2010

How Users Actually Use Financial Statements: A New Tool for Research in Experimental Accounting

Kevin Burke
Claremont McKenna College

CLAREMONT MCKENNA COLLEGE

HOW USERS ACTUALLY USE FINANCIAL STATEMENTS: A NEW TOOL FOR RESEARCH IN EXPERIMENTAL ACCOUNTING

SUBMITTED TO

PROFESSOR ANANDA GANGULY

AND

DEAN GREGORY HESS

BY

KEVIN BURKE

FOR

SENIOR THESIS

FALL 2010

NOVEMBER 29, 2010

Acknowledgements

Thank you to my patient thesis reader and adviser, Ananda Ganguly, who steered this non-accounting student through a thesis in accounting, and held me to a high standard throughout the process. Thanks also to Nzinga Broussard, for your advice and encouragement throughout the process. Finally, I would like to thank my family, who made this possible.

CONTENTS

ABSTRACT

This thesis presents a new methodology based on directly measuring user behavior and making decisions based on experimental results. I have built and tested a tool which will enable researchers to use the methodology to determine whether particular financial statement presentations are more beneficial than others. The tool records user movement on a computer screen with mouse tracking, which allows researchers to track user behavior in greater detail than ever before. The methodology was tested on a subject pool of non-professional financial analysts and junior professionals, who were presented with a company's financial data in the current GAAP and a new proposed FASB presentation format. The results show that this methodology could be useful in differentiating between present GAAP and proposed alternatives.

CHAPTER 1

Introduction

In this paper, I will outline the benefits of the user testing methodology and why the Financial Accounting Standards Board (FASB) should consider giving an expanded role in its decision making process to user testing, especially when setting standards for the presentation of financial data. I will summarize the current state of FASB experimental methods and point out where they can be improved by using the new methodology. I will then outline the features of a new Web tool that I have built to capture user behavior in precise detail. I have conducted experimental research to display some of the capabilities of the tool; the results show that the tool can be useful in determining whether the FASB should recommend one presentation of financial statements over another.

I have built an open-source, cross-platform Web interface which displays accounting statements and questions about the statements side-by-side, that the Board and researchers can use to measure how analysts use financial statements. The tool tracks viewing and mouse hover behavior to generate large amounts of data about how users are actually using financial statements. In addition, the tool allows users the convenience of allowing users to participating remotely, instead of driving to the researcher's location to participate. The tool will allow the FASB to incorporate user testing methodology into its decision making process.

When asked who is likely to generate better predictions, an expert with decades of experience, or an observer who assumes no expertise and makes recommendations based

on her observations, many people would pick the expert, whose opinions are highly valued. In practice, the expert's opinions may be colored because of his long years of experience. The expert is also vulnerable to assuming that every other user acts in the same way as himself. Usability research has shown that the observer, who does not form opinions but instead trusts her observational skill, is much more likely to generate good recommendations than the intuition of an individual expert.

The day-to-day job of the FASB is to research problems and discrepancies in Generally Accepted Accounting Principles (GAAP), the framework of guidelines for financial reporting in the United States, and to write opinions instructing companies on how they should report their financial data. Their goal in setting standards is to maximize the chance that a company's financial statements reflect the financial position of the firm, minimize the opportunity for a company to misrepresent itself, and ensure that companies with similar characteristics report their data in the same way. The Board is composed of five respected accountants with decades of experience in business and academia, who are well-versed in the GAAP framework. The Board chooses its areas of emphasis reactively; they choose an issue to study based on the concerns and requests of users, and then write an opinion to resolve the problem. Because the FASB chooses what to research based on the concerns of users, this methodology is defensive and reactive in nature; problems must arise before they are investigated. As the recent financial crisis has shown, assets are becoming more complex, and financial statements are becoming more volatile, so it is essential for the FASB to be able to anticipate or react to new developments quickly. As the standards setter for all companies registered in the United States, if the FASB could anticipate and avoid problems with GAAP, rather than constantly respond to problems

reported by users, they could improve the speed at which they make decisions, and the consistency of financial reporting guidelines in the United States.

The FASB can improve its decision making process by watching users use financial statements, especially when it is considering rules affecting the presentation of financial data. The FASB currently asks users for their input, but users may say one thing to the FASB and actually do another when they are evaluating financial statements for their own benefit. The user or preparer of financial statements has the incentive to maximize their own gain from FASB policy, while the FASB wants to maximize the gain across all parties involved in financial statement disclosure. Constituents may benefit from flaws in GAAP, especially preparers of financial statements or analysts with access to other information about the health of the firm, and have an incentive to obscure this information from the FASB. By asking users to complete tasks with financial statements and observing them in the process of evaluation, the FASB can sidestep some of the incentive issues that arise from listening to user concerns. The FASB may also find in the process of observing users that their assumptions about user behavior do not match well with actual user behavior.

Companies and firms are increasingly making decisions based on tests performed directly on users. This approach has taken an especially firm hold in the technology industry, where the Internet makes it easy to track user behavior in precise detail. By testing users before implementing changes, companies that use the new methodology ensure that they will never implement a change that is worse than the current status. These companies place less weight on management expertise and opinion, and more weight on what their data tells them about user behavior.

There is a lack of accounting research exploring how users actually use financial statements to answer questions. As a result, researchers and the FASB have a limited ability to determine whether analysts use a specific line item to determine the answer to a specific question. The current experimental standard is to measure differences in user responses to questions about financial statements prepared in a specific way. Detailed user testing research has not been conducted in the past because the tools to measure user behavior in precise detail have not existed. I have built a tool that will let researchers explore how users actually use financial statements, and that will help improve the FASB's decision making process.

CHAPTER 2

The current state of experimental accounting

In this section I will outline the current state of experimental research into financial statement presentation, focusing on the methods the authors used to derive their results and the limitations of those methods. I will show that my tool could have helped the authors gather more data to support or reject their hypotheses about user behavior.

Multiple studies have established that the presentation of financial data affects a user's perception of the health of the underlying company. Maines and McDaniel (2000) found that nonprofessional investors take the volatility of comprehensive income into account only when it is presented in the statement of comprehensive income, not in the statement of stockholders' equity. The experiment was designed to test SFAS No. 130, an FASB ruling in 1997 that required companies to report their comprehensive income, but allowed them to do so on either the income statement or the statement of stockholders' equity.

As Maines and McDaniel describe in their paper (2000), analysts were upset that companies were obscuring items of comprehensive income by combining them with other categories of income in the equity statement. The FASB responded to the complaint by issuing a proposal, inviting comment from financial statement preparers and analysts, and finally issuing a ruling that companies could either report comprehensive income in the income statement or in the statement of shareholders' equity. Allowing companies flexibility to report income on the income statement or on the equity statement was thought of as a compromise between analysts, who wanted the information listed on the income statement, and preparers, who wanted to present the information in the statement

of stockholders' equity. Instead of determining which presentation would lead to better analysis, or gathering data on the issue, the FASB put off the decision for further study. Maines and McDaniel found that the presentation significantly affected users' analysis of the data, but their experiment was published two years after the FASB issued SFAS No. 130.

Even though they conducted only one experiment, the results collected by Maines and McDaniel would have provided more information to the FASB about which option they should have chosen. Had the FASB commissioned this test before writing SFAS No. 130, they would have seen that there were significant differences in analyst perception depending on the location of information about comprehensive income.

Maines and McDaniel based their analysis on statistical tests of user responses to questions asked on a Likert scale. The authors used a between-subjects design, where some subjects received the comprehensive income information in the statement of comprehensive income, and others in the statement of shareholders' equity. In addition, some of the subjects analyzed a firm that had high earnings volatility, while the other half analyzed a firm with low volatility. The subjects were asked to rate management's effectiveness at managing operations and the risk of investing in the company's stock. After they completed those questions, they were given a second set of questions about the volatility of the company's unrealized gains. Subjects in each group report having seen the comprehensive income figure, but only the group that saw the comprehensive income on the income statement correctly assessed the volatility. Maines and McDaniel's only experimental data were the user responses on the Likert scale; they could not examine

what data users looked at to make their decisions, or the length of time that users spent examining the information in each part of the financial statements.

Experimental accounting is expensive, in terms of researcher time and experiment cost. As a result, researchers tend to extract as much benefit as they can from a single experiment. In this case, the authors formed a hypothesis, developed an experiment, and were able to have their results published in *The Accounting Review*, for one test given to 95 users. Given the expense of developing hypotheses, testing users, and publishing results, it makes sense for researchers to collect as much data as possible from a single experiment.

In another test in 2010, Clor-Proell, Proell and Warfield found that presenting information about the changes in the fair value of an asset in a prominent side column affected their perception of the reliability of the information, but users did not see a significant difference when the information was presented in current GAAP format. The participants in this study were shown an income statement and asked to make preliminary judgments, then shown information on the fair value of the asset and asked to make a second judgment about the firm's P/E multiple and the reliability of its financial statements. Each of these papers shows that the presentation of data can have an effect on how users judge the reliability and profitability of the underlying company. Clor-Proell, Proell and Warfield also used a Likert scale to measure user responses.

In another test conducted by the Financial Accounting Standards Research Institute (FASRI), the arm of the FASB that is supposed to use experiments to inform FASB standard setting, sixty credit analysts were split into one of four groups to measure the effect of disaggregation and classification on the face of financial statements or in the

notes to financial statements. The FASRI researchers used a between-subjects comparison and asked participants which firm they would rather downgrade, with the idea that differences between the two firms might be more evident in one condition than the other. The experiment generated significant results, which will help inform the FASB's future decision making process. However, the experiment was costly; the researchers had to make several trips to New York to gather the data from 56 analysts. If the cost of testing could be reduced, then researchers could either test more people or conduct more tests in the same amount of time.

The FASB's Current Decision Making Process

The FASB is composed of five members, four of whom have backgrounds in industry and one of whom comes from the academic realm, as well as around sixty staff members. Decisions are made by majority vote of the five board members. The International Accounting Standards Board (IASB), which sets accounting standards for most developed nations outside of the United States, has a similar structure, but has 16 members. Each member serves a five-year term, and can be elected to one additional five year term, during which time they are supposed to sever all ties with their previous employers and the industry.

The Board receives comments from users and preparers of financial statements about policies that the users believe are misleading. The Board conducts a formal user survey, and publishes a preliminary paper outlining its tentative recommendation. After that the Board is lobbied by every constituent who has a stake in the policy; in general, analysts like measures that make their statements more transparent, while companies

oppose regulations that make their statements more transparent. The Board crystallizes the proposal and takes a vote on whether to change GAAP or leave it as is.

The Board's main decision principle is to choose the option that holds most true to conceptual framework of the FASB, the Statements of Financial Accounting Concepts (SFAC) (Barth 2006). The FASB has published seven SFACs, which cover objectives of financial reporting, measurement in financial statements and other topics. The conceptual framework may make the FASB's rulings more consistent internally, but the guidelines may not give a clear recommendation in all cases, or may contain assumptions about which criteria are most useful for analysis. Doing research and testing users is likely to improve the quality of their opinions.

In the past, experiments conducted *after* FASB opinions have been released have produced data that likely could have been incorporated into making a better initial decision. Furthermore, with many users and lobbyists talking to the FASB at any one time, it may be difficult for the FASB to deduce the signal within all of the noise. Experiments are an excellent way to inform FASB research, and FASRI research has produced valuable data for the FASB, but experiments are costly in terms of hypothesis formulation and analyst time. If the cost of producing experiments could be shortened, then the FASB could conduct more experiments, leading to better policy. Furthermore, all experiments conducted so far involve presenting users with financial statements and then measuring responses to questions about the statements; no data is collected on what the analysts are actually doing with the statements to generate their recommendations.

CHAPTER 3

A New Research Methodology

All schoolchildren are taught that the scientific method is how we learn new things about the world. All academic research is conducted using the scientific method; a researcher makes hypotheses, then creates experiments or analyzes data to test the hypothesis, and publishes the results. The key component of the scientific method is that the data supports the conclusions of the researcher. In theory, anyone who wanted to replicate the researcher's work could do so and achieve the same results. In the research community, the opinions of researchers do not have any weight unless they are supported by results. As a general rule, academics do not have a personal interest in one result or the other; this ensures that their conclusions are not biased.

Many companies make decisions based not on evidence, but on the opinions of the management. Senior managers are hired because of their expertise, and they may believe that they are expected to justify their higher salaries by producing wisdom that leads to business success. For a business to trust experimental results over a manager's instinct, the management would have to admit that data is a better source of wisdom than the management, which many managers believe would cause them to lose respect among the employees. A manager who is confident in his opinion will not set up or test experiments; thus one incompetent manager can destroy a data-driven culture by insisting that everyone trust his intuition. This type of manager is so common that there is even a nickname to describe him - "HIPPO," or Highest Paid Person's Opinion (Wins). This refers to a person who always asserts his opinion over the group. As former Netscape

CEO Jim Barksdale once said, "If anyone has some data, let's hear it. If we're just going to use opinions, then we're going to use mine" (Sutton and Pfeffer 2006, 31). Barksdale is willing to trust the data, but other managers may believe that their opinion is sufficient. The corporate hierarchy is an obstacle to the experimental method, even though testing hypothesis before making decisions is likely to lead to better decisions than making decisions based on hypotheses.

