

The experiment has four conditions, and it manipulates the information structure (matching or not matching) for analytic and heuristic users. The structures proposed and tested are based on the literature review in Chapter II and summarized in Figure 3 (schematic structure) and Figure 4 (taxonomic structure).

The information provided to both groups was the same, to the extent that the sentences in the disclosures were the same. Only the organization of the information varied to reflect both structures, and the companies were labeled differently as well.

Information available to subjects

The methodology applied requires decisions to be made about the knowledge acquisition and processing of the subjects in different treatment conditions during the experiment. To examine the proposed hypotheses, information has to be gathered for

different group of participants classified according to their cognitive characteristics. The methodology developed involves the acquisition of information through questionnaires administered on-line and unobtrusive measures. The questionnaires, as well as the case materials are included in the Appendix to Chapter VI.

The materials used include a Consent Form, an Analytics/Heuristics classification questionnaire, instructions, summary of text disclosures organized in schematic or a taxonomic structure, a experimental questionnaire, and a post-experimental questionnaire with demographics.

Written questionnaires

Participants received three questionnaires. The first one was the Analytics/Heuristics Questionnaire described in Chapter IV to determine their cognitive style. The second one, was the experimental questionnaire, and after finishing with this experimental task, they were given a post-experimental questionnaire with demographic questions. Figure 10 describes the experimental design summarizing the administration of these instruments.

Figure 10 – Experimental Design

Step	Description	Explanation
1	Subject procurement	Search for participants in MBA program
2	Reception and instructions	Participants are placed in a computer lab and given introductory explanations
3	Analytic/Heuristic Questionnaire	Participants respond to questions in the first questionnaire
4	Case	Participants read the instructions and the text disclosures
5	Second Questionnaire	Participants respond with no access to the documents
6	Third Questionnaire	Participants respond to demographic questions
7	Debriefing	Participants are given an overview of the objectives of the experiment

Figure 10 - Study 2 - Experimental Design

Unobtrusive measures

Unobtrusive measures were included in the instruments. They were built into the interface and recorded the starting and ending time.

Experimental environment

The experiment was performed in a computer lab, with each individual working independently. Participants were not allowed to interact and had to complete the task before leaving the lab. Participants had the researcher's assistance in case they had problems with the program.

Dependent variables

"**Knowledge Acquisition**" was assessed by asking nine recall questions. It was measured as a score of the number of questions answered correctly. "**Assessment**" of the company was measured by asking how they expected sales and collections to be in the future, how loans would affect the ability to pay debt, and what would be the impact of R&D in future sales. It was measured using a seven point Likert scale. "**Confidence**" was measured with a 7 point Likert scale question. Although no experiment can be open ended due to physical limitations, no time constraints were explicitly indicated to the students. Also, the time taken (difference between end and start time) was measured in the background by the system with no indication to participants of the time elapsed or remaining. Hence, "**Time Spent**" is a non intrusive measure.

Pilot Tests

A preliminary study was conducted with undergraduates and MBA students to test appropriateness of the materials. No problems were reported by participants or noted by the researcher.

Experiment

A test was performed with 55 students in an accounting class in the Master in Accountancy Program in Rutgers University in a computer lab during a half an hour session. The purpose of using the computer lab was to gather the answers automatically, and to ensure that they answered the questions without having access to

the information. They were not allowed to take notes as well. Demographic data are presented in Table 13; there is no significant difference in demographics between groups.

Table 13
Sample Characteristics

	Mean	Std. Dev.	Min	Max
Age	24.38	5.25	20	46
Years work experience	1.62	3.98	0	23
Accounting courses	10.38	2.9	1	17
Finance courses	2.93	1	10	1.83
Males	47.27%	0.5	0	1
Evaluated Companies (yes)	0.89	0.31	0	1
Plan to invest in stocks (yes)	0.87	0.34	0	1
Plan to ask a broker exclusively (yes)	0.07	0.26	0	1
Risk averse (yes)	0.78	0.42	0	1
Read text disclosures when analyzing	0.59	0.5	0	1
Don't look at text because of overload	0.48	0.51	0	1
Don't look at text because I don't like reading text	0.17	0.38	0	1
I would prefer information with a story structure	0.85		0	1
I would prefer addl information in text rather than charts	0.28		0	1

This table presents details of number of subjects, age, gender, number of accounting and finance courses passed, if they plan to invest in stocks in the future, if they evaluated a company for investment purposes before, if they plan to invest exclusively through a broker, and if they plan to decide the alternative of investment exclusively by themselves, if they read text, the reasons for not reading text, risk aversion, and how they would prefer text disclosed.
Table 13 - Demographics

Procedure

After completing the Analytic/Heuristic questionnaire described in Chapter IV, individuals were randomly assigned to one of two treatment groups. One of the groups received text disclosures related to a sales process organized around financial

statements accounts (taxonomic structure), and the other group received text disclosures related to the same process organized around sales events (schematic structure). After reading the information, they were presented with a questionnaire to answer without access to the disclosures. The purpose of the questionnaire is to assess if their evaluation of the companies is different when the information is presented in a format that matches their cognitive characteristics, as opposed to a format that does not match them, and to evaluate their level of confidence and knowledge acquired. Demographics and questions related to their preferences were asked after they finished with the experimental task.

Results

Before leaving the computer lab, students were asked if they had received the information expressed as a list of accounts. All subjects in the taxonomic structure answered Yes, although 10% of the subjects in the schematic structure also answered Yes, probably due to the fact that the information contained general titles.

Hypotheses test

The analytics heuristics questionnaire provides a range of scores in a continuum; therefore, the result is not bipolar. Studies in cognition, education and accounting, that classify individuals in two categories according to their cognitive style, do that by partitioning the sample in halves (Vasarhelyi, 1977; Peters, Vastfjall et al., 2006; Peters, Dieckmann et al., 2007). In this study, two partitionings were used. One is the whole

sample, partitioned in halves, and the other one is a sample considering only the extreme cases in the Analytics/Heuristics spectrum. For the extreme cases, due to the sample size, both parametric and non-parametric tests were performed. There is no difference in the significance of the results, so parametric tests are reported.

Taxonomy structure vs. Schematic structure

The first set of hypothesis is no directional and states that investors will assess a company similarly (H1a), will acquire similar knowledge (H1b), will have the same confidence in the assessment (H1c) and will spend the same amount of time (H1d) when the information is presented as a schematic representation or as a taxonomic representation. To test these hypotheses, the whole sample was used since these general hypotheses are not related to cognitive style. Table 14 Panel A presents the means (standard deviation) of the variables, and a t-test comparing the means between both presentation formats. Although 85% of participants indicated that they would rather receive information with a story structure, participants in the taxonomy structure felt more confident with their assessments than participants in the schema structure. The result is marginally significant (p-value = .055). No significant difference was found in knowledge acquisition and time spent. Panel B presents the Analysis of variance of the variables, which shows no source of variation from the presentation format, and marginal variation from the interaction term and the cognitive style. Therefore, regarding Hypothesis 1, which has no direction, individuals assess the company differently when presented with information in a schematic or a taxonomic

representation, but the knowledge acquired and the time spent is no different. Planned contrasts for the matching/not-matching groups are tested in Table 15, considering the extremes in the analytics/heuristics scale.

The variables selected to measure assessment are the answers to four seven-point Likert scale questions that indicate the investor perception of the company. Since they received information about only one company, they had no parameter to measure how good the company was, and by answering how they perceived future sales, the effect of R&D in future sales, future collections and future ability to pay debt, they were making an evaluation of the future of the company. Maxwell (2001) states that a MANOVA test is more appropriate than separate ANOVAS to test different dependent variables which are supposed to respond similarly to an experimental manipulation. Both Maxwell (2001) page 21, and Kerlinger and Lee (2000) page 803 indicate that the conditions to use MANOVA are that the variables are correlated. Maxwell (2001) suggests a level of correlation from .3 to about .7, since less correlation would indicate no real relation between variables, and more correlation indicates redundancy. It also has to make sense conceptually to group the variables, and in this study it does since the questions indicate how the participants evaluate the future of the company. In this study, the level of correlation of the four variables is in the required range (.3 to .7), and the Cronbach's Alpha is .7, indicating that the variables measure the same construct (a principal component analysis indicates one component as well). Table 14 Panel B presents the Means and Standard Deviation of the variables that measure assessment, and the results of the MANOVA. Participants in the schematic representation group evaluated

the company around the mean values, where participants in the taxonomic representation group evaluated the company more optimistically in terms of the positive items (increase in sales and collections in the future) and more negatively in terms of negative items (probability that they will be able to pay the future debt). This difference per se, indicates different assessment between groups, but since the text provided included information about difficulties to pay future debt, it indicates that participants in the taxonomy structure were more able to incorporate the information to their evaluation. A multivariate test (MANOVA) for the whole population (extreme and moderate analytics and heuristics) shows that variations in the assessment were produced by the presentation format.

Table 14
Effect of presentation format on investors' confidence, knowledge acquisition, time spent on the task, and assessment

Panel A – Dependent Variable Means (Standard deviations)

t-test difference in means between the two presentation formats

	Taxonomy(N=27)		Schema(N=28)		T-Statistic	P-value	H
	Mean	Std.Dev.	Mean	Std.Dev.			
Confidence	4.37	0.88	3.75	1.40	1.952	0.055	1c
Knowledge Acquisition	5.04	1.74	4.61	1.34	1.03	0.312	1b
Time Spent	717.48	148.63	728.43	175.32	0.25	0.803	1d

Panel B – Analysis of Variance

Confidence (H1c)	df	F-Statistic	Sig.
Intercept	1	817.560	.000
Taxonomy/Schema	1	2.985	.142
Analytic/Heuristic	1	1.310	.327
T*A (Matching)	1	4.190	.083
Error	51		
Total	55		

Knowledge Acquired (H1b)	df	F-Statistic	Sig.
Intercept	1	1196.444	.000
Taxonomy/Schema	1	1.733	.402
Analytic/Heuristic	1	2.983	.276
T*A (Matching)	1	.842	.558
Error	51		
Total	55		

Time Spent (H1d)	df	F-Statistic	Sig.
Intercept	1	1060.214	.000
Taxonomy/Schema	1	.738	.394
Analytic/Heuristic	1	3.016	.089
T*A (Matching)	1	3.826	.056
Error	51		
Total	55		

Table 14
Effect of presentation format on investors' confidence, knowledge acquisition, time spent on the task, and assessment (cont.)

Dependent Variable Assessment Means (Standard deviations)

	Taxonomy(N=27)		Schema(N=28)	
Assessment Variables (composite measure)	Mean	Std.Dev.	Mean	Std.Dev.
Probability that they will pay future debt (1=unlikely 7=very likely)	3.70	1.17	4.07	1.21
How do you expect the sales next year to be? (1=less than this year 7=more than this year)	5.04	0.85	4.50	1.14
How will investment in R&D impact future sales? (1= no increase 7=increase significantly)	4.11	1.12	4.46	0.69
How will collections increase next year? (1=no increase 7=increase significantly)	4.33	0.96	4.29	0.76

MANOVA

Between Subjects	F	Sig.
Taxonomy/Schema	2.65	.044
Analytic/Heuristic	.77	.549
Taxonomy*Analytic	1.84	.136

Table 14 Effect of presentation format on confidence, knowledge acquired, time spent and assessment
Panel A presents the difference in confidence and knowledge acquired in the schematic and the taxonomic representations of text for the whole sample. A t-test shows that difference in confidence is marginally significant
An F-test for unequal variances in Panel B indicates marginal source of variance in the interaction term (matching/not-matching and in the cognitive style but not in the presentation format.
Panel C presents the mean and std. Deviation of the variables used to measure assessment and the MANOVA results.

Matching/Not-Matching Conditions:

Hypothesis 2 refers to the interaction term (A/H * Schema/Taxonomy), since the hypotheses relate to the diagonal of the matrix (Analytics with Taxonomy and Heuristics with Schema). It predicts that investors in the matching condition will acquire more knowledge (H2a) and assess the company differently (H2b) than investors in the non-

matching group. Hypothesis 4 compares confidence between participants in the matching and not-matching condition, predicting that investors in the matching condition will be more confident with their assessment than investors in the non-matching condition. The mean of these two groups was compared considering the whole spectrum of heuristic/analytic participants, and also comparing the extreme subjects in the spectrum. Results for the extreme participants are stronger and reported in Table 15.

No difference was found between groups in knowledge acquisition. H2a is not supported. Participants in the matching group felt more confident with their assessment than participants in the non-matching group. This result is significant ($p = .005$), which supports H4.

Regarding assessment, individuals in the matching condition assessed the information more positively than individuals the non-matching condition. The scores were higher in evaluation of futures sales and collections and lower in terms of difficulties to pay debt. The information provided expressed difficulties in the payment of debt in the future. Therefore, participants in the matching condition were more able to identify that information than participants in the not-matching condition. This result is significant ($p = .014$). H2b is supported.

An additional test shows that participants in the matching condition structure spent more time in the task than participants in the non matching condition structure. This result might indicate that investors with information in a format that matched their cognitive characteristics felt comfortable reading the text and worked with it for a

longer period of time. For the whole sample the result is marginally significant ($p = .08$), while for the extreme cases the result is significant ($p = .048$).

The analysis of variance of the variables that changed significantly between the matching and not-matching conditions (time spent, confidence and assessment) indicates that the source of variability is not produced by the cognitive style or the structure of the information, but by the interaction between the cognitive style and the structure, which was the hypothesized effect.