Even a small amount of data is much more trustworthy than guesswork, and experts can often guess wrongly, especially in the field of design. Jakob Nielsen is the world's foremost expert in usability, notes in a paper that designers who use data are much more likely to generate correct decisions than users who guess. Nielsen asked a group of interface designers whether most users knew how to resize the fonts in their browser. Of the designers who only guessed the answer, 75% were incorrect, whereas 100% of the designers who referred to actual data were correct (Nielsen 2009). An online site called *Which Test Won?* (http://whichtestwon.com) provides more evidence that designers should trust the data over their opinions. On the site, two versions of the same page are presented and the audience (composed mostly of professional web designers) is asked which design improved sales or conversion rates. The number of people guessing incorrectly is often greater than 50%, stressing the importance of trusting the data over user opinion. Guesses about user behavior are likely to be wrong, even if made by experts; the data is more likely to yield good design recommendations.

Amazon, Google, Harrah's, and several other companies have embraced a new methodology that tries to remove HIPPOs from their management teams and instead make decisions based on the results of their experiments. These companies can quickly

test hundreds of hypotheses by running experiments on their websites and collecting the results.[1] If an experimental condition causes users to spend more money than the control group, the company shifts to the new design. This incremental iterative approach ensures that every change the companies make is guaranteed to move user behavior closer to the company's desired outcome. Gary Loveman, CEO of Harrah's, is famous for saying that there are three ways to get fired from Harrah's: steal, harass women, or institute a policy without first running an experiment. (Sutton and Pfeffer 2006, 15). Experiments are cheap to implement, relative to the cost of a bad business move; they only require a hypothesis and a method of measuring success. These companies are using the experimental methodology to gain an edge over their competitors.

Note that these companies gather data by directly measuring user behavior, instead of asking users to report their own behavior. They only trust measured user actions, because users are generally bad judges of their own behavior. In an article titled "First Rule of Usability? Don't Listen to Users" (2001), Nielsen outlines the reasons that firms should not trust the opinions of users, which are described below.

First, if users are given a series of designs and asked which design they like best, they will base their comments on surface features, instead of commenting which design is most likely to help them get the job done. A novel or interesting feature may look cool in a one-hour focus group, but when users have to use the feature to accomplish a task, they may find that it is not very useful. In the beginning days of the Internet, the management at many companies placed fancy 3D graphics and animations on their sites, because when asked, users told the management that 3D interfaces looked the best. However, the

[1] Google even employs an economist, Hal Varian, to help design its billion dollar advertisement auctions.

graphics caused pages to load very slowly, and often impeded a user's ability to accomplish basic tasks. 3D graphics and animations were not very effective at helping users do things on the Internet, which is why they are rarely seen on websites today.

If the firm asking the questions is the same one that has the power to make changes, users may say things that they think they believe the firm wants to hear, or what they believe the majority of users think. Users may be reluctant to criticize a firm's product, and often users who struggle to use a firm's product will blame themselves instead of the product. However, if the product has a feature that is particularly difficult to use, it will be difficult for everyone to use. It is difficult for firms to ask questions in a way that ensures that user answers are honest. While the FASB is not a firm, it faces the same problems as the firms that collect data in this fashion.

Second, according to Nielsen (2001), users can only tell you what they remember doing. Users cannot tell you about parts of a product that they did not see or use. In addition, when performing a complex task, they may not be able to remember what they were doing or why they were doing it. As an example, in a basketball game a player may make ten to twenty split second decisions in the course of a few seconds; good players are able to make these decisions without even thinking about them. If you were to ask them later why they chose to move to a particular position on the court, or pass the ball to a person, it would be difficult for them to provide an answer, because they made the decision without thinking. When browsing the Web, users similarly make many subconscious decisions about what to click on or what to read and asking them why is unlikely to yield satisfying results. Firms should be hesitant to trust user reported data because users' memories are fallible.

Third, people rationalize their behavior by offering qualifications and explanations for why they are behaving the way they are. Tests have shown that users do not think about *why* they are doing what they are doing when they are completing a task. Therefore, when they are asked later about why they did what they did, they often make up explanations that may not fully explain their behavior. Nielsen (2010) notes that users tend to make up stories about how they used a site to make their behavior sound more logical. Instead of relying on a user's stories, researchers should observe a user's actions, to avoid rationalization.

In conclusion, the experimental method can help decrease the number of costly actions taken by a firm, because the firm first tests the decisions to see if they will be an improvement over the status quo. Even though testing hypotheses leads to better results than blind implementation of hypotheses, management may be so confident in its own hypotheses that it sees no need to test them, possibly hurting the firm. The experimental method requires that companies measure actual user behavior instead of reported behavior, because reported behavior is unreliable. Experts often guess incorrectly, which is why evidence should drive a firm's decision making process. In the next section, I will outline the ways that the FASB can incorporate user testing methodology into its decision making process.

CHAPTER 4

How the FASB Can Improve Its Methodology

How can the FASB improve its decision making process by using the methodology? The primary goal of the FASB is to make financial statements accurately reflect the financial health of the underlying firm. The usability of financial statements depends upon their presentation and upon the rules that determine how financial data is reported. To ensure that analysts can perform accurate analysis, the FASB often issues opinions about how businesses should report data or record a transaction in their financial statements, with the goal of aligning a firm's financial statements with the true health of the underlying firm. Without measuring users in the process of decision-making, and testing new layouts or reporting requirements directly on users, the FASB must rely upon the opinions and analysis of its board members, which may contain flawed assumptions about user behavior. When choosing between multiple courses of action, the FASB's opinions can be informed by testing users and choosing the option that maximizes their ability to accurately assess the health of the underlying company.

It can take the FASB years from the day they decide to research an issue to the day that they write an opinion to resolve the problem, so their method for choosing their next research topics must be able to anticipate which issues are likely to be the biggest problems several years down the road. Currently, the FASB decides what to research by listening to concerns from its users. This means that the FASB can only act on an issue in response to a user complaint, and that the FASB's only knowledge of the problem comes from the user. Therefore the FASB is always *reacting* to problems with GAAP, instead of predicting them. The FASB is slow to learn about new problems with GAAP, and also

slow to research and write opinions, creating a large lag between the appearance of a problem with GAAP and the FASB's resolution of the problem, which makes many accountants unhappy with the FASB.[2]

FASB opinions may benefit preparers at the expense of analysts, or vice versa. The FASB may issue an opinion in response to complaints from preparers, and then years later hear complaints from analysts that they should not have changed the rule. The FASB also has no criteria to rate the seriousness of the issue reported by the user. Preparers and analysts each have an incentive to overstate the severity of their problems.

If the FASB conducted regular experiments to determine how users behave, they would be aware of gaps between their opinions about how users behave and how those users actually behave, which would inform the theories put forth in the SFAC. They would be able to anticipate problems that users have while analyzing financials, because they can watch users analyze statements and view the stumbling points. Then when a user raises a concern about financial statements, they could turn to their own estimate of the seriousness of the issue in question. For example, a lumber company analyst may say that the way lumber companies recognize revenue makes it difficult to determine the true financial position of the company. Currently, the FASB would determine whether this was actually an issue by asking other analysts if they had a similar problem. Instead, the FASB could look at its own research on the issue and determine that the large majority of users had no problem with the rule, and decide that it would be better to keep the rule in its current state.

How user testing would benefit the FASB

[2] See, for example, the footnotes to Mundstock (2003, 813)

The FASB is constantly under pressure from lobbyists and end users, who have an incentive to lobby only in support of their own interests. In this situation, it can be difficult for the FASB to accurately determine the seriousness of the issue at hand. The FASB could benefit from a series of user tests that will determine whether a proposed reporting measure helps or hurts consistency and transparency.

Specifically, they can benefit from research that allows them to see which parts of the financial statements are used to answer which questions about the financial health of a firm. This will allow the FASB to determine whether a particular line item in a company's financial statements is used by analysts to measure a particular problem in financial statement analysis. Moreover, watching users use financial statements will allow researchers to extract more data from each experiment that they conduct, and possibly conduct multiple experiments and test multiple hypotheses at the same time.

Furthermore, watching users use financial statements can also give researchers a better idea of what they should test next. Most experimental accounting research is based on exploring discrepancies between theory and practice; for example, measuring how user perception of the firm changes based on the presentation of financial statements. By watching users and collecting more data on their behavior, researchers can generate better hypotheses about how users act, and how they will respond to various changes to financial statements.

The FASB Presentation Project

The FASB has been involved in a ten-year process of converging GAAP with International Financial Reporting Standards (IFRS). The main component of the process is a change in the way that financial statements are presented, with some significant

changes in the internal data that companies are required to collect and report. The goal of the presentation project is to make it easier for stakeholders to make decisions about whether to provide capital to a firm and to estimate a firm's future cash flows.

In the proposal for the new agenda project in 2001, the FASB notes that "the principal reason for the project is to address significant financial reporting *concerns raised by constituents of the FASB"* [emphasis added] (FASB "Proposal" 2001, 1). One of the three main concerns noted in the proposal was that there was "Increased pro forma reporting and other evidence suggesting that the use of and reliance on net income as an indicator of performance is decreasing." Here the FASB admits that they have not measured the metrics analysts use for performance, but instead rely on self-reported evidence from analysts. Compared with proactively testing users, learning about issues from analysts is less likely to generate reliable information and more likely to cause a delay between the time a problem arises and the time the FASB begins work on a solution. Because it takes so long to research and prepare opinions, it is essential that the FASB have policies in place to quickly discover and evaluate problems. Waiting until users report the issues to the FASB is an unacceptable lag in policy.

The FASB began to work on the presentation project in 2002 by asking users what problems they have with financial statements. They received lots of feedback about what analysts wanted to see in financial statements (FASB 2002). The survey contained useful information about the problems and shortcomings users describe with the current statements, and what they would like to see in new statements. The survey results found that users were not dissatisfied with current financial statements, but were interested in receiving more information from firms on their statements, in the form of disaggregated

line items. However, as noted in section 2 of this paper, asking users to recall their difficulties in analysis, and asking them what features they would like to see in a new set of financial documents, is not an effective substitute for actually watching them use statements. In this phase, the FASB did not conduct user tests to verify user concerns that net income was not being used anymore.

After collecting the responses from users and doing some more research, the FASB put out a preliminary paper proposing the largest changes to financial reporting since the Depression, including grouping items by category (Operating, Investing, or Financing) instead of by type (Asset, Liability or Equity), and reporting cash flows directly, instead of getting cash flows by working backwards from net income.

THE AMES MANUFACTURING COMPANY
BALANCE SHEET
As of December 31, 1924

Assets		
Csah		$10,512
Accounts Receivable		5,857
Inventories		22,210
Fixed Assets		37,290
Prepaid Expense		2,459
Total Assets		$78,328
Liabilities and Capital		
Notes Payable—Trade	$1,000	
Notes Payable—Bank	2,000	
Accounts Payable	5,000	
Dividends Payable	2,000	
Accruals Payable	248	
Total Liabilities		10,248
Net Worth		$68,080
Represented by:		
Capital Stock Outstanding	$50,000	
Surplus	18,080	68,080

Figure 1: Sample balance sheet from Stephen Gilman's *Analyzing Financial Statements*, 19251.

As the figures to the right show, while the reporting and measuring requirements have undergone dramatic changes, the design of financial statements has not changed significantly in nearly a century. In the past, the FASB's research has focused much more on reporting requirements and standards than on large scale changes to the presentation of financial statements. The new presentation

WAL–MART STORES, INC.
Consolidated Balance Sheets

(Amounts in millions except per share data)	Januar 2010
ASSETS	
Current assets:	
Cash and cash equivalents	$ 7,907
Receivables, net	4,144
Inventories	33,160
Prepaid expenses and other	2,980
Current assets of discontinued operations	140
Total current assets	48,331
Property and equipment:	
Land	22,591
Buildings and improvements	77,452
Fixtures and equipment	35,450
Transportation equipment	2,355
Property and equipment	137,848
Less accumulated depreciation	(38,304)
Property and equipment, net	99,544
Property under capital leases:	
Property under capital leases	5,669
Less accumulated amortization	(2,906)
Property under capital leases, net	2,763
Goodwill	16,126
Other assets and deferred charges	3,942
Total assets	$170,706
LIABILITIES AND EQUITY	
Current liabilities:	
Short–term borrowings	$ 523
Accounts payable	30,451
Accrued liabilities	18,734

Figure 2: Sample balance sheet from Walmart's Annual Report, 2010. The categories are the same as they were in 1925.

represents both a challenge and an opportunity for the FASB; they may not be as prepared to conduct this type of user research, but they also have the chance to improve their research methodology. The current testing method used by the FASRI and others may not be sufficient to measure the effects of switching presentation formats so dramatically.

To generate usable feedback on the proposed presentation, the FASB should conduct user tests on the proposed statements to determine which new changes are most helpful for financial statement users and which changes make financial statements more confusing than the current GAAP. The FASB did attempt to get users' opinions by sending 43 analysts a company's statements prepared in both the old and the new financial format, and asking users to comment on the new presentation (FASB Staff Paper 9B). However, the FASB did not ask users to perform analysis using the new presentation, and it also gave them the company's statements in the old format, which provided users with a fixed point of reference. Thus the survey did not address the new presentation's usefulness in decision-making, as all analysts had access to both versions of each financial statement.

Switching to the new presentation format is likely to be very expensive for preparers and analysts, as Bloomfield et al noted (2008). Testing users on the new presentation is cheap relative to the cost of implementing a change that makes financial statements less usable. Ideally, the FASB would test each change, gather feedback on the effectiveness of the change in improving user decisions, and then repeat this process iteratively, so that the final standards are a product of multiple revisions. By spending

more money to test its hypotheses in the short run, the FASB can cut down on the number of problems with GAAP in the long run.

Companies with a data driven culture are making excellent decisions, because every move they make has been tested and will improve the value of the company. The FASB does not compete with other organizations, but it can improve its decision making process and reduce the number of errors it makes by testing changes before implementing them. To determine whether the FASB's proposed presentation is more usable than the current GAAP presentation, the FASB has been asking preparers and users to comment on the features they like and dislike. As shown in the previous chapter, this method is not as effective as asking users to complete representative tasks and observing them as they do so. Researchers and the FASB are more likely to get good results from testing hypotheses on users than they are by asking experts to give opinions on which outcome would be best.

Research into the effects of changes to the presentation of financial documents is much more of a design problem than research into the rules determining how line items should be reported. Because financial statements have not changed in appearance for so long, it is unlikely that the FASB is equipped to conduct this type of research effectively. As shown in the previous chapter, the best way to generate good design recommendations is to test various designs on users and iterate through this process until the designer finds one that works. The FASB does not currently have the tools to conduct this type of research.

CHAPTER 5

A New Tool and Methodology for Experimental Accounting

What would the ideal testing environment for accounting research look like? It should be easy to import and export financial data from the testing environment, and easy to make changes to those documents on the fly. Experimenters would also want to run every experiment with many different companies, and with many different experimenters in each condition. However, as a general rule, the easier the experiment is to set up and take, the easier it is to persuade people to participate. A user should be able to begin taking the experiment within one minute of receiving it, and the experimenter should be able to collect data without any extraordinary effort. The environment should also make it easy to set up different experimental conditions and assign experimenters to each different treatment group.

The environment should allow researchers to collect every single possible piece of information about the participant, which would mean following their eye as it moved across the data. In addition to their responses to researcher questions, the researcher could analyze the amount of time it took analysts to answer each question, and the movement patterns for each question you asked. The researcher could then generate a heatmap, which would tell her which spots on the page the user looked at the most, and she could determine where their eye looked when the user answered each question.

I have built a tool that implements many of the features of the ideal testing environment for accounting research. The tool will also help the FASB improve its decision-making methodology and conduct research into the effects of the new financial

statement presentation. The tool is entirely Web-based and allows the researcher to measure user behavior in more detail than has been possible before.

To make it simple to copy data into the Web tool, I wrote a program that makes it easy to import financial data from a comma separated value (CSV) file. This means that a researcher can take a given financial statement displayed on the Internet or in a Microsoft Excel file on his computer, and quickly convert it to a format that can be interpreted by the Web tool.

Another feature of the tool is that the underlying financial statement data and the questions asked of users can be swapped in and out independently of the software running in the background. The data contained in each financial statement is kept in its own file, and when the tool is run, all of the component parts are loaded in the browser. This makes it easy to adjust the experiment on the fly, or for the researcher to create a version of the testing environment for the researcher's own purposes.

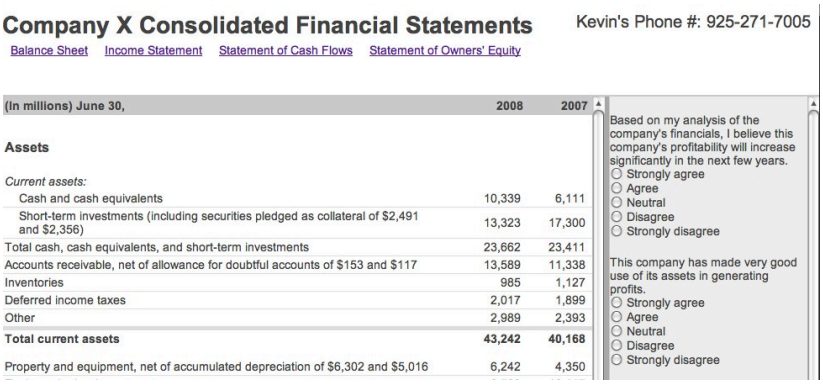


Figure 1: The web interface. The links at the top control the financial statement viewable in the main window. The questions are in grey on the right hand side.

The tool uses the Model-View-Controller (MVC) software architecture pattern, which breaks the data (the model), the instructions for how to display the data (the controller), and the styling of the data on the screen (the view) into three separate parts, so that any of these parts can be changed and work with any other part. This means

that the underlying financial data, as well as the code to run the experiment, only exists in one place.

The treatment groups are generated and tracked by the controller, and kept separate from the data. For example, in my experiment, half of the statements presented to subjects had all of the numbers multiplied by a factor of 1.45, so that the participants would not recognize that they were evaluating identical companies. Instead of creating a separate copy of the financial data with every number multiplied by 1.45, the tool used Javascript to manipulate the number displayed on the user's screen. This means that if the experimenter would like to make a change to the treatment groups, they only have to make the change in one place, and all of the experimental conditions will update automaticaly.

As the user completes the experiment, the position of his mouse is tracked twenty times per second and recorded in a mouse position log. The user's hover behavior is tracked in a separate "hover" log, which records a new event any time a user's mouse hovers over a piece of text on the screen. The hover log also records the user's scrolling behavior and the timing and values of his responses to the questions asked by the researcher.

```
1290551132035     INIT: ID:   6
1290551133723     BEGIN: User begins experiment
1290551133723     VIEW: User is currently viewing the Balance Sheet
1290551134140     HOVER: Data
1290551134591     HOVER:CAT:  Other short-term assets  YEAR: 2008  time: 17
1290551134607     HOVER:CAT:  Inventory    YEAR: 2008  time: 16
1290551134657     HOVER:CAT:  Inventory    YEAR: 2007  time: 50
1290551134774     HOVER:CAT:  Accounts receivable, net YEAR: 2007  time: 117
1290551136526     HOVER: Data
1290551136543     HOVER: Questions
1290551139650     VIEW: User is currently viewing the 2007 SCF Recon to IS
1290551140314     HOVER: Data
1290551140330     HOVER:CAT:        Employee travel    YEAR: Recurring Valuation Adjustmentstime: 17
1290551140346     HOVER:CAT:        Employee recruiting and training     YEAR: All Other   time: 16
1290551140363     HOVER:CAT:   YEAR: All Other    time: 16
1290551140380     HOVER:CAT:   YEAR: Comprehensive Income (B+C+D+E) time: 17
1290551140397     HOVER:CAT:        Overhead     YEAR: Comprehensive Income (B+C+D+E) time: 17
1290551140430     HOVER:CAT:        Materials and cost of services YEAR: Comprehensive Income (B+C+D+E) time: 33
```

Figure 2: A sample log file generated by user activity. The long numbers to the left are timestamps, measured to the millisecond.

Tracking the user's eye would be ideal, but the equipment is expensive and requires the subject's physical presence. Mousetracking is a close substitute for eyetracking. Chen, Anderson and Sohn (2001) conducted simultaneous mouse-and-eye

tracking while users browsed a website and found that on average, the mouse cursor was about 300 pixels from the user's eye, which is large (the average screen is about 1200 pixels wide). Furthermore, the average page visit during their study was 8-9 seconds, while users will view our experiment for twenty to thirty minutes at a time. However, they found that during their experiment, the user's mouse cursor visited 84% of the same regions that the user's eye visited. Significantly, the cursor also did not visit 88% of regions that the user's eye did not visit.

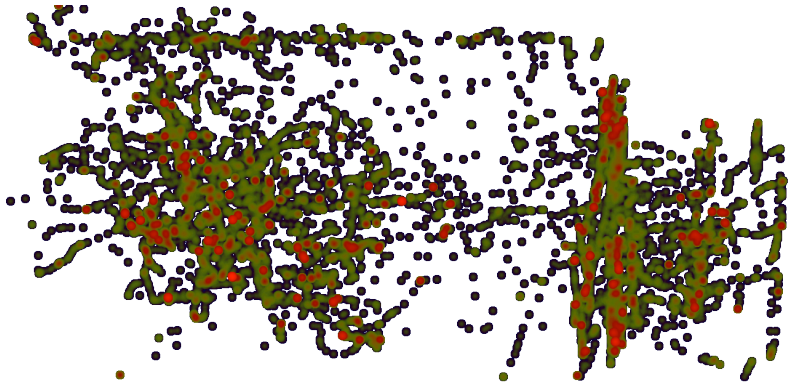


Figure 3: Sample heatmap of mouse movements during a user session. The user's mouse is active throughout the experiment. The large circle in the bottom left is where the financial data is displayed. The line at the top is where the user clicked to change the view, and the scrollbar and question forms are on the right.

There are some problems with using mousetracking for analysis. A user's mouse visits 84% of the same regions that a user's eye visits, but the mouse may not visit at the same time as the user's eye visits; their numbers measured the mouse movements over the total period of time that the user browsed the page. Furthermore, a significant subset of users do not move the mouse to follow their eye, which makes their behavior more difficult to track. However, because users are leaving my experiment open for twenty to thirty minutes at a time, the absence of the mouse's presence in an area of the financial statement is good evidence that the user did not take that part of the financial statement

into consideration. The tool is also designed so that only one financial statement is viewable at a time. This way, researchers can measure which statement users are looking at because they have to click on the statement to view the associated data.

I wrote numerous scripts to facilitate analysis of the data generated by the tool. The scripts automatically parse the logs generated by the tool and present the data in a format that can easily be imported into any data analysis program. One script determines the total amount of time the user spent answering a particular question, while another script determines the total amount of time users spent viewing each statement and the total number of times they switched between statements.

I also wrote a script that generates a heatmap (a colored chart that records the density of user activity) from a user's mouse behavior. The background of the heatmap is transparent, so it can be overlaid on the interface to determine where a user's mouse was positioned relative to the screen. The heatmap can be customized to show only mouse movements for each individual question answered, or to show only mouse movements for each individual financial statement. The code for these scripts is available online and in the appendix.

Figure 4

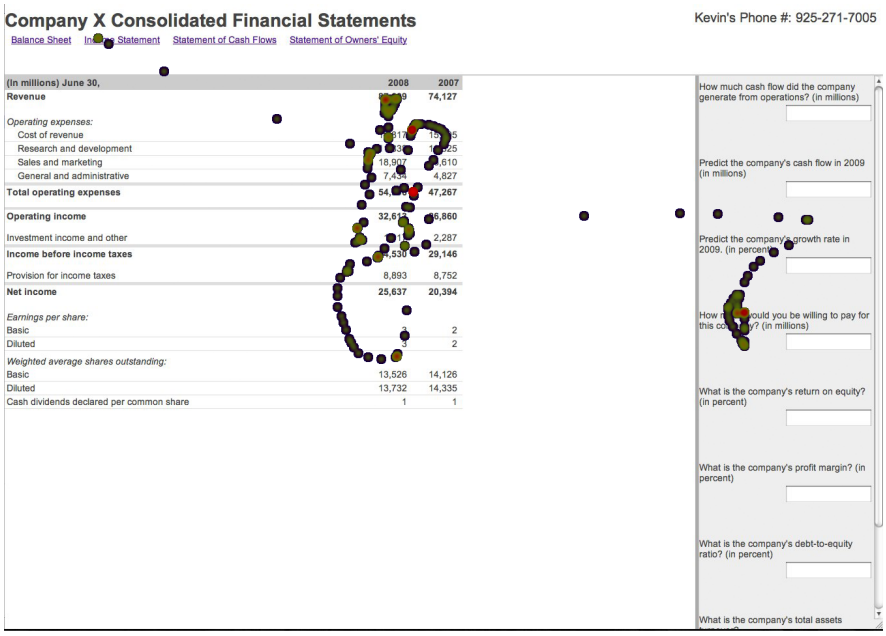


Figure 4: A sample heatmap for a user who answered the question correctly.

contains a heatmap of a user's mouse movements as he attempts to determine the profit margin of Company X, whose statements have been prepared using current GAAP. The red shaded areas indicate areas of high mouse activity, and blue shaded areas indicate areas passed over quickly by the user's mouse. The profit margin is usually determined by dividing a firm's net income into its total revenue, and we can see that the user's mouse hovers over both of those line items. The user's answer was 0.28, which was correct.

Another user gave a different answer of 0.39. We can use the heatmap of his mouse movements in Figure 5 to determine why the user answered the question differently. As you can see from the heatmap, the user's mouse focuses on the "Income before income taxes" item for 2008 instead of the "Net income" item. Divided into total revenue, this computation yields an answer of 0.39.

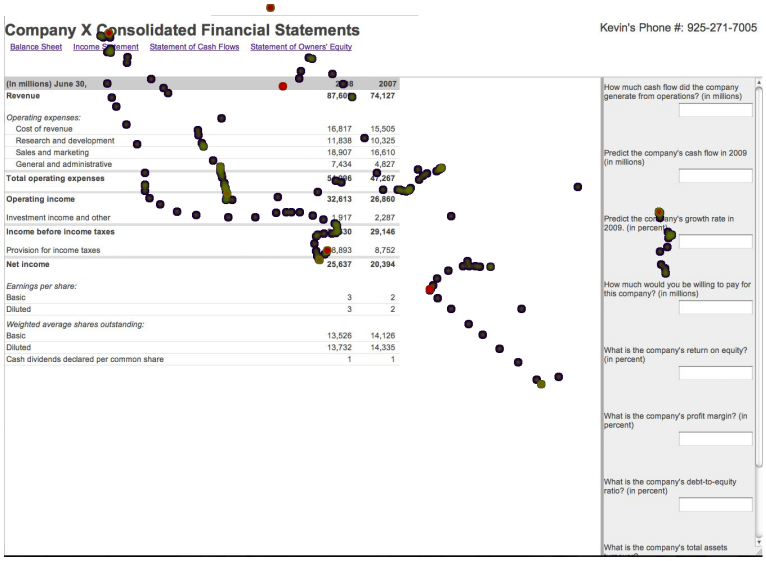


Figure 5: A sample heatmap for a user who gave a different answer to the question.