Table 15

Effect of presentation format on investors' confidence, knowledge acquisition, time spent on the task, and assessment between matching and not-matching groups

Panel A – Dependent Variable Means (Standard deviations)

t-test difference in means between analytic and heuristic individuals in their matching - not-matching presentation formats

	Matching (N=21)		Not-matching (N=16)		T-Statistic	P-value
	Mean	Std.Dev.	Mean	Std.Dev.		
Confidence (H3)	4.57	1.03	3.56	1.21	2.74	0.005
Knowledge Acquisition (H2a)	4.48	1.57	5	1.41	1.05	0.301
Time Spent	781.29	664.63	677.05	173.2	2.05	0.048

p-values for Confidence are one tailed (H3)

p-values for Knowledge Acquisition (H2a) and Time Spent are two-tailed

Panel B – Analysis of Variance

Confidence	df	F-statistic	sig.
Intercept	1	436.292	.000
Taxonomy/Schema	1	.388	.537
Analytic/Heuristic	1	.038	.847
T*A	1	5.989	.020
Error	33		
Total	37		

Knowledge Acquired	df	F-statistic	sig.
Intercept	1	342.747	.000
Taxonomy/Schema	1	2.023	.164
Analytic/Heuristic	1	.802	.377
T*A	1	1.985	.178
Error	33		
Total	37		

Time Spent	df	F-statistic	sig.
Intercept	1	580.494	.000
Taxonomy/Schema	1	.234	.632
Analytic/Heuristic	1	.896	.351
T*A	1	4.353	.045
Error	33		
Total	37		

Table 15
Effect of presentation format on investors' confidence, knowledge acquisition, time spent on the task, and assessment between matching and not-matching groups (cont.)

Panel C -Dependent Variable Means (Standard deviations)

Assessment Variables (composite measure) (H2b)	Matching (N=21)		Not-matching (N=16)	
	Mean	Std.Dev.	Mean	Std.Dev.
Probability that they will pay future debt	3.52	1.4	4.06	1.24
How do you expect the sales next year to be?	5.04	0.97	4.38	0.96
How will investment in R&D impact future sales?	4.38	1.07	4	0.97
How will collections increase next year?	4.48	0.75	4.06	0.93

MANOVA

Between Subjects	F	sig.
Analytics/Heuristics	.555	.697
Schema/Taxonomy	1.049	.398
A/H * S/T	3.732	.014

Table 15 Effect of presentation format on matching and not matching condition
Panel A presents the difference in confidence, knowledge acquisition and time spent between participants in the matching and not matching groups. The results are significant for all the variables except knowledge acquisition. Panel B reports the analysis of variance of the variables which shows that the variability is produced by the interaction between cognitive style and presentation format, which is the hypothesized source of variation.
Panel C presents the differences in the variables used to measure assessment between matching and not matching groups and the MANOVA results. The variability in the perception of the firm is also determined by the interaction between cognitive style and presentation format as hypothesized.

Hypothesis 3 predicts no difference between analytic and heuristic investors in their matching condition in terms of knowledge acquisition (H3a) and assessment (H3b), and Hypothesis 5 predicts no difference in confidence between analytic and heuristic investors in their matching condition. Table 16 reports the results of the tests comparing the means of extreme analytics and heuristics in their matching conditions, which are

not significantly different. Similar results were obtained with non parametric tests and for the whole spectrum of analytics and heuristics. Hypotheses H3a and H3b are supported.

Table 16
Effect of presentation format on investors' confidence, knowledge acquisition, time spent on the task, and assessment between analytics and heuristics in their matching groups (extreme cases)

Panel A – Dependent Variable Means (Standard deviations)
t-test difference in means between analytic and heuristic investors in their matching presentation format

	Analytics (N=13)		Heuristics (N=8)		T-Statistic	P-value
	Mean	Std.Dev.	Mean	Std.Dev.		
Confidence	4.69	0.63	4.38	1.51	0.677	0.51
Knowledge Acquisition	4.92	1.66	3.75	1.16	1.747	0.097
Time Spent	791.77	145.12	764.25	188.54	0.377	0.73

Panel B - Dependent Variable Means (Standard deviations)

	Analytics (N=13)		Heuristics (N=8)	
Assessment Variables (composite measure)	Mean	Std.Dev.	Mean	Std.Dev.
Probability that they will pay future debt	3.23	1.3	4	1.51
How do you expect the sales next year to be?	5.08	0.64	5	1.41
How will investment in R&D impact future sales?	4.23	1.3	4.62	0.52
How will collections increase next year?	4.46	0.88	4.5	0.53

MANOVA

Between Subjects	F	Sig.
Analytic/Heuristics	.925	.492

Table 16 – Differences between analytics and heuristics in their matching condition
Panel A presents the differences in knowledge acquired, time spent and confidence between analytics and heuristics in their matching groups. Those differences are not significant. Panel B presents the differences in the variables used to measure assessment between analytics and heuristics in their matching groups, and the MANOVA results.

Conclusions

The purpose of this study is to test a schematic and a taxonomic representation for the presentation of a summary of text disclosures, and to relate those presentation formats

to investors' cognitive characteristics. The results show that although knowledge acquired does not change, individuals make different assessments of the companies when they receive information in formats that match their cognitive characteristics. They also feel more confident with their assessments when the information matches those cognitive characteristics. Therefore, companies in their websites, or providers of financial information like yahoo finance, would favor investors if they offered different presentation formats.

At the end of the study, participants were asked the likelihood that they would invest in the company. It was measured using a 7 point Likert scale. Investors in the taxonomy condition were less likely to invest (2.70) than investors in the process condition (3.36). This result is significant ($p = .025$). Even when the assessment of the company was significantly different in the matching condition, the likelihood that they would invest in the company was not. This result indicates that investment decision might be influenced by the presentation format independently of the content. Further research is needed to confirm this assumption.

Chapter VII - Conclusions and Directions for Future Research

The purpose of this dissertation was to test if by providing cognitive style tailored information reports, the decision making of investors with those cognitive characteristics was enhanced. As discussed in Chapter III, two alternatives were considered for the administration of the analytic/heuristic test. One of them involved the pre-screening of subjects and only taking extremes on the scale, and the other involved accepting the full range on the Analytics/Heuristics scale. Since the subjects were available in only one opportunity, they were given the analytic/heuristic test and were assigned randomly to the experimental task without considering the cognitive style. As a result, the design is not balanced. Another limitation is the reduced amount of information provided to the participants, as compared to the amount of information in a real investment decision. This effect might be compensated because even when they had no constrains in time during the experiment, they had another activities to choose from that might disregard if they were evaluating companies for real investment. As discussed in Chapter 2, the effect of providing a large amount of information is similar to the effect of not giving enough time to consider all of it.