The example above is simple, but it is easy to see how this approach can be applied to determine the reasons users gave different answers to the same question. When subjects give two different answers to the same question, the researcher can analyze the heatmaps to see each subject's areas of emphasis. The researcher can then attempt to

reconstruct the subject's computations. For questions where users' answers vary on a Likert scale, the researcher can similarly check each user's areas of emphasis, and determine the relative weight that each subject placed on each area of the financial statements. This ability to break down the data will give the researcher further insight into subjects' patterns of analysis.

The tool also gives researchers the opportunity to see when analysts are not paying full attention to the experiment, or giving their best effort to answer the questions. Experimental accounting researchers usually test for users who have not been paying full attention by performing a manipulation check at the end of the survey; they ask simple questions to check whether the users were paying attention. With the new tool, researchers can perform manipulation checks in real time and for each response given by a user. A user who is not giving his best effort is giving less thought to each of his responses. In practice, this means that he will answer questions more quickly, make fewer switches between statements, and make fewer movements of the mouse than a user who is answering the questions in earnest. Each of these variables can be tracked easily with the new tool and accompanying scripts. In any experiment where the incentives are not well aligned, there is a chance that the subjects will not answer the questions to the best of their ability, preferring to quit early and collect their cash for participating. With my tool, researchers can better identify and exclude this group of participants from the sample.

For example, in Figure 6, the user spends 46 seconds answering the first question, but it took her only 2.7 seconds to answer question four after she gave an answer to question three. She completes the remaining seven questions in under 40 seconds. This

subject is probably not putting forth her best effort to interpret the question and give her best answer. This datapoint may add random noise to the experimenter's results, or contain a bias that a more careful examination of the financial statements would avoid. Because we can measure the user's response times and mouse movements, researchers can identify the problem and choose whether they would like to exclude her data from the sample.

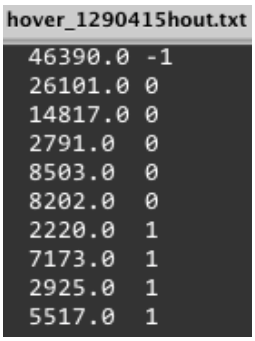


Figure 6: Log file showing a user's time to respond to each question (in milliseconds). The final seven questions are answered in under ten seconds each.

By enabling users to take experiments at their own time, the experimenters give up some control over the experimental conditions. Users may choose to take the survey in a high-distraction setting, where the user's environment, or other links open within the same browser, may distract the user from the survey at hand. If a user leaves the experiment and returns to it, they may have lost track of what they were doing, and a large gap will exist in the time to completion of the question they were answering at the time they left the experiment. Users may complete the experiment at different times of day, which may pollute the results of a between-subjects experimental design.

For these reasons, it may be better for researchers to use a within-subjects design than a between-subjects design, so that experimental conditions are consistent for each subject. It is arguable that the benefits from allowing users to take the experiment in their normal setting - increased convenience for researchers and participants, and better simulation of real-life analysis conditions - outweigh the downsides due to varying experimental conditions.

In the future, researchers can use the tool to generate decision-useful information about user behavior. I have demonstrated that it is easy to import and export financial data from the tool, and that it is also easy to create and track experimental conditions. The tool should lower the cost of implementing experiments, and increase the amount of data that can be collected from each. The tool should also help researchers test alternative designs to current GAAP by allowing researchers to gain more information about how users are behaving during an experiment.

CHAPTER 6

Experimental Design and Results

Participants

To test out the Web interface tool, thirteen students and young alumni with a background in financial statement analysis were recruited and asked to perform representative tasks using the tool. The students ranged from sophomore to senior, and the alumni ranged from one year to five years out of school. Participants responded to an email invitation to participate in an experiment for a chance to win a cash prize, at which point they were assigned randomly to one of eight treatment groups. Current student respondents had either taken a course in financial statement analysis, or had completed an internship as a research analyst. Alumni were either working in the field of finance or accounting, or had recently graduated with coursework in financial statement analysis. Some students who responded to the initial request did not possess enough skills to competently finish the experiment, but these students did not complete the experiment.[3]

Procedure

Participants completed the survey on their own time on their own computers. They were instructed to try and complete the experiment in one sitting. The time of day varied between participants, but most of them completed the survey on a weeknight. Participants completed the survey in 30-60 minutes. While the Web interface was the same for all participants, the experimental environment surrounding the participants during the study varied.

Dependent Variables

[3] Generally, they would look at the questions posed to them and then quit the browser without attempting to provide responses.

I collected data on the user's responses to Likert questions about the firm's health and about the clarity of the statements. The goal of asking questions on a Likert scale was to examine which parts of the financial statements users looked at to assess a firm's profitability, to assess its risk, and other broad metrics. I also collected data on user responses to questions requiring a numerical answer, with the goal of determining whether users gave systematically different responses when users answered questions using the new financials. For each question asked, I collected data on the user's time to respond to the question, as well as the number of sheets viewed for each question asked. I investigated unusual patterns in the data by checking a user's mouse logs, as well as their response timing, to see if they were fully engaged in the survey at the time of the unusual response.

I split the user's mouse movements into chunks based on the question the user was attempting to answer while moving the mouse, as well as the financial statement the user was currently viewing. To classify the mouse movements according to question answers, the user's mouse movements were broken into eighteen chunks corresponding to the time stamps when a user answered a question. All mouse movements in a chunk were then 'credited' to the question answer.

Experimental Hypotheses

Subjects responded to the same questions about the same company, so my null hypothesis was that no significant difference would exist between a user's responses to the statements presented in the old way and their responses to the statements presented in the proposed format. However, the methods involved in answering each of the questions would differ. For the questions on a Likert scale which asked participants to assess the

company's profitability, risk of bankruptcy, and use of financial leverage, I expected users to take a more broad look at the company's financial statements. For the questions with numerical answers, which asked participants to find the growth rate and compute various financial ratios, I expect that users would have specific formulas in mind for how they would answer each question.

I expect that users would view more statements while they answered the Likert questions than they would while answering the numerical questions, in an effort to get a sense for the health of the firm instead of computing a specific number. I also predict that because the new presentation shifts and disaggregates many items in the financial statements, subjects would have to think harder about their answers to the questions. Because users lacked training in the new presentation format, I expect that the variance of user responses to the new presentation would be higher than the variance of user responses to questions on the current GAAP presentation.

Experimental Design and Methods

The participants were presented with financial statements prepared in the traditional way for an unspecified company, and then presented with the same company's balance sheets presented in the FASB's new presentation format. When users were shown the current GAAP presentation, they were offered links to each of the four main financial statements: the balance sheet, the income statement, the statement of cash flows, and the statement of owners' equity. When users were shown the proposed FASB presentation, they were offered links to six statements: the statement of financial position containing information usually shown on the balance sheet, the statement of comprehensive income, the statement of cash flows, the statement of owners' equity, as

well as two statements that reconciled the statement of cash flows to the statement of comprehensive income for 2007 and 2008. Before beginning analysis of each company, users were shown several paragraphs of text explaining how the company's financial data was presented, as well as a short instruction informing the subject that he or she was an expert in financial statement analysis, and that I hoped to learn more about financial statement analysis by analyzing their behavior

The statements were acquired from an anonymous Dow Jones Industrial Average company that was asked by the FASB in 2008 to prepare their financial statements according to the new presentation guidelines. No information about the company's industry or competitors were provided to subjects. Notes to the financial statements were also not provided to participants. While I would have liked to provide this information to subjects, the company provided the financial data on condition of anonymity, so I could not provide more information about the company to the experiment participants.

For each statement, users were asked to rate how strongly they agreed or disagreed with a series of statements about the company's profitability, its risk, and the potential of its stock, and then asked to compute a series of numerical answers, such as finding the company's free cash flow in the next year, finding the asset turnover ratio and finding the present value of the company.

To minimize the effects of ordering on responses, treatment groups were randomized with respect to three variables. Half of the students received the new presentation before the old, and the other half received the current GAAP presentation and then the proposed presentation. Half of the students were given the Likert questions before the numerical questions, and the other half were given the questions in the opposite order. Furthermore, to obscure the fact that viewers were evaluating the same company in both cases, half of the participants saw the true numbers for Company X, and saw Company Y's numbers multiplied by a constant factor, while the other half saw the true numbers for Company Y and the scaled numbers for Company X. Randomizing across all three of these categories meant that there were a total of eight treatment groups. I do not expect that the ordering, scaling, or order of questioning will matter, although it is good practice to vary these to minimize their effects on the results.

Table 1: The eight treatment groups.

Likert first, then text questions		**Text questions first, then Likert**	
1.5*Old, New	New, 1.5*Old	1.5*Old, New	New, 1.5*Old
1.5*New, Old	Old, 1.5*New	1.5*New, Old	Old, 1.5*New

To ensure that students completed the task in good faith, we offered students a chance to win a $300 cash prize if they responded correctly. Specifically, if their answers to the numerical questions fell within a certain range of the correct answer, they received an additional entry into a drawing for the cash prize. Offering more entries as a reward for accurate responses meant that the subjects had an incentive to answer each question to the best of their ability.

Problems with the sample group

The subjects had no experience using the financial statements presented in the new format, other than a brief introductory message explaining the differences between the new and the old financial statements. The new presentation included two new statements, the reconciliation between the income statement and the statement of cash flows for both 2008 and 2007. Users spent an average of 1.9% of their time examining the 2008 reconciliation from the income statement to the statement of cash flows, and 1% examining the 2007 reconciliation, indicating that these statements were not very useful in the subjects' analytical process. In the future, researchers may want to hold training sessions on the new format before conducting the experiment, to explain the significant changes between the new and old statements, and give some guidelines for analyzing statements presented in the new format.

The experiment required Institutional Review Board approval, and because I only had permission to use students and alumni from the Claremont Colleges as subjects, there were problems recruiting a significantly large sample of students to participate. The experiment required students to have capable accounting skills, so the pool of available students and alumni was small. Furthermore, these students generally earned or expected to earn high salaries after graduation, so they were less motivated by a cash reward than the average student (alumni majoring in economics, as well, also have high salaries).

A prize was offered to discourage subjects from comparing pay with their hourly wage (which would also align their incentive to earn the prize with an incentive to perform well during the experiment). In retrospect, offering a large prize and no guaranteed payment may not have been as wise as offering a low cash rate for participation, as well as an entry into a drawing for a smaller cash prize. If the subjects

were motivated to complete the survey purely because of the prize, we would expect that the time they took to complete analysis of the first company presented to them would be equal to the time they took to complete analysis of the second company presented to them. However, the average participant completed the second analysis almost twice as quickly as the first analysis, suggesting that cash may not have been their primary motivating factor for completing the survey.

In addition, because this was a hypothetical company and the subjects had none of their own money riding on the outcome of their analysis, their behaviors might differ from their behaviors if they were interested in investing in the company, or had more years of experience under their belt. If that were the case, the subjects may have spent more time in evaluating each question, and attempted to check their answers in more detail. It will be difficult to evaluate analysts using financial statements for actual decision making, because the researcher needs to set up a custom environment to capture all of the data from their analysis.

The user's hover movements were difficult to quantify for a number of reasons. The tool was set up to track user hover movements over the question window, the data window, and all of the numbers on the form, generating logs that could determine, for example, that the user spent 153 milliseconds hovering over the "Cash & Cash Equivalents" line of the balance sheet in 2008. However, the heuristics for distinguishing incidental hover patterns from true ones would be complicated at best; for example, if the user brought the mouse up the screen to click over to a new sheet, they might hover over twenty numbers on the page and skew the counts. Another example would be a user who has temporarily stepped away from their computer and left the page open, or a user who has begun a

computation on their calculator; this user would continue to generate hover data that would not be accurate in the sense that they were not actively evaluating that part of the page at the time their mouse was hovering there.

The low number of subjects meant that any effect of the presentation format on the average subject response was overwhelmed by the effect of having a small sample. The most promising avenue for statistically significant results was a within-subject analysis of the differences between user responses to questions about the GAAP presentation and about the new presentation. One feature of the user interface that helped analysis was that users could only view one statement (Balance Sheet, Income Statement etc) at a time, and had to click the page to reach another statement, so that their clicking and viewing patterns between statements could be analyzed.

Results

After subjects completed the experiment, their data was re-scaled to allow comparison across treatment groups. Therefore if a user answered a question about data that was scaled to 1.45 times the normal, his response was scaled back down to the normal value before analysis was conducted. I also made corrections to some user responses for the purpose of comparison; due to differences in interpretation of the question, some users marked 30 percent as “30” and others would indicate 30 percent as “0.30.” I tried my best to preserve the user’s intent, and left ambiguous values alone. In two cases, users had large gaps (upwards of an hour) between entries in the log files. After confirming by email that these users were away from their computer during this period, I manually removed the gap from the logs, so that the user’s time to complete each question could be compared with that of other users.

All other responses were left as they were entered by the users. The data was aggregated across all treatment groups and all orders of experiment completion. The data was aggregrated because no difference was expected in results between treatment groups; a user who received Likert questions before text response questions may have answered differently than a user who received them in the opposite order, but I hypothesized no difference before the experiment. Subjects completed the analysis of the second company presented to them significantly quicker than the first company presented to them, but the number of subjects who saw the GAAP presentation first and the new presentation first were nearly equal.

To test for systematic differences in response between user responses to the survey questions, I conducted a matched-pairs t-test comparing the user's response to the GAAP statements with their response to the new presentation statements; my null hypothesis assumed that there would be no difference between responses. Because there was no predicted difference between formats, the tests were two-tailed, and because there was a predicted difference in variance, the t-test was conducted assuming unequal variance between the sample populations.

Matched Pairs Analysis of User Responses

Mean Assessments (Standard Deviations) for response to each question asked in the experiment

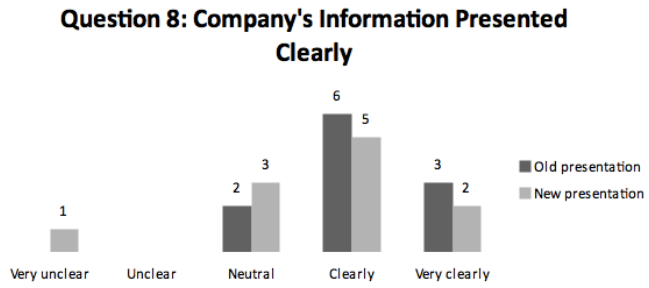
Likert Scale Questions				Numerical Questions			
	GAAP Presentation	*New Proposed Presentation*	*Difference New - Old*		*GAAP Presentation*	*New Proposed Presentation*	*Difference New - Old*
Likert #1 Profitability	3.54 (0.66) n = 13	3.69 (0.75) n = 13	0.15	**Numerical #1 Cash flow from operations**	23011.52 (8708.7) n = 13	28845.98 (25380.27) n = 13	5834.46
Likert #2 Good Use of Assets	3.77 (0.73) n = 13	4.00 (0.91) n = 13	0.23	**Numerical #2 Cash flow in '09**	17295.14 (8960.14) n = 13	21889.03 (25811.03) n = 13	4593.89
Likert #3 Main Profit Driver	1.23 (0.6) n = 13	1.15 (0.55) n = 13	-0.08	**Numerical #3 Growth rate in '09**	0.13 (0.08) n = 13	0.13 (0.09) n = 13	0.00
Likert #4 Cause of Financial Trouble	2.15 (0.8) n = 13	1.92 (0.86) n = 13	-0.23	**Numerical #4 Firm Value**	76812.45 (53696.22) n = 13	83188.07 (113047.76) n = 13	6375.62
Likert #5 Risk of Bankruptcy	2.54 (1.05) n = 13	2.23 (1.17) n = 13	-0.31	**Numerical #5 Return on Equity**	0.46 (0.12) n = 12	0.30 (0.29) n = 13	-0.16
Likert #6 Leverage	2.31 (1.18) n = 13	2.08 (1.32) n = 13	-0.23	**Numerical #6 Profit Margin**	0.32 (0.16) n = 13	0.35 (0.18) n = 13	0.03
Likert #7 Stock Buy/Hold/Sell	3.46 (0.66) n = 13	3.23 (1.09) n = 13	-0.23	**Numerical #7 Debt-to-equity**	0.53 (0.41) n = 13	0.43 (0.32) n = 13	-0.10
Likert #8 Risk management	3.54 (0.88) n = 13	3.54 (1.05) n = 13	0.00	**Numerical #8 Total Asset Turnover**	0.76 (0.2) n = 13	1.25 (0.55) n = 13	0.49**
Likert #9 Information presented clearly	4.23 (0.73) n = 13	3.38 (1.04) n = 13	-0.85*				
Likert #10 Relationships between stmts	3.08 (1.66) n = 13	3.38 (1.26) n = 13	0.30				

*** and ** indicate significance at p < 0.05 and p < 0.01, respectively.**

For Likert scale responses, 1 and 5 indicate "Strongly Agree" and "Strongly Disagree" (questions 1, 2, 9, 10), "Very Risky" and "Not risky at all" (5, 6), "Strong Buy" and "Strong sell" (7), respectively. For questions 3 and 4, 1 represents "Operating", 2 represents "Financing" and 3

*** and ** indicate significance at p < 0.05 and p < 0.01, respectively.**
For Likert scale responses, 1 and 5 indicate "Strongly Agree" and "Strongly Disagree" (questions 1, 2, 9, 10), "Very Risky" and "Not risky at all" (5, 6), "Strong Buy" and "Strong sell" (7), respectively. For questions 3 and 4, 1 represents "Operating", 2 represents "Financing" and 3 represents "Investing."

The tests revealed that only two questions had a statistically significant difference in user response between the GAAP presentation and the new presentation. The first question asked users to rate their level of agreement with the statement that the information was presented clearly, with users stating that they believed the current GAAP had information that was presented more clearly than the new presentation. This may be unfair because users are unfamiliar with the new presentation; to get a fair assessment of information clarity, a researcher would probably want to look at the data more than the user's response.



The second question with a statistically significant difference between responses asked users to find a company's asset turnover ratio. The asset turnover ratio is traditionally measured as a company's revenue divided by its total assets. 85% of users came up with an answer of 0.83 when they answered the question using the old presentation; the line items for revenue and for total assets are clearly marked on the old presentation, explaining why so many users came up with the same value. The subjects found a value of 1.44 for the asset turnover ratio for the same company under the new presentation.

It is surprising that the presentation caused subjects to generate such different answers when they were asked to find a simple accounting ratio. Unlike current GAAP,

the new presentation format has a line on the statement of financial position for "Net operating assets" and "Net business assets," which is the firm's total assets presented net of liabilities, but no line for "Total Assets." In the new presentation, the value of 1.44 can be computed by taking the company's total *operating* revenue (presented as a distinct category) and dividing by the firm's total operating assets. Asset turnover is a measure of how efficiently companies use their assets, so the turnover ratio computed under the new presentation may be a better reflection of the firm's true turnover.

The asset turnover number brings up a related drawback of the computer tool relative to an experiment conducted on paper. The revenues and assets from operating activities were presented at the top of the page, while a user would have to scroll down the page, or "below the fold," to see the revenues and assets from investing and business activity. It is possible that when computing asset turnover, subjects would have included investing assets and revenues, if they had seen the investing category. It is also possible that users saw the investing category but decided not to include it.

Another statistically significant finding at the 95% confidence level was that users took more time to find the debt-to-equity ratio under the new presentation than they did with the old presentation. Like the total asset turnover, subjects probably took more time to compute the debt-to-equity ratio with the new presentation because the new presentation did not directly show the numbers for computation. Under the new presentation, the firm's total liabilities were not presented on their own line, but folded into the line totaled "Net assets."

I predicted that user responses to the questions on the new presentation format would be more variable than user responses to the questions on the current GAAP format.

To test the hypothesis, I conducted an F test on the variance of responses for each numerical response question.[4] Because I expected the variance of responses for the new statement presentation to be greater than the variance of responses for the old presentation, I conducted a one-tailed F test.

The test showed that the variance of responses to questions asked with the new presentation format was significantly wider than the variance of responses to questions asked with the current GAAP format. The variance of user predictions about the cash flow of the firm from operations in the next year, the firm's overall cash flow in the next year, and the asset turnover ratio were all statistically greater than the variance of responses to those same questions asked with the current GAAP format, at the 99.7% confidence level.

I also expected that users would view *more* statements while answering questions using the new presentation. I believe that this would be the case because users would be more uncertain about how to compute the answers to questions, and try to get more data about the company before answering. I used a one-tailed, matched pairs t-test to compare the total number of statements viewed by

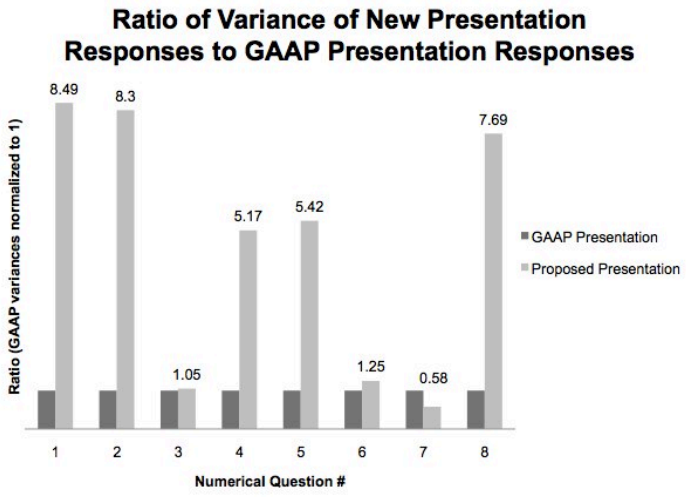


Figure 7: User responses to questions asked of the proposed presentation were more variable than their responses to questions about the current GAAP presentation.

[4] The F test is not appropriate for the Likert scale questions because it assumes the data is normally distributed. The variances of the Likert scale questions were relatively well matched.

each subject in the current GAAP presentation and the new presentation. This test did not reveal a significant relation between the number of sheets viewed and the presentation format. A closer analysis revealed that the presentation order affected the number of statements viewed much more than the presentation format. Ten out of thirteen subjects clicked to view more statements on the first presentation shown to them, and on average users switched statements seven more times on the first statement shown to them than the second statement shown.

User responses as a whole were more varied when using the new presentation format. On average, users spent an extra minute per question asked in the new presentation format. This provides some evidence that users were unfamiliar with the new design and took a longer time to find answers on the new presentation. It is likely that much of the variance and longer response time stemmed from the fact that the information was presented in an unfamiliar way. Most of the questions asked during the user survey had formulaic answers; users would expect to find the parts of the solution in certain spots of the statements and then compose them to reach a final answer. However, the new presentation format added many new lines to financial statements, as well as several re-definitions of items on the statements, which may have caused some confusion about how to interpret the new financial statement presentation. While users were given a brief explanation of the new presentation format, they were not given any guidance on how to interpret the line items of the new presentation format.

The results suggest two things. First, most of the subjects had clear ideas about how to answer the questions asked of them under the current GAAP format, but were less clear about how to interpret the new line items on the new presentation format. Users'

responses to the questions in the new format were more varied than their responses to questions in the old format, and the responses also suggested that the information presented in the current GAAP presentation was more clear than the information presented in the proposed GAAP.

Second, user engagement with the experiment fell as the experiment continued. On average, users completed the second experiment they viewed twice as fast as they completed the first experiment they viewed. This suggests either that the monetary incentive for good performance was not strong enough to motivate users to try as hard on the second half of the survey, or that users needed to jog their memory to remember how to respond to the questions in the first half of the survey, and once they remembered how to answer the questions they could complete the second set of questions more quickly. Given that subjects needed to look in different places to answer the questions on each of the statements presented to them, the first explanation appears more likely to be true than the second. The tendency of users to take less care when completing the second set of financial statements is a potential drawback of asking users to complete their survey over

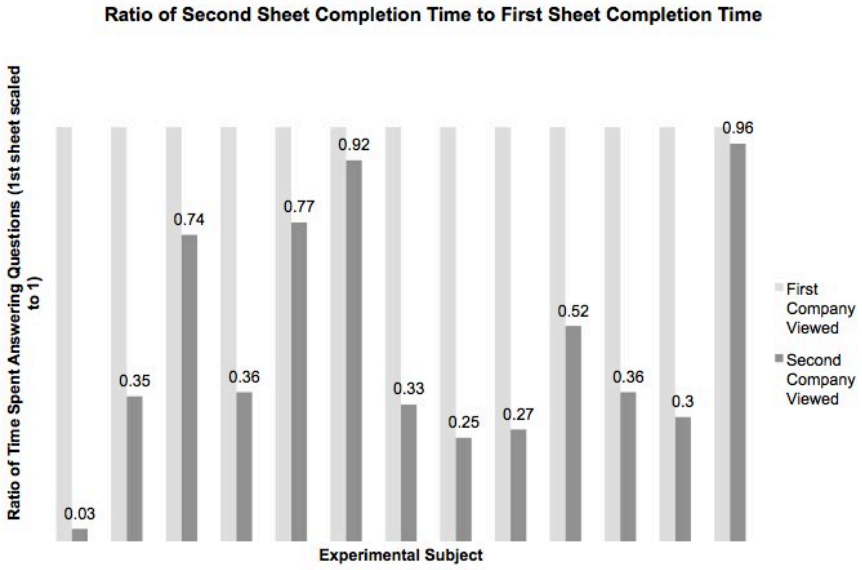


Figure 8: Users completed the second analysis much more quickly than they completed the first analysis.

the Internet, and future researchers need to ensure that participants' incentives are sufficient to keep them engaged throughout the course of the experiment.

CHAPTER 7

Conclusion

I have built a tool that allows researchers to track in explicit detail the ways in which users actually use financial statements. The tool records information about the user's mouse movement and statement viewing history. Financial statements can be swapped in and out easily, and the experimental conditions can be easily altered to accomodate any experiment. All of the experimental conditions are simulated in the browser, so changes to the underlying data only have to be made one time and all experimental conditions will update. The tool works on all modern browsers on all operating systems. This should allow experimenters to lower the cost of participating to clicking on a Web link and answering questions over the Internet, which in turn should allow them to recruit more participants and conduct more tests. The tool also allows researchers to collect more data, and observe when subjects are not devoting their full attention or energy to the experiment.

I conducted an experiment with junior professionals and student non-professionals with a background in financial statement analysis. In the experiment, subjects were shown the same company's financial data in the current GAAP presentation as well as in the new financial statement presentation. Users were asked the same set of questions about each presentation, and the responses were analyzed to determine whether a user's responses differed based on the presentation format. Consistent with a theory that users would be unfamiliar with the new presentation, user responses to questions relating to the new presentation were more varied than their responses to questions relating to the current GAAP presentation. Users did not switch

between statements more often when using the new presentation. I was able to use mouse position heatmaps and analysis of user behavior to evaluate the decisions made by users, and to evaluate whether the subject was giving full effort to the experiment. The tool allowed me to analyze the behavior of subjects at a more granular level than past experimental accounting researchers have been able to do in their own experiments.