Two presentation structures were tested with MBA students as surrogates for individual investors. The first of those structures was tested in the study described in Chapter V. Analytic investors were presented with a matching format providing numeric

disaggregated data, and heuristic investors were presented with a matching format with a summary of numbers and the additional information in text. Non-matching documents are the same ones reversed, so that analytics received the summary of numbers and text and heuristics only numeric data. The results show no significant difference between matching and non matching groups. However, the results for investors with analytic characteristics were different from the results for heuristics. Individual investors with heuristic characteristics make better investment decisions (choose the better company for investment) when they are presented with a summary of numbers and additional information in text, as opposed to presentation formats that provide only numbers. Although no difference in decision was found for analytic investors, they felt more confident when they received disaggregated numeric information. The study did not test for risk aversion, and there might have been no preference for the best company because analytics did not evaluate the other alternative as considerably better. To compare the difference between risk aversion of analytics and heuristics the second study included a lottery question, but no difference was found between analytic and heuristic groups.

The result of the first study indicates that it is not only numbers what individual investors are looking for, and that the effort that on-line providers put in developing structures to facilitate analysis of quantitative data, should be extended to facilitate access to text disclosures. Given that the presentation of disaggregated information as an alternative to text disclosures produced overload in analytic investors, and that they

did not look at text, it is important to study structures to facilitate access to information that is usually disclosed in footnotes for investors with this cognitive style.

The second study, discussed in Chapter VI, compares differences in assessment of companies by analytic and heuristic investors presented with cognitive style tailored information. The information provided was in text format, with one structure organized as a taxonomic representation and the other as a schematic representation. Based on the literature described in Chapter 2, the schematic representation matches the characteristics of heuristics; while the taxonomic representation matches the characteristics of analytics. Results show that both analytic and heuristics investors felt more confident with their assessment. They also spent more time on the task. Regarding assessment of the company, the participants in the matching condition evaluated more positively the company in terms of future sales; however, the narrative included some difficulties in the payment of future debt, and this situation was more negatively evaluated by participants in the matching condition. These results might indicate that investors in the matching condition found the information easier to analyze, which allowed them to read it for a longer time, and facilitated their perception of the difficulties the company was facing in the future. Also having information in a structure they liked, might have facilitated the access to the information about future difficulties of the company, and might have improved how much they liked the company and how positively they evaluated their future in terms of positive variables (sales and collections). Decision to invest, on the other hand, was affected by the presentation

format, with investors in the schematic representation more willing to invest, but not by the interaction between format and cognitive style.

Future research

Since the results of the second study show benefits for both analytics and heuristics in terms of confidence with their evaluations, and both groups evaluated the companies differently when the format matched their cognitive style, further research is needed to test the effect of taxonomic and schematic presentations in different tasks like investment choice.

The first study showed that analytics do not read text, and given that there is information that is not disclosed other than in text format, the development of structures organized around the taxonomy of the chart of accounts could help them access the text they are missing in the current reporting environment.

Different tools can be proposed and tested to produce summaries of text disclosures. Structured and unstructured document summarization[4] is intended to produce summaries with information retrieved from different sources. Given the large amount of text information available for an investment decision, the production of summaries with a temporal structure might constitute a tool for heuristic investors. Regarding analytic investors, the production of indexes based on a chart of accounts might constitute a facilitating tool to access text disclosures. To produce the indexes, different information retrieval techniques like Latent Semantic Indexing as described by

[4] http://www1.cs.columbia.edu/~hjing/summarization.html

Dumais (1991) have been proposed in literature. The advantage of LSI over other retrieval techniques, like word matching, is that it allows grouping together terms that are similar in meaning (like liability and debt) without the production of dictionaries of synonyms, while it disregards terms that have the same spelling with different meaning (like liability in the accounting and legal vocabulary). For example, text paragraphs related to debt can be retrieved and grouped together in summaries even when the term "debt" is not included in the paragraph. Further research is needed to test the effect of these tools on analytic and heuristic users.

Appendix A

A.1 Analytics-Heuristics Questionnaire

Instructions

Please answer these 20 questions at face value. Do not try to read anything into them. Do not take a long time to decide on an answer. Respond with your first impression.

Do you like to have your life organized and structured to the minimum detail?

Yes _____ Sometimes _____ No _____

Do you analyze a situation and act the way you think to be the best according to that analysis?

Yes _____ Sometimes _____ No _____

If you got a "hot tip" or a stock from a broker but the financial reports of the firm in question seemed unfavorable, would you buy the stock?

Yes _____ Sometimes _____ No _____

Do you value statistics when making your personal decisions?

Yes _____ Sometimes _____ No _____

Do you try to reduce a problem to a small series of related sub-problems?

Yes _____ Sometimes _____ No _____

When dealing with a problem do you search in your mind for analogies or rather do you try to find mathematical relationships between the elements of the situation?

Analogies _____Unclear _____ Mathematical relationships _____

Your friend shows you that paying theft insurance on your car throughout the next 30 years would cost as much as buying a new car and that the likelihood of your car being stolen in the next thirty years is only 30%. But your wife/husband has the feeling that the car will be stolen. Would you buy theft insurance for your car?

Yes _____ Sometimes _____ No _____

Do you take most of your repetitive decisions by trial and error?

Yes _____ Sometimes _____ No _____

Is it true that when you have to find some information about a new product you search in Google for technical information and product characteristics?

Yes _____ Sometimes _____ No _____

Do you like to have a mathematical model on which to base your decisions?

Yes _____ Sometimes _____ No _____

In a flirtatious situation do you act more the way you feel like acting rather than the way some consultant would lead you?

Yes _____ Sometimes _____ No _____

Is it true that you prefer to ask friends about the quality of a new product you want to purchase instead of looking for technical characteristics and prices?

Yes _____ Sometimes _____ No _____

Do you try to build a model of a typical situation if that is possible?

Yes _____ Sometimes _____ No _____

Do you find it difficult to make decisions?

Yes _____ Sometimes _____ No _____

Do you think that a careful analysis of the financial statements of a firm provides more information for a stock purchase decision than your feelings about the management of the firm after looking at its numbers?

Yes _____ Sometimes _____ No _____

Do you make your decisions on your intuitive feelings about a situation?

Yes _____ Sometimes _____ No _____

Is it true that you don't trust formulas to solve real life problems since they tend to oversimplify complex problems?

Yes _____ Sometimes _____ No _____

Do you tip percentually?

Yes _____ Sometimes _____ No _____

If you were buying a car, rank in order of importance to you (from 1 the most important to 5 the least important) the following factors:

A friends strong favorable recommendation _____

A technical report about it in the Consumer Report_____

Your feelings about the car_____

The car's technical specifications such as weight, torque, gallons per mile, horsepower, acceleration, etc._____

Appearance of the car_____

Do you ever buy something because you feel that this it the best thing to buy without analyzing much its characteristics or how it compares with other products?