There are several possible improvements that can be made to the tool. Adding a graphical user interface for setting up experimental conditions would help expand the pool of researchers that could use the tool. Modifications could be made to the logs to make them easier to parse, and to the logging of hover data to make it easier to determine which parts of the statements are being analyzed by subjects. Real-time analysis of user responses could warn subjects who are not trying hard that their reward for participating will not be valid unless they focus on the experiment.

Currently, the FASB plays "defense" with respect to opinions about GAAP. This means that their policy is formed in response to user complaints, instead of having an "offensive" policy strategy and forming policy in response to problems the FASB has found itself. Users are likely to overstate their concerns when speaking with the FASB, and users can only speak to their own experience; lobbyists and entrenched interests may obscure the FASB's ability to discern the true effects of the issue in dispute. Randomized trials and user observation would provide the FASB with better data than deciding policy based on user-reported concerns. User testing is currently expensive in terms of researcher and participant time; methods that cut down on the amount of time that it takes to conduct and analyze an experiment, or methods that allow researchers to collect more data from every experiment, will increase the number of potential experiments and

improve the FASB's decision making process by increasing the amount of data they have at their command. The tool that I have built will improve the ability of the FASB and researchers to gather data from experiments.

No one has conducted research into the specific patterns of analysis that analysts use when making decisions. By observing how users actually use the statements, researchers can develop a better understanding of how users come to believe what they do about the underlying companies. Researchers can also use the evidence to predict future areas of trouble within financial statements, and to have some basis for assessing user complaints other than what users tell the FASB.

The FASB and the FASRI should consider testing users extensively on the new presentation before going through with its planned changes to financial statements, which will be expensive to implement. The new presentation of financial statements contains the largest set of changes to financial statement presentation in the past ninety years, and the FASB currently assumes that every change will make it easier for analysts to use financial statements to make decisions about the underlying firm. The cost of testing the FASB's assumptions directly on users is low relative to the cost of making a change to the presentation of financial statements that hinders the usability of the statements.

The tool that I built will be especially useful for testing alternative presentation formats for financial statements. The tool lowers the cost for researchers to conduct experiments, and it lowers the cost for subjects to participate in experiments, which should allow researchers to conduct more experiments and generate more data. The tool generates a large amount of data, which should give researchers a better understanding how their subjects are using financial statements for decision making.

APPENDIX

In this section I list the source code for the tool and accompanying scripts. For future research and development, the latest version of all of the code listed here is also hosted at http://bitbucket.org/kevinburke/thesis.

On-Screen Display: This code is the PHP code loaded in the browser by the user. This file loads the Javascript and financial statement data that then gets executed.

```
1.  <html>
2.  <head>
3.      <title>Company Y Financial Statements</title>
4.      <link href="../style.css" rel="stylesheet" type="text/css">
5.      <script type="text/javascript" src="http://www.google.com/jsapi"></script>
6.      <script type="text/javascript">google.load("jquery", "1.4.2");</script>
7.      <script type="text/javascript" src="../splitter.js"></script>
8.      <script type="text/javascript" src="../oyolive.js"></script>
9.      <?php require("../script.php"); ?>
10. </head>
11. <body>
12. <div id="container">
13.     <div id="topnav">
14.         <h1>Company Y Consolidated Financial Statements</h1>
15.         <div style="float:right; font-size:20px;">Kevin's Phone #: 925-271-
    7005</div>
16.         <ul id="menu" class="idTabs">
17.             <!--links to each of the financial statements --
     clicks handled in script.js -->
18.             <li><a href="#" id="balsheetlink">Statement of Financial Position</a></li>

19.             <li><a href="#" id="incomelink">Comprehensive Income Statement</a></li>
20.             <li><a href="#" id="scflink">Statement of Cash Flows</a></li>
21.             <li><a href="#" id="soelink">Statement of Owners' Equity</a></li>
22.             <li><a href="#" id="2008link">2008 SCF Reconciliation to Income Statement<
    /a></li>
23.             <li><a href="#" id="2007link">2007 SCF Reconciliation to Income Statement<
    /a></li>
24.         </ul>
25.     </div>
26.     <div id="intro" style="display:block;">
27.         <Br><br>
28.         <!-- preliminary instructions to the user -->
29.         You are the expert in financial statement analysis. We want you to teach us ho
    w you use and analyze the documents in front of you. We will observe and learn from yo
    ur work.<br><br>
30.         The following company's balance sheets have been presented using a new design
    proposed by the FASB. It bears some of the same elements as the old financial statemen
    ts, but also attempts to show in greater detail how the financial statements are relat
    ed to each other. Specifically, the balance sheet and income statement data are groupe
    d by Operating, Investing, and Financing activities, like the Statement of Cash Flows
    is now.<br><br>
31.         On the statement of cash flows, instead of starting with net income and workin
    g backwards to determine the company's cash flows, the cash flows are reported by comp
    uting the firm's direct inflows and outflows. The indirect method is used in two new s
    tatements called "Reconciliation from Income Statement to SCF" for 2008 and 2007.<br><
    br>
32.         Please use the statements to answer the questions.<br><br>
33.         <a href="#" id="startexperiment" style="font-
    size:20px;">Begin the experiment</a>
34.     </div>
35.     </div>
36.     <div id="splitter" style="display:none;">
37.         <div id="leftbar">
```

```
38.             <!-- load each of the statements -
     each one is declared in a file called statement.php and then "included" here. this wa
    y they can be easily swapped in and out. -->
39.             <div class="window" id="balsheet">
40.                 <?php include("bs.php"); ?>
41.             </div><!--end balance sheet window-->
42.             <!--begin income statement window-->
43.             <div class="window" id="income" style="display:none;">
44.                 <?php include("is.php"); ?>
45.             </div>
46.             <div class="window" id="scf" style="display:none;">
47.                 <?php include("scf.php"); ?>
48.             </div>
49.             <div class="window" id="soe" style="display:none">
50.                 <?php include("soe.php"); ?>
51.             </div>
52.             <div class="window" id="2008" style="display:none;">
53.                 <?php include("2008recon.php"); ?>
54.             </div>
55.             <div class="window" id="2007" style="display:none;">
56.                 <?php include("2007recon.php"); ?>
57.             </div>
58.             <div style="clear:both;"></div>
59.         </div>
60.
61.         <!--load the questions file-->
62.
63.         <?php include("../questions.php"); ?>
64.
65.     </div>
66. </body>
67. </html>
```

Javascript Code: This code does most of the work for the application, including handling experiment conditions and multiplying all the numbers on the screen by a constant factor.

```
<script type="text/javascript">
var posx;
var posy;
var mouse_log = [];
var hover_log = [];
var question_log = [];

//(56,453) -> (76,352)
//4,000 -> 6,500
//half the cases need to be multiplied by 1.45, this fn does that
function convertToOneFourFive(b){

    var s = b;
    var isNegative = false;

    //special case, hack
    if (s == "(0.40)"){
        return s;
    }
    //strip whitespace
    s = s.replace(/[,\s]/g, "");
    s = s.toString();
    if (s.charAt(0) == '('){
        isNegative = true;
    }
    //strip brackets
    s = s.replace(/[\(\)]/g, "");

    //number regex
    anum = /(^\d+$)|(^\d+\.\d+$)/

    if (anum.test(s))
    {
        s = Math.round(s*1.45);
        s = addCommas(s);
        if (isNegative){
            //re-add brackets
            return '(' + s + ')';
        }
        else{
            return s;
        }
    }
    return b;
}

//re-add commas to converted #s
function addCommas(nStr)
{
    nStr += '';
    x = nStr.split('.');
    x1 = x[0];
    x2 = x.length > 1 ? '.' + x[1] : '';
    var rgx = /(\d+)(\d{3})/;
    while (rgx.test(x1)) {
        x1 = x1.replace(rgx, '$1' + ',' + '$2');
    }
    return x1 + x2;
}

$(document).ready(function()
{
    //get all posted variables
```

```
64.     var $_POST = <?php echo json_encode($_POST); ?>;
65.     var name = $_POST["name"];
66.     var id = $_POST["id"];
67.     var firstpage = $_POST["firstpage"];
68.
69.     var t1 = "\t";
70.     var d = new Date();
71.     var curr_time = d.getTime();
72.
73.     var time;
74.     var year;
75.     var category;
76.
77.     var likert_order;
78.     var multiplier;
79.     var nextpage;
80.     var company_x_link = "/thesis/company_x/";
81.     var company_y_link = "/thesis/company_y/";
82.     var thanks = "/thesis/thanks/";
83.
84.     switch(parseFloat(id)){
85.
86.     case 1:
87.         likert_order = 0;
88.
89.         if (firstpage == "true"){
90.         nextpage = company_y_link;
91.         multiplier = 0;
92.         }
93.         else{
94.         nextpage = thanks;
95.         multiplier = 1;
96.         }
97.         break;
98.     case 2:
99.         likert_order = 0;
100.            if (firstpage == "true"){
101.            nextpage = company_y_link;
102.            multiplier = 1;
103.            }
104.            else{
105.            nextpage = thanks;
106.            multiplier = 0;
107.            }
108.            break;
109.        case 3:
110.            likert_order = 0;
111.            if (firstpage == "true"){
112.            nextpage = company_x_link;
113.            multiplier = 1;
114.            }
115.            else{
116.            nextpage = thanks;
117.            multiplier = 0;
118.            }
119.            break;
120.        case 4:
121.            likert_order = 0;
122.            if (firstpage == "true"){
123.            nextpage = company_x_link;
124.            multiplier = 0;
125.            }
126.            else{
127.            nextpage = thanks;
128.            multiplier = 1;
129.            }
130.            break;
```

```
131.        case 5:
132.            likert_order = 1;
133.            if (firstpage == "true"){
134.            nextpage = company_y_link;
135.            multiplier = 0;
136.            }
137.            else{
138.            nextpage = thanks;
139.            multiplier = 1;
140.            }
141.            break;
142.        case 6:
143.            likert_order = 1;
144.            if (firstpage == "true"){
145.            nextpage = company_y_link;
146.            multiplier = 1;
147.            }
148.            else{
149.            nextpage = thanks;
150.            multiplier = 0;
151.            }
152.            break;
153.        case 7:
154.            likert_order = 1;
155.            if (firstpage == "true"){
156.            nextpage = company_x_link;
157.            multiplier = 1;
158.            }
159.            else{
160.            nextpage = thanks;
161.            multiplier = 0;
162.            }
163.            break;
164.        case 8:
165.            likert_order = 1;
166.            if (firstpage == "true"){
167.            nextpage = company_x_link;
168.            multiplier = 0;
169.            }
170.            else{
171.            nextpage = thanks;
172.            multiplier = 1;
173.            }
174.            break;
175.        }
176.
177.        if (likert_order == 0){
178.        $("#likert_link").click(function(event){
179.                $("#likert").hide();
180.                $("#responses").show();
181.                event.preventDefault();
182.            });
183.        $("#responses_link").click(function(event){
184.                submitAnswers(1);
185.            });
186.        }
187.        else if (likert_order == 1){
188.        //switch default ordering
189.            $("#responses").show();
190.            $("#likert").hide();
191.
192.        $("#responses_link").click(function(event){
193.                $("#responses").hide();
194.                $("#likert").show();
195.                event.preventDefault();
196.            });
197.        $("#likert_link").click(function(event){
```

```
198.                submitAnswers(2);
199.            });
200.        }
201.        $("#the_id").get(0).setAttribute("value", id);
202.        $("#the_name").get(0).setAttribute("value", name);
203.        if (nextpage == "true"){
204.        $("#the_nextpage").get(0).setAttribute("value", "false");
205.        }
206.        $("#question_form").get(0).setAttribute("action", nextpage);
207.        if (multiplier == 1){
208.            //convert everything to 1.45x
209.            $("td.year").html(function(index, oldhtml){
210.                a = convertToOneFourFive(oldhtml);
211.                return a;
212.            });
213.        }
214.
215.        var init_var = name + "\n" + curr_time + "\tINIT: " + "\t" + "ID:" + t1 + id;

216.
217.        hover_log.push(init_var);
218.        mouse_log.push(init_var);
219.        question_log.push(init_var);
220.
221.        $.post("../submit.php",
222.            {qlog : question_log, output_file : "question_data/question_" + curr_time
    + ".txt" }
223.        );
224.
225.        question_log = [];
226.
227.        function writeToLog()
228.        {
229.            var cmd = new Date().getTime() + "\tX: " + posx + " \t\tY: " + posy ;
230.            mouse_log.push(cmd);
231.        }
232.
233.        function sendLog()
234.        {
235.
236.            //push hover log to server
237.            if (hover_log.length != 0){
238.                $.post(
239.                        "../submit.php",
240.                        {hov : hover_log, output_file: "hover_data/hover_" + curr_time
    + ".txt"},
241.                        function(){
242.                         return true;
243.                        }
244.                        );
245.            }
246.            hover_log = [];
247.
248.            //post mouse log
249.            $.post(
250.                    "../submit.php",
251.                    {mous : mouse_log, output_file : "mouse_data/mous_" + curr_time + "
    .txt"},
252.                    function(){
253.                     return true;
254.                    }
255.                   );
256.            mouse_log = [];
257.        }
258.
259.        //capture user hover data
260.        $("td.year").hover(function(){
```

```
261.
262.             time = new Date().getTime();
263.
264.             var thistable = $(this).closest("table");
265.             var numcols = thistable.find("th").length;
266.
267.             for(var i = 1; i < numcols+1; i++){
268.                 if ($(this).hasClass(i)){
269.                     //find the year
270.                     year = thistable.find("#year_" + i).html();
271.
272.                     //find the category matching the hover
273.                     category = $(this).siblings(".name").html();
274.                 }
275.             }
276.
277.         },function(){
278.             leavetime = new Date().getTime() - time;
279.             s = new Date().getTime() + t1 + "HOVER:"  + "\tCAT:\t" + category + "\tYEA
    R:\t" + year + t1 + "time:\t" + leavetime;
280.             hover_log.push(s);
281.         });
282.
283.         $(".window").scroll(function(){
284.             s = new Date().getTime() + t1 + "SCROLL:" + t1 + $(this).scrollTop();
285.             hover_log.push(s);
286.             mouse_log.push(s);
287.         })
288.
289.         $("#questions").hover(function(){
290.             s = new Date().getTime() + t1 + "HOVER: Questions";
291.             hover_log.push(s);
292.         });
293.
294.         $("#leftbar").hover(function(){
295.             s = new Date().getTime() + t1 + "HOVER: Data";
296.             hover_log.push(s);
297.         });
298.
299.         $("input:text").each(function(index, value){
300.             $(value).focus(function(){
301.                 s = new Date().getTime() + t1 + "FOCUS:" + t1 + "text" + "\t" + index
    ;
302.                 hover_log.push(s);
303.             });
304.
305.             $(value).blur(function(){
306.                 s = new Date().getTime() + t1 + "BLUR:" + "\t" +  "text" + "\t" + inde
    x + "\tvalue\t" + $(value).val();
307.                 hover_log.push(s);
308.             });
309.         });
310.
311.         $("input:radio").each(function(index, value){
312.             $(value).change(function(){
313.                 s = new Date().getTime() + t1 + "FOCUS:" + t1 +  t1 + "likert" + "\t"
    + index + "\t" + $(value).val() ;
314.                 hover_log.push(s);
315.             });
316.         });
317.
318.         $(document).mousemove(function(e){
319.             posx = e.pageX;
320.             posy = e.pageY;
321.         });
322.
323.         $("#startexperiment").click(function(){
```

```
324.            $("#intro").hide();
325.
326.            $("#splitter").show();
327.            $("#splitter").splitter({anchorToWindow: true, minLeft: '600', minRight :
    '250', resizeToWidth: true, sizeRight: 250 });
328.        var t = new Date().getTime();
329.        s = t + t1 + "BEGIN: User begins experiment";
330.        hover_log.push(s);
331.        s = t + t1 + "VIEW: User is currently viewing the Balance Sheet";
332.        hover_log.push(s);
333.        });
334.
335.        $("#balsheetlink").click(function(){
336.            s = new Date().getTime() + t1 + "VIEW: User is currently viewing the Balan
    ce Sheet";
337.            hover_log.push(s);
338.            mouse_log.push(s);
339.            $("#balsheet").show();
340.            $("#income").hide();
341.            $("#scf").hide();
342.            $("#soe").hide();
343.            $("#2008").hide();
344.            $("#2007").hide();
345.            $("#splitter").trigger("resize");
346.        });
347.
348.        $("#incomelink").click(function(){
349.            s = new Date().getTime() + t1 + "VIEW: User is currently viewing the Incom
    e Statement";
350.            hover_log.push(s);
351.            mouse_log.push(s);
352.            $("#balsheet").hide();
353.            $("#income").show();
354.            $("#scf").hide();
355.            $("#soe").hide();
356.            $("#2008").hide();
357.            $("#2007").hide();
358.            $("#splitter").trigger("resize");
359.        });
360.
361.        $("#scflink").click(function(){
362.            s = new Date().getTime() + t1 +"VIEW: User is currently viewing the Statem
    ent of Cash Flows";
363.            hover_log.push(s);
364.            mouse_log.push(s);
365.            $("#balsheet").hide();
366.            $("#income").hide();
367.            $("#scf").show();
368.            $("#soe").hide();
369.            $("#2008").hide();
370.            $("#2007").hide();
371.            $("#splitter").trigger("resize");
372.        });
373.
374.        $("#soelink").click(function(){
375.            s = new Date().getTime() + t1 +"VIEW: User is currently viewing the Statem
    ent of Owners Equity";
376.            hover_log.push(s);
377.            mouse_log.push(s);
378.            $("#balsheet").hide();
379.            $("#income").hide();
380.            $("#scf").hide();
381.            $("#soe").show();
382.            $("#2008").hide();
383.            $("#2007").hide();
384.            $("#splitter").trigger("resize");
385.        });
```

```
386.
387.         $("#2008link").click(function(){
388.             s = new Date().getTime() + t1 + "VIEW: User is currently viewing the 2008
    SCF Recon to IS"
389.             hover_log.push(s);
390.             mouse_log.push(s);
391.             $("#balsheet").hide();
392.             $("#income").hide();
393.             $("#scf").hide();
394.             $("#soe").hide();
395.             $("#2008").show();
396.             $("#2007").hide();
397.             $("#splitter").trigger("resize");
398.         });
399.
400.         $("#2007link").click(function(){
401.             s = new Date().getTime() + t1 + "VIEW: User is currently viewing the 2007
    SCF Recon to IS";
402.             hover_log.push(s);
403.             mouse_log.push(s);
404.             $("#balsheet").hide();
405.             $("#income").hide();
406.             $("#scf").hide();
407.             $("#soe").hide();
408.             $("#2008").hide();
409.             $("#2007").show();
410.             $("#splitter").trigger("resize");
411.         });
412.
413.         //when user clicks "Submit," let's click the data
414.         function submitAnswers(id){
415.             mouse_log.push(new Date().getTime() + t1 + "SUBMIT: User submits answers")
    ;
416.             hover_log.push(new Date().getTime() + t1 + "SUBMIT: User submits answers")
    ;
417.             question_log.push(new Date().getTime() + t1 + "SUBMIT: User submits answer
    s");
418.             sendLog();
419.             $("input:radio:checked").each(function(index, element){
420.                 question_log.push("likert question " + index + ":\t " + $(element).val
    ());
421.             });
422.
423.             $("input:text").each(function(index, element){
424.                 question_log.push("text question " + index + ":\t " + $(element).val()
    );
425.             });
426.
427.             $.post("../submit.php",
428.                 {qlog : question_log, output_file : "question_data/question_" + curr_t
    ime + ".txt" },
429.                 function(){
430.                     $("#question_form").submit();
431.                 }
432.             );
433.         }
434.     setInterval(writeToLog, 50);
435.     setInterval(sendLog, 5000);
436.
437.     });
438.     </script>
```