Yes _____ Sometimes _____ No _____

A.2 Self assessment form

An analytic decision maker is a person who reduces a problem to a core set of causal relationships and tries to find an optimal solution by using formulas and models (fixed rules).

A heuristic decision maker is someone who emphasizes workable solutions to solve problems. He/she tries to solve problems through his/her intuitive feelings and by trial and error.

How would you describe yourself?

Analytic _____

Weakly analytic _____

Weakly heuristic _____

Heuristic _____

Appendix B

B.1 Coin Test

Coin test

The coin test consists of 2 parts, A and B. Both parts refer to the following problem:

You have a number of similar coins, which are all except one of the same weight. The number of coins is different in each question. The one coin that differs in weight is heavier (in all cases), but can in no other way be distinguished from the other. The only weighting instrument you have is a balance.

Your problem in each case is to determine which coin is the heavier one, given a limited number of times that you may use the balance.

Example:	# of coins	# of times you may weight
	4	2

In your answer you should clearly specify the coins you take to weight each time.

For example:

1st weight: 2 – 2

take 2 heavier ones

2nd weight: 1 – 1

the heavier one in the second weigh is the answer.

Only the questions of part A should be answered in detail (step by step).

For the questions in part B, you have only to state if you would be able to solve the problem (Yes or No).

You have 25 minutes to complete both parts A and B (suggested time limit).

1. Part A

	# of coins	# of times you may weight
a)	7	2
b)	10	2
c)	16	3

2. Part B

For the following questions you have only to state if you would or would not be able to determine which coin is the heavier one, given the number of coins and the number of times you may weight (Yes or No)

	# of coins	# of times you may weight	answer
a)	23	3	
b)	30	3	
c)	36	3	
d)	48	4	
e)	77	4	
g)	79	5	
h)	187	5	
i)	220	5	

3. Answer the following questions

a) Have you done this type of problem before?

b) Do you like this type of problem?

c) How did you try to solve the problem? (Please describe as explicitly as possible the way you actually approached the problems on the foregoing pages).

B.2 Pitcher Test

Pitcher test

The pitcher test consists of 2 parts, A and B. Both parts refer to the following problem

You have one barrel filled with wine (31 1/2 gallons). The only measures you have are 2 empty pitchers, whose capacity is stated in quarts. There are no marks on the pitchers, hence the **only** amount you are able to measure exactly with the pitcher is its capacity. The capacity of the pitchers is different for each question.

Your problem in each case is to measure a specific number of quarts, given the capacity of the pitchers. No wine may be spilled. Remember that you have no other containers than the 2 pitchers.

Examples:	Capacity P1	Capacity P2	Quarts required
	4	1	3

In stating your answer, you may use the following abbreviations:

B = barrel

P1 = pitcher 1

P2 = pitcher 2

The answer to the above question then becomes:

Take wine from B with P1

Put wine from P1 in P2

3 quarts are left in P1

Note that the quarts required have to be measured **exactly**.

You should give detailed solutions (step by step, as in example) to the questions of part A. For the questions in part B, you have to state if you would be able to solve the problem (Yes or No).

You have 25 minutes to complete both parts A and B (this is a suggested time-limit).

1. Part A

	Capacity P1	Capacity P2	Quarts required
a)	4	3	2
b)	8	3	4
c)	13	4	

2. Part B

For the following questions you have only to state if you would not be able to measure the required amount of quarts. (Answer Yes or No).

	Capacity P1	Capacity P2	Quarts req.	Answer
a)	16	4	6	
b)	61	12	50	
c)	29	9	24	
d)	32	7	29	
e)	25	6	20	

f) 47 13 42

3. Answer the following questions:

a) Have you done this type of problems before?
b) Do you like this type of problems?
c) How did you try to solve the problems? (Please describe as explicitly as possible the way you actually approached the problems on the foregoing pages).

B.3 Coin and Pitcher Test solutions

Coin Test

Analytic solution:

Let:

C = number of coins

X = number of weightings allowed

It is possible to detect the one heavier coin from C coins in maximally x weightings, if C 3^x

Pitcher Test

Analytic solution:

Let:

P1 = Larger of the two pitchers

P2 = Smaller of the two pitchers

If Capacity of P1-(Capacity of P2 minus the rest of the division of P1/P2) = number divisible by the quarts required, it has a solution

Appendix C

The validation of the Heuristic/Analytic classification techniques

A separate experiment was designed to examine the heuristics/analytics questionnaire. One of the main concerns was the time required to complete the experiment. Participants had to fulfill the classification test and then the main experiment task and spending a long time in the first could reduce the efficiency of the second due to fatigue. Therefore, the purpose of this experiment was to test if a questionnaire that could be completed in less than ten minutes could discriminate participants in analytic and heuristic groups.

The Analytic versus Heuristic Questionnaire

This questionnaire was adapted from the questionnaire tested by Vasarhelyi (1973). It was developed from the descriptions given by Huysman (1968) of cognitive styles. Participants were asked how they would behave in hypothetical circumstances and what kind of decisions they would make. These questions were administered to fifteen subjects in a pilot run. This pilot was designed to refine the questionnaire and eliminate the non-discriminating questions.

Once the pilot test was completed and the results analyzed a new version of the questionnaire was prepared for the next step in the examination of the Analytic/Heuristic classification.

The Analytic/Heuristic Pilot test

The pilot test was conducted with fifteen subjects with different backgrounds, ages and education levels. The purpose of this pilot test was to refine the questionnaire, test the inter-judge rate of reliability and examine the correlation between the several measures. All of the subjects answered the questionnaire and the self-assessment question. Due to time limitations, most subjects completed only one of the coin and pitcher tests; six completed the coin test and eight the pitcher test. Coin and pitcher tests were rated by two judges. These ratings were compared using Kendall-tau correlations with both showing very high inter-judge rate of reliability. Table 17 Coin test ratings and Table 18 Pitcher Test Ratings display the results of these tests. In the cases where judges did not agree, subjects were given the mean score.

Table 17
Coin Test ratings

Participant	Rating Judge 1	Rating Judge 2	Average Rating
1	1	1	1
2	3	4	3.5
3	3	3	3
4	4	4	4
5	1	1	1
6	2	2	2

Kendall's tau Correlation .923 Sig. (2 tailed) .016
Table 17 Coin test ratings

Table 18
Pitcher Test ratings

Participant	Rating Judge 1	Rating Judge 2	Average Rating
1	2	2	2
2	3	3	3
3	1	1	1
4	2	2	2
5	2	2	2
6	2	2	2
7	1	1	1
8	2	1	1.5

Kendall's tau Correlation .835 Sig. (2-tailed) .017
Table 18 Pitcher Test Ratings

Ratings in the questionnaire, except for question 19, were made by attributing 1 for a yes, 2 for a sometimes and 3 for a no. Question 19 required the ranking of five attributes according to the subject's preference. Two judges agreed on a ranking that would correspond to an analytic individual. Participants' responses were evaluated using the Kendall test. When the result was <= 4 the question was assigned a value of 1, when it was > 4 <= 6 the question was assigned a value of 2, and when the result was > 6 (maximum possible was 10) the question was assigned a value of 3. Questions 3, 6, 7, 8, 12, 16, 17 and 20 were reverse coded.