Python Parser: this code parses the log files generated by the program. This program prints out the total number of switches between statements, and the total time the user spent viewing each statement.

```
import os
import sys

BS = 0
IS = 1
SCF = 2
SOE = 3
T8 = 4
T7 = 5

d = {}
d[BS] = "Balance Sheet"
d[IS] = "Income Statement"
d[SCF] = "Statement of Cash Flows"
d[SOE] = "Statement of Owners Equity"
d[T8] = "2008 SCF Recon to IS"
d[T7] = "2007 SCF Recon to IS"


def reset_temp():
    return [0,0,0,0,0,0]

def count_time_likert( a, counts, times):
    '''''when the user is answering likert questions,
    count the time they spend analyzing each statement'''

    #keep track of times
    #if we find a likert first:
    #add time to likert
    #keep doing until we find a blur, then stop
    #if we find a blur first:
    #reset all data until we find a likert
    a.readline()
    prev_time = int(a.readline().split()[0])

    temp_count = temp_times = reset_temp()
    total_viewcount = 1
    current_item = 1

    while True:
        line = a.readline()
        if not line:
            break

        if "BLUR" in line:
            likert_on = False
            prev_time = int(line.split()[0])
            #reset the temp array
            temp_count = reset_temp()
            temp_times = reset_temp()
        if "FOCUS" in line and "likert" in line:
            likert_on = True
            #add temp to permanent counts
            for i in range(len(temp_count)):
                counts[i] += temp_count[i]

                times[i] += temp_times[i]
            #print temp_count
            temp_count = reset_temp()
            temp_times = reset_temp()
        if "VIEW" in line:
```

```
62.             #user changed view
63.             #add to a temp array
64.             curr_time = int(line.split()[0])
65.
66.             temp_times[current_item] += curr_time - prev_time
67.             prev_time = curr_time
68.             total_viewcount += 1
69.             if d[BS] in line:
70.                 temp_count[BS] += 1
71.                 current_item = BS
72.             elif d[IS] in line:
73.                 temp_count[IS] += 1
74.                 current_item = IS
75.             elif d[SCF] in line:
76.                 temp_count[SCF] += 1
77.                 current_item = SCF
78.             elif d[SOE] in line:
79.                 temp_count[SOE] += 1
80.                 current_item = SOE
81.             elif d[T7] in line:
82.                 temp_count[T7] += 1
83.                 current_item = T7
84.             elif d[T8] in line:
85.                 temp_count[T8] += 1
86.                 current_item = T8
87.
88.     s = "Total Likert Hover Time: " + "\t" + str(total_viewcount) + "\n"
89.     for x in range(len(counts)):
90.         s += d[x] + "\t" + str(counts[x]) + "\n"
91.     s += "\n"
92.     for x in range(len(times)):
93.         s += d[x] + "\t" + str(times[x]) + "\n"
94.
95.     return s
96.
97. def main(folder, secondarg):
98.     count = 1
99.     files = os.listdir(folder)
100.        files.sort()
101.        for x in files:
102.            if x[0:5] == "hover" and x[-8:] != "hout.txt":
103.                a = open(folder + "/" + x)
104.                b = open("hover/" + folder[13:] + "_likert" + str(count) + ".txt", 'w'
    )
105.
106.                a.readline()
107.
108.                counts = [1,0,0,0,0,0]
109.                times = [0,0,0,0,0,0]
110.
111.                if secondarg == "likert":
112.                    s = count_time_likert(a, counts, times)
113.
114.                else:
115.                    prev_time = int(a.readline().split()[0])
116.                    total_viewcount = 1
117.                    current_item = BS
118.                    while True:
119.                        line = a.readline()
120.                        if not line:
121.                            break
122.                        if "VIEW" in line:
123.                            curr_time = int(line.split()[0])
124.                            times[current_item] += (curr_time - prev_time)
125.                            prev_time = curr_time
126.                            #test which one
127.                            #add to its count
```

```
                                #change current item
                                if d[BS] in line:
                                    counts[BS] += 1
                                    current_item = BS
                                elif d[IS] in line:
                                    counts[IS] += 1
                                    current_item = IS
                                elif d[SCF] in line:
                                    counts[SCF] += 1
                                    current_item = SCF
                                elif d[SOE] in line:
                                    counts[SOE] += 1
                                    current_item = SOE
                                elif d[T7] in line:
                                    counts[T7] += 1
                                    current_item = T7
                                elif d[T8] in line:
                                    counts[T8] += 1
                                    current_item = T8

                                total_viewcount += 1

                    s = "Total: " + "\t" + str(total_viewcount) + "\n"
                    for x in range(len(counts)):
                        s += d[x] + "\t" + str(counts[x]) + "\n"
                    s += "\n"
                    for x in range(len(times)):
                        s += d[x] + "\t" + str(times[x]) + "\n"

                b.write(s)
                b.close()

            count += 1

    if __name__ == "__main__":
        main(sys.argv[2], sys.argv[1])
```

Python parser: This program parses the logs and determines the total amount of time taken to answer each question.

```
1.  import re
2.  import sys
3.  import traceback
4.  import math
5.
6.  def main():
7.      #sys.argv1 is filename
8.      a = open(sys.argv[1])
9.      b = open(sys.argv[1][0:-10] + "hout.txt", 'w')
10.
11.     a.readline()
12.     prev_text_time = prev_likert_time = a.readline().split()[0]
13.     prev_text_num = prev_likert_num = -1
14.     t1 = "\t"
15.
16.     likertfirst = textfirst = False
17.
18.     text = {}
19.     likert = {}
20.
21.     while True:
22.         line = a.readline()
23.         if not line:
24.             break
25.         words = line.split()
26.
27.         if words[1] == "BLUR:":
28.             if prev_text_time < prev_likert_time and not textfirst:
29.                 textfirst = True
30.                 prev_text_time = prev_likert_time
31.
32.             if prev_text_num != words[3] and len(words) >= 6:
33.                 if text.has_key(words[3]):
34.                     #keep start time same
35.                     #update end time
36.                     #add sum to sum
37.                     text[words[3]][1] = words[0]
38.                     text[words[3]][2] = text[words[3]][2] + (float(words[0]) -
    float(prev_text_time))
39.
40.                 else:
41.                     text[words[3]] = [prev_text_time, words[0], float(words[0]) -
    float(prev_text_time), prev_text_num, words[3]]
42.
43.                 prev_text_time = words[0]
44.                 prev_text_num = words[3]
45.
46.
47.         if words[1] == 'FOCUS:' and words[2] == "likert":
48.             if prev_likert_time < prev_text_time and not likertfirst:
49.                 likertfirst = True
50.                 prev_likert_time = prev_text_time
51.
52.             the_num = convert_likert(words[3])
53.             if prev_likert_num != the_num:
54.
55.                 if likert.has_key(the_num):
56.                     likert[the_num][1] = words[0]
57.                     likert[the_num][2] = likert[the_num][2] + (float(words[0]) -
    float(prev_text_time))
58.                 else:
59.                     likert[the_num] = [prev_likert_time, words[0], float(words[0]) -
    float(prev_likert_time), convert_likert(prev_likert_num), the_num]
```

```
60.                 prev_likert_num = the_num
61.                 prev_likert_time = words[0]
62.
63.     #print out all entries
64.     for i in range(10):
65.         i = str(i)
66.         if likert.has_key(i):
67.             #print likert[i]
68.             b.write("\t".join([str(likert[i][k]) for k in range(len(likert[i]))]) + "\
    n")
69.
70.     b.write("\n")
71.     for i in str(range(10)):
72.
73.         if text.has_key(i):
74.             b.write("\t".join([str(text[i][k]) for k in range(len(text[i]))])+"\n")
75.
76. def convert_likert(number):
77.     number = float(number)
78.     if number <10:
79.         return str(int(math.floor((number)/5)))
80.     elif 10<= number < 16:
81.         return str(int(math.floor((number-10)/3) + 2))
82.     elif number >= 16:
83.         return str(int(math.floor((number-16)/5) + 4))
84.
85. if (__name__ == "__main__"):
86.     main()
```