Table 19 shows the descriptive statistics of the questions included in the questionnaire

Table 19
Descriptive Statistics for Questionnaire answers

Question #	Mean	Std. Deviation
1	1.22	0.7238
2	1.40	0.5071
3	1.50	0.7596
4	1.80	0.6761
5	1.93	0.7988
6	2.07	0.8837
7	2.40	0.8281
8	1.93	0.8287
9	1.80	0.7746
10	1.07	0.8837
11	2.54	0.5189
12	2.07	0.7037
13	1.87	0.8338
14	1.93	0.5936
15	1.58	0.7559
16	2.00	0.5345
17	1.87	0.7432
18	1.46	0.7763
19	1.33	0.4880
20	1.93	0.7988

Table 19 Descriptive Statistics

Questions were evaluated and responses examined. Kerlinger and Lee (2000) define reliability as "the lack of distortion or precision of a measuring instrument", and mention the following synonyms of reliability "dependability, stability, consistency, reproducibility and lack of distortion." They also state "a highly reliable measure only tells us that it is measuring something precisely or consistently." Rogers (1969) suggests that total scores represent the best available measure of the total concept, and the correlation between each scale item with the total score indicates the degree to which

items in a scale measure the same dimension. The internal consistency of the test was examined and questions were deleted according to this criterion. The results were also examined to test the discriminating power, because a reliable instrument with no discriminating power would not be desirable. The correlation between questions 2, 3, 12, 14, 15, 17 and the total score were smaller than 30%, therefore they were considered undiscriminating, but remained in the questionnaire as fillers. Correlations between questions 5, 6, 8, 10, 13, 18, 19, 20 and the total score showed significant association. A specific combination was chosen as best of these combinations and used in the final rating of the instrument. The criteria to develop these combinations involved the examination of internal consistency by the level of correlation with the pitcher and coin tests. These correlations were calculated using parametric (Pearson's) and nonparametric (Spearman and Kendall's) tests obtaining similar results.

The correlations between different instruments were calculated using the mentioned tests, and are displayed in Table 20.

Table 20
Correlations among the different instruments in the pilot test

	A/HQuest.	Coin Test	Pitcher Test	Self Assessment	A/HRating
A/HQuest.	1.00				
Coin Test	.832* (.04)	1.0000			
Pitcher Test	.434 (.282)	.917 (.083)	1		
Self Assessment	-0.516* (0.049)	-.655 (.158)	.504 (.203)	1.00	
A/HRating	-.831* (.00)	-.926** (.008)	-.178 (.674)	.645** (.009)	1.0000

Table 20 Correlation among instruments pilot

Pearson correlations between the tests indicate that the Analytic/Heuristic Questionnaire is significantly correlated with the Self Assessment. It is also correlated with the coin test. Since there are only 6 subjects in the coin test, a non-parametric test is more appropriate. Kendall and Spearman's tests indicate similar results.

A non-parametric test for the difference of means (Mann-Whitney) of the score of the questionnaire was performed between analytics and heuristics. The means were significantly different indicating a good discriminating power of the questionnaire

The Analytic/Heuristic validation test

The validation of the test was done with sixty undergraduate students in an Introduction to Financial Accounting class. The purpose was to test if the questionnaire that was tested with subjects from different disciplines would be discriminating with a more uniform population of students in business.

The students were given the analytics/heuristics questionnaire and after finishing it, the self-assessment question, to avoid the bias that knowing what was being tested might produce. All the students finished in less than five minutes.

The result of the classification into analytics and heuristics using the analytics/heuristics questionnaire was significantly correlated with the self-assessment test. Results are shown in Table 21.

Table 21

Correlations between the analytics/heuristics rankings and the classification instruments

	A/Hrate	A/HQuestionnaire	A/HSelfAssessment
A/Hrate	1		
A/HQuestionnaire	-.856* (.00)	1	
A/HSelfAssessment	.292* (.026)	-.246 (.063)	1

Table 21 Correlation between analytics/heuristics rankings

A t-test was performed to evaluate the discriminating power of the instrument. The results show that the means between the analytics and heuristics groups are different and that the difference is statistically significant (Table 22).

Table 22
Difference in means Analytics/Heuristics

	A/HQuestionnaire		A/HSelfAssessment	
	Analytics (29)	Heuristics (31)	Analytics (29)	Heuristics (29)
Mean	2.2238	1.6987	0.3793	0.6897
Std. Dev	0.1884	0.1307	0.5614	0.4706
Sig. (2 tailed)	.000		.026	

Table 22 Difference in means Analytics/Heuristics

In order to characterize if there is association between the major and the cognitive characteristics of the subjects, the analytic/heuristic rate was regressed into demographic items (age, business/non business, accounting/non accounting and finance/non finance majors). The results show that there is no significant association between the major and the analytic heuristic cognitive style. This result confirms that individuals more likely to evaluate financial statements are not necessarily analytics, and therefore the development of tailored reports will be useful to them.

Appendix to Chapter V - The case and questionnaires

Consent Form

Tailored financial information for individuals with different cognitive characteristics

You are invited to participate in a research study that is being conducted by Silvia Romero, PhD candidate in the Rutgers Business School. The purpose of this research is to determine whether individuals with different cognitive characteristics benefit from financial information presented in different formats.

Approximately 50 subjects will participate in the study, and each individual's participation will last approximately sixty minutes. The study procedures include analysis of two companies' financial information, and completion of three questionnaires.

Subjects will first be asked to complete a questionnaire to classify them according to their cognitive characteristics. This questionnaire will take less than 5 minutes.

After the first questionnaire, financial information about two companies will be given, as well as a questionnaire to measure how the format of the information affects the participant's decision. The analysis and the questionnaire will take approximately 30 minutes to complete.

The final phase will be an additional questionnaire asking for demographics and recall questions of the information analyzed. This questionnaire will take approximately 30 minutes.

If you agree to take part in the study, you will be assigned a random code number that will be used on each questionnaire. Your name will appear only on a list of subjects, and will not be linked to the code number that is assigned to you. There will be no way to link your responses back to you. Therefore, data collection is anonymous.

There are no foreseeable risks to participation in this study. The experiment will be conducted in one session, and you will given lunch after you finish with your task.

Participation in this study is voluntary. You may choose not to participate, and you may withdraw at any time during the study procedures without any penalty to you. In addition, you may choose not to answer any questions with which you are not comfortable.

This research is anonymous. Anonymous means that I will record no information about you that could identify you. This means that I will not record your name, address, phone number, date of birth, etc. If a report of this study is published, or the results are presented at a professional conference, only group results will be stated.
If you have any questions about the study procedures, you may contact Silvia Romero at sromero@pegasus.rutgers.edu. If you have any questions about your rights as a research subject, you may contact the Sponsored Programs Administrator at Rutgers University at:
Rutgers University Institutional Review Board for the Protection of Human Subjects
Office of Research and Sponsored Programs
3 Rutgers Plaza
New Brunswick, NJ 08901-8559
Tel: 732-932-0150 ext. 2104
Email: humansubjects@orsp.rutgers.edu

By clicking this box you agree to participate
I agree (box)
IMPORTANT
Read this page before beginning the case

This case is about how non-professional investors evaluate financial information.
The case consists of analyzing two firms and answering two questionnaires related to your analysis.
All of your questionnaire responses will be kept confidential.
To start, please answer the following set of questions at face value. Do not try to read anything into them. Do not take a long time to decide on an answer. Respond with your first impression. You will then be directed to the task related questionnaires.
Thank you
To begin please click on the box below

Top of Form
enter

Instructions

Assume that you have $1000 and you want to invest the money in shares of common stock. You are considering two companies; both of them in the software development industry, and your analysis should lead you to select any or both of them for investment. Due to the nature of this competitive industry, their future sales depend on their ability to maintain their market share. Keeping the best employees they can hire and train, as well as investing in research and development costs are important factors. However, investment in new products is inherently speculative, and does not guarantee the profitability of new developments.

You will be provided financial information of both companies. Once you complete your evaluation of performance, your task is to decide how to invest the money, and to explain how you reached to that decision

After you finish with this questionnaire, you will be given another one with 11 questions about your evaluation and your decision. In this new step you will not have access to the material to answer the questions.

Questionnaire II

1. If you had to invest all $1000 in one firm, which one would you invest in? (check)
   A
   B
   Why?

_____
_____
_____
_____
_____
_____

2. If you could invest in both firms what percentage would you invest in each?

A	
B	
Total	100%

3. How confident are you with your decision?

1 2 3 4 5 6 7

Not at all confident — Very confident

4. Briefly discuss the following information of A:

Income of the period

_____
_____

R&D expenses

_____
_____

Salaries

_____
_____

Assets

_____

Future Sales

5. Briefly discuss the following information of B:

Income of the period

R&D expenses

Salaries

Assets

Future Sales

Questionnaire III

1. Is there any difference in the proportion of software expenses capitalized by each firm?
    a. A capitalized more than B
    b. B capitalized more than A
    c. There was no difference

2. Is there any difference in the expected income for each firm during the next year?
    a. A is expected to have more income than B
    b. B is expected to have more income than A
    c. There was no difference

3. Do the companies have the same ability to pay future debt?
    a. A has better ability than B
    b. B has better ability than A
    c. Both have equal ability

Why?

4. Is there any difference in the ability of the companies to collect receivables?
    a. A has better ability than B
    b. B has better ability than A
    c. Both have equal ability

5. If you had to invest all $1000 in one firm, which one would you invest in? (check)
    a. A
    b. B

Why?

---

6. If you could invest in both firms what percentage would you invest in each?

A	
B	
Total	100%

7. How many times have you evaluated a company's performance by reading the financial statements and related disclosures? (check)
    a. Never
    b. 1 - 5 times
    c. 6 - 10 times
    d. more than 10 times

8. How many accounting and finance courses have you taken?
   a. Accounting_____
   b. Finance_____

9. Have you ever bought or sold an individual company's common stock? (check)
   Yes / No

10. How many years have you been buying or selling individual common stocks?
    _____ years

11. Have you ever analyzed financial statements using an on-line provider like yahoo finance?
    Yes /No

12. Do you plan to invest in an individual company's common stock in the future?
    Yes /No

13. How do you plan to research the investment? (check)
    a. On my own using the web
    b. Looking advice from an analyst
    c. Both

14. How do you plan to make the investment? (check)
    a. By myself
    b. Pay a broker
    c. Both
    d. I am not planning to make an investment in future.

15. How many years of full-time work experience do you have?
    _____ years

16. Do you feel that the experiment was? (check)

1	2	3	4	5	6	7
Unmotivating						Challenging

1	2	3	4	5	6	7
Easy						Difficult

Age _____ Gender_____

Appendix to Chapter VI

The Case

IMPORTANT

Read this page before beginning the case

Please, read the following text with information about a company. After you finish with it you will be asked questions about the company and you will be required to answer them without having access to the text. Please, work alone.

All of your questionnaire responses will be kept confidential.

By clicking the box you are accepting to participate. Thank you,

Instruments

Version Schematic Organization

COMPANY A 2006
Revenue Cycle

A is a company in the Software and Hardware development industry. Every segment of the software business is competitive and subject to rapid technological change, evolving customer requirements, and changing business models.

We distribute our products primarily through resellers and online services. Our customers include individuals, small and medium-sized organizations, educational institutions, and application developers. Individual consumers and small-sized organizations obtain our products primarily on-line. Customers who purchase our services sign a year contract and pay a monthly fee. Hardware and Software purchases are usually collected 30 days after delivering the product.

During 2006, a new customer, Starter, purchased equipment for start up. Sales to Starter accounted for approximately 22% of total sales in fiscal year 2006. Starter is experiencing financial problems and has not been paying the installments during the last six months. They expect to overcome their difficulties gradually and we are negotiating the payment of their $700,000 debt plus interests, beginning in 2008. We do not expect Starter to make major investments in hardware and software next year, but they will keep on paying the monthly service fee. All the remaining customers are minor. We have $8.95 million long-term debt due on September 2007, and since we are facing a

cash shortage we plan to pay this debt by offering a special discount to those Customers who anticipate their payments.

Cash for fiscal year 2006 decreased 46% to $ 4.35 million due primarily to an increase in payments of research and development costs. Besides, we signed an agreement with the CEO and anticipated him $1.2 million of future salaries. This loan will be discounted each month from his salaries.

We expect the markets for our products to continue growing as a result of the development of new products and services that are specifically designed to appeal to emerging markets. Among them are products designed to be readily available and affordable for first-time users. We also expect our anchor businesses to grow through successfully competing against alternative solutions.

The development of software products is a complex and time-consuming process. New products and enhancements to existing products can require long development and testing periods. We have made and will continue to make significant investments in research, development, and marketing for new products, services, and technologies. Investments in new technology are inherently speculative. Commercial success depends on many factors including innovativeness, developer support, and effective distribution and marketing. Significant revenue from new product and service investments may not be achieved for a number of years, if at all. Moreover, new products and services may not be profitable, and even if they are profitable, operating margins for new products and businesses may not be as high as the margins we have experienced historically. During fiscal years 2004, 2005, and 2006, research and development expenses represented an average of $5 million, 20% of the operating expenses of those years. During 2006 $19,000 in Research and Development costs were capitalized since a new set of PC video games was developed and proved feasible. We plan to continue significant investment in a broad range of research and product development.

Research and development expenses include payroll, employee benefits, stock-based compensation, and other headcount-related costs associated with product development. Research and development expenses also include third-party development and programming costs, and the amortization of purchased software code and services content. Our research and development expenses increased in fiscal year 2006 due to a special effort put in developing new products to keep our levels of revenue.

Cost of revenue includes manufacturing and distribution costs for products sold, operating costs related to product support service and product distribution centers, costs incurred to maintain Internet-based products and services, and costs associated with the delivery of consulting services.

Sales and marketing expenses include payroll, employee benefits, stock-based compensation, and other headcount-related costs associated with sales and marketing personnel and advertising, promotions, tradeshows, seminars, and other marketing-related programs. For fiscal year 2006, these costs were increased because of a special advertising campaign we were developing to increment the sales. Advertising costs are expensed as incurred.

Version Taxonomic Organization

Balance Sheet

Thau is a company in the Software and Hardware development industry.

Cash and equivalents:

Cash for fiscal year 2006 decreased 46% to $ 4.35 million due primarily to an increase in payments of research and development costs.

Accounts Receivable:

Starter, one of our major customers, is experiencing financial problems and has not been paying the installments during the last six months. They expect to overcome their difficulties gradually and we are negotiating the payment of their $700,000 debt including interest beginning in 2008. Starter will keep paying the monthly service fee during next year.

Other Receivables:

We signed an agreement with the CEO and anticipated him $1.2 million of future salaries. This loan will be discounted each month from his salaries.

Inventory:

We produce the hardware and software ourselves. We expect the markets for our products to continue growing as a result of the development of new products. At the same time, we are developing new products and services that are specifically designed to appeal to emerging markets. Among them are products designed to be readily available and affordable for first-time users. We also expect our anchor businesses to grow through successfully competing against alternative solutions.

The development of software products is a complex and time-consuming process. New products and enhancements to existing products can require long development and testing periods. We have made and will continue to make significant investments in research, development, and marketing for new products, services, and technologies. Investments in new technology are inherently speculative. Commercial success depends on many factors including innovativeness, developer support, and effective distribution and marketing. Significant revenue from new product and service investments may not be achieved for a number of years, if at all. Moreover, new products and services may not be profitable, and even if they are profitable, operating margins for new products and businesses may not be as high as the margins we have experienced historically.

During 2006, $19,000 in Research and Development costs was capitalized since a new set of PC video games was developed and proved feasible.

Liabilities:

We have $8.95 million long-term debt due on September 2007. We plan to pay this debt by offering a special discount to those Customers who anticipate their payments.

Income Statement

Sales:

Every segment of the software business is competitive and subject to rapid technological change, evolving customer requirements, and changing business models.

Our customers include individuals, small and medium-sized organizations, educational institutions, and application developers. Individual consumers and small-sized organizations obtain our products primarily on-line. Customers who purchase our services sign a year contract and pay a monthly fee. Hardware and Software purchases are usually collected 30 days after delivering the product.

Sales to Starter accounted for approximately 22% of total sales in fiscal year 2006 but we do not expect Starter to make major investments in software and hardware next year,

Cost of Revenue:

Cost of revenue includes manufacturing and distribution costs for products sold, operating costs related to product support service and product distribution centers, costs incurred to maintain Internet-based products and services, and costs associated with the delivery of consulting services.

Research and development:

Most of our software products are developed internally. During fiscal years 2004, 2005, and 2006, research and development expenses represented an average of $5 million, 20% of the operating expenses of those years. We plan to continue significant investment in a broad range of research and product development.

Research and development expenses include payroll, employee benefits, stock-based compensation, and other headcount-related costs associated with product development. Research and development expenses also include third-party development and programming costs, and the amortization of purchased software code and services content. Our research and development expenses increased in fiscal year

2006 due to a special effort put in developing new products to keep our levels of revenue.

Distribution, Sales and Marketing Costs:

We distribute our products primarily through resellers; and online services. Sales and marketing expenses include payroll, employee benefits, stock-based compensation, and other headcount-related costs associated with sales and marketing personnel and advertising, promotions, tradeshows, seminars, and other marketing-related programs. For fiscal year 2006, these costs were increased because of a special advertising campaign we were developing to increment the sales. Advertising costs are expensed as incurred.

Questionnaire[5]

1. How many mayor customers does the company have?
a. 1
b. 2
c. I don't know

2. Did (company's name) capitalize R&D?
a. Yes
b. No
c. I don't know

3. If it capitalized, was the amount significant?
a. Yes
b. No
c. I don't know

4. How do customers pay for services?
a. In advance
b. 30 days after service
c. They sign a contract and pay per service
d. They sign a contract and pay a monthly fee
e. I don't know

5. How do customers pay for software purchases?
a. In advance
b. 30 days after delivery
c. Monthly
d. I don't know

6. How are products distributed?
a. On line and retailers
b. On line and company store
c. Reseller and company store
d. I don't know

7. Does the company have other receivables besides Accounts Receivables?
a. Yes
b. No
c. I don't know

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[5] [5] Questions 1 to 9 are used to measure knowledge acquisition
Questions 10 to 14 are used to measure assessment

8. Why did Cash decrease during the past year?
a. Paid dividends
b. Invested in R&D
c. Paid Loan
d. I don't know

9. (Company Name) states that
a. R&D are speculative
b. Increase in R&D will increase sales
c. Both

10. The likelihood that the company wil be able to pay its future debt during this year:

1.	2.	3.	4.	5.	6.	7.
Very Unlikely						Very likely

11. How do you expect the sales to be next year?

1.	2.	3.	4.	5.	6.	7.
Lower than This year			Same as this year			Higher than this year

12. How do you expect the loan to impact the availability of cash next year

1.	2.	3.	4.	5.	6.	7.
No Harm						Harm a lot

13. How do you expect the R&D expenses will impact next year's sales?

1.	2.	3.	4.	5.	6.	7.
No increase In sales						Significant increase in sales

14. How do you expect collections to increase during next year?

1.	2.	3.	4.	5.	6.	7.
No increase No plan						Increase a lot Good plan

15. How likely is it that you would invest in the company?

1.	2.	3.	4.	5.	6.	7.
Not at All						Very likely

16. How confident are you with your assessment of the company?

1.	2.	3.	4.	5.	6.	7.
Not at all						Very confident

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