Python heatmap generator: this code will generate heatmaps from a given set of mouselogs. For brevity, some repetitive sections of the code are omitted.

```
1.  from __future__ import with_statement, nested_scopes
2.  import random
3.  import sys
4.  import cairo
5.  import math
6.  import os
7.  import traceback
8.  def addToArray(array, the_max, x, y):
9.
10.     for i in range(-8, 8):
11.         for j in range(-8,8):
12.             if (x + i >= 0) and (y + j) >= 0 and (x + i) <= len(array)-1 \
13.                 and (y + j) <= len(array[i]) - 1 \
14.                 and math.sqrt(i*i + j*j) <= 8:
15.                     array[x+i][y+j] += 8 - math.sqrt(i*i + j*j)
16.                     the_max = max(array[x+i][y+j], the_max)
17.
18.     return array, the_max
19.
20. def isEmpty(array):
21.     '''''returns false if array has any non-zero values'''
22.     for x in range(len(array)):
23.         for y in range(len(array[x])):
24.             if array[x][y]:
25.                 return False
26.     return True
27.
28. def square(x, y, value):
29.     r, g, b = value * 255, value * 255, 255
30.     s = '<rect x="%d" y="%d" width="1" height="1" style="fill:rgb(%d,%d,%d);"/>' % (x,
     y, r, g, b)
31. #     t = '<text x="%d" y="%d" font-
    size=".2" fill="yellow">%f</text>' % (x, y + 1, value)
32.     return s
33.
34. def img_from_array(array, the_max):
35.     '''''takes an array and returns a cairo graphics img.
36.     all values scaled by max value'''
37.     img = cairo.ImageSurface(cairo.FORMAT_ARGB32,len(array),len(array[0]))
38.     g = cairo.Context(img)
39.     for x in range(len(array)):
40.         for y in range(len(array[0])):
41.             if array[x][y] > 0:
42.                 the_log = math.log(array[x][y]+1)/math.log(the_max)
43.                 g.set_source_rgb(the_log, (-8)*the_log * the_log + 6* the_log -
     0.7, 0.6 - 0.8*math.pow(the_log, 0.3))
44.             else:
45.                 g.set_source_rgba(0,0,0,0)
46.             g.rectangle(x,y,1, 1)
47.             g.fill()
48.     return img
49.
50. def create_array():
51.     '''''create 1400x1000 array'''
52.
53.     temp_array = []
54.     for x in range(1400):
55.         temp_array.append([])
56.         for y in range(1000):
57.             temp_array[x].append(0)
58.
59.     return temp_array
60.
```

```
61. def find_hover_log(a):
62.     '''''take a filename and find hover log in same folder with same timestamp. return
    s filename'''
63.     folders = a.name.split('/')
64.     timestamp = folders[len(folders)-1][5:18]
65.     the_folder = "/".join([i for i in folders[0:-1]])
66.
67.     for i in os.listdir(the_folder):
68.         if i.find(str(timestamp)) > -1:
69.             return "/".join([the_folder, i])
70.
71.     raise FileNotFoundError("couldn't find matching hover file")
72.
73. def convert_likert(number):
74.     '''''takes a string or int and returns value. some likert questions have
75.     length 5, others have length 3, so some special conversion is needed.
76.     returns a string'''
77.     number = float(number)
78.     if number <10:
79.         return str(int(math.floor((number)/5)))
80.     elif 10<= number < 16:
81.         return str(int(math.floor((number-10)/3) + 2))
82.     elif number >= 16:
83.         return str(int(math.floor((number-16)/5) + 4))
84.
85. def draw_sheet_question_heatmap(a, count):
86.     '''''the crazy - filter by both question and name'''
87.
88.
89.     count = str(count)
90.     b = open(find_hover_log(a))
91.
92.     b_count = 0
93.     a_count = 0
94.     a.readline()
95.     the_max = 0
96.     current_item = BS
97.     temp_array = []
98.     try:
99.         while True:
100.                line = b.readline()
101.                b_count += 1
102.                if not line:
103.                    break
104.
105.                elif "VIEW" in line:
106.
107.                    words = line.split()
108.                    temp_array.append((current_item, int(words[0])))
109.
110.                    for key in dd.keys():
111.                        if dd[key] in line:
112.                            current_item = key
113.
114.                elif "BLUR" in line or ("FOCUS" in line and "likert" in line):
115.                    words = line.split()
116.                    temp_array.append((current_item, int(words[0])))
117.
118.                    if "BLUR" in line:
119.                        text_or_likert = "text"
120.                    else:
121.                        text_or_likert = "likert"
122.                        words[3] = convert_likert(words[3])
123.
124.                    the_index = 0
125.
126.                    while True:
```

```
127.                         l = a.readline().split()
128.                         if len(l) == 0:
129.                             temp_array = []
130.                             break
131.
132.                         if int(l[0]) >= temp_array[the_index][1]:
133.                             the_index += 1
134.                             if len(temp_array) == the_index:
135.                                 temp_array = []
136.                                 break
137.
138.                         #need to convert current_item to BS, IS, etc
139.                         if "X:" in l and not "undefined" in l and len(temp_array) > 0:

140.                             curr_sheet = temp_array[the_index][0]
141.                             dict_string = eee[curr_sheet] + "_" + text_or_likert + "_"
    + words[3]
142.                             d[dict_string], the_max = \
143.                             addToArray(d[dict_string], the_max, int(l[2]), int(l[4]))

144.
145.
146.
147.         except Exception, e:
148.             traceback.print_exc()
149.
150.         #ok, we now have a dict of arrays, each of which needs to get written to file

151.         #n20/heatmap/subject_name/questionsheet/count/text_0/incomestatement.png
152.         c = a.name.split("/")
153.         img_base_name = "/".join(['heatmap', c[len(c)-2], "questionsheet", count])
154.
155.         for key in d.keys():
156.             if not isEmpty(d[key]):
157.                 img = img_from_array(d[key], the_max)
158.                 parts = key.split("_")
159.
160.                 #get question name
161.                 the_folder = parts[1] + "_" + parts[2]
162.
163.                 the_question = ddd[ee[parts[0]]]
164.                 mid_file = "/".join([img_base_name, the_folder])
165.
166.                 if not os.path.isdir(mid_file):
167.                     os.makedirs(mid_file)
168.
169.                 #create file name
170.                 out_name = "/".join([mid_file, the_question + ".png"])
171.
172.                 with open(out_name, 'wb') as f:
173.                     img.write_to_png(f)
174.                     print "image written to " + out_name
175.
176.     def draw_sheet_heatmap(a, count):
177.         '''''write heatmaps for each sheet (IS, BS, SCF etc) to file'''
178.         b = open(find_hover_log(a))
179.         count = str(count)
180.
181.         d = {}
182.         d[BS] = create_array()
183.         d[IS] = create_array()
184.         d[SCF] = create_array()
185.         d[SOE] = create_array()
186.         d[T8] = create_array()
187.         d[T7] = create_array()
188.
189.         b_count = 0
```

```
190.        a_count = 0
191.        a.readline()
192.        the_max = 0
193.        current_item = BS
194.        try:
195.            while True:
196.                line = b.readline()
197.                b_count += 1
198.                if not line:
199.                    break
200.
201.                if "VIEW" in line:
202.                    print line
203.                    #end of views for current item, let's switch
204.                    words = line.split()
205.                    the_stamp = int(words[0])
206.
207.                    while True:
208.                        l = a.readline().split()
209.                        if (len(l) == 0 or int(l[0]) >= the_stamp):
210.                            break
211.                        if "X:" in l and not "undefined" in l:
212.                            d[current_item], the_max = addToArray(d[current_item], the
    _max, int(l[2]), int(l[4]))
213.
214.                    #change the current item
215.                    for key in dd.keys():
216.                        if dd[key] in line:
217.                            current_item = key
218.
219.        except Exception, e:
220.            traceback.print_exc()
221.
222.        #ok, we now have a dict of arrays, each of which needs to get written to file

223.        #n20/heatmap/subject_name/count/sheet/incomestatement.png
224.        c = a.name.split("/")
225.        img_base_name = "/".join(['heatmap', c[len(c)-2], "sheet", count])
226.        if not os.path.isdir(img_base_name):
227.            os.makedirs(img_base_name)
228.        for key in d.keys():
229.            if not isEmpty(d[key]):
230.                img = img_from_array(d[key], the_max)
231.                out_name = "/".join([img_base_name, ddd[key] + ".png"])
232.                with open(out_name, 'wb') as f:
233.                    img.write_to_png(f)
234.                    print "image written to " + out_name
235.
236.
237.
238.    def draw_question_heatmap(a, count):
239.        '''''draw a question heatmap. write heatmaps for each question to file'''
240.
241.        b = open(find_hover_log(a))
242.        count = str(count)
243.
244.        #d will hold all of the question arrays
245.        #hopefully the overhead won't be huge
246.        d = {}
247.        d["likert_0"] = create_array()
248.
249.        #ok, a is open and b is open
250.        #scan b until you hit a likert or text
251.        #get the timestamp
252.        #while a's timestamp is smaller than that:
253.        #add all entries to b
254.        b_count = 0
```

```
255.         a_count = 0
256.         a.readline()
257.         the_max = 0
258.
259.         try:
260.             while True:
261.                 line = b.readline()
262.                 b_count += 1
263.                 if (b_count % 100 == 0):
264.                     print b_count
265.                 if not line:
266.                     break
267.                 if "BLUR" in line or ("FOCUS" in line and "likert" in line):
268.                     words = line.split()
269.
270.                     if "BLUR" in line:
271.                         text_or_likert = "text"
272.                     else:
273.                         text_or_likert = "likert"
274.                         words[3] = convert_likert(words[3])
275.
276.                     #get timestamp
277.                     the_stamp = int(words[0])
278.                     while True:
279.                         l = a.readline().split()
280.                         a_count += 1
281.                         if (a_count % 1000 == 0):
282.                             print a_count
283.                         if (len(l) == 0 or int(l[0]) >= the_stamp):
284.                             break
285.                         if "X:" in l and not "undefined" in l:
286.                             d[text_or_likert + "_" + words[3]], the_max = addToArray(d
    [text_or_likert + "_" + words[3]], the_max, int(l[2]), int(l[4]))
287.
288.         except Exception, e:
289.             traceback.print_exc()
290.
291.         #ok, we now have a dict of arrays, each of which needs to get written to file

292.         #n20/heatmap/subject_name/count/question/text_1.png
293.         c = a.name.split("/")
294.         img_base_name = "/".join(['heatmap', c[len(c)-2], "question", count])
295.         if not os.path.isdir(img_base_name):
296.             os.makedirs(img_base_name)
297.         for key in d.keys():
298.             if not isEmpty(d[key]):
299.                 img = img_from_array(d[key], the_max)
300.                 out_name = "/".join([img_base_name, key + ".png"])
301.                 with open(out_name, 'wb') as f:
302.                     img.write_to_png(f)
303.                     print "image written to " + out_name
304.
305.
306.     def draw_single_heatmap(a, count):
307.
308.         count = str(count)
309.
310.         array = create_array()
311.         the_max = 0
312.
313.         a.readline()
314.         while True:
315.             line = a.readline()
316.             if not line:
317.                 break
318.             words = line.split()
319.
```

```
320.             if "X:" in line and not "undefined" in line:
321.                 array, the_max = addToArray(array, the_max, int(words[2]), int(words[4
    ]))
322.
323.         img = img_from_array(array, the_max)
324.
325.         out_name = 'heatmap/' + a.name[13:-23] + "_" + str(count) + '.png'
326.         return out_name, img
327.
328.
329.     def main(argv=None):
330.         if argv is None:
331.             argv = sys.argv
332.         foldername = argv[1]
333.         subjects = os.listdir(foldername)
334.         subjects.sort()
335.         for subject in subjects:
336.             files = os.listdir(foldername + subject)
337.             files.sort()
338.             i = 1
339.             for file in files:
340.                 if "mous" in file:
341.
342.                     a = open(foldername + subject + "/" + file)
343.                     if argv[2] == 'sheet' and argv[3] == 'question':
344.                         draw_sheet_question_heatmap(a, i)
345.
346.                     elif argv[2] != 'sheet' and argv[3] == 'question':
347.                         draw_question_heatmap(a, i)
348.
349.                     elif argv[2] == "sheet" and argv[3] != 'question':
350.                         draw_sheet_heatmap(a, i)
351.
352.                     else:
353.                         out_name, img = draw_single_heatmap(a, i)
354.
355.                         with open(out_name, 'wb') as f:
356.                             img.write_to_png(f)
357.                     a.close()
358.                     i += 1
359.
360.     if __name__ == "__main__":
361.         sys.exit(main())
```

Import and export financial data: this code generates HTML from a CSV file. Use this to easily import financial statement data into HTML format. Copy and paste the output into an HTML file.

```
1.  import java.util.*;
2.  import java.io.*;
3.  import java.util.regex.*;
4.
5.  public class ImportFinancialStatement {
6.
7.      Scanner a;
8.      public ImportFinancialStatement(File f) throws FileNotFoundException{
9.
10.         //read the file into the scanner
11.         a = new Scanner(f);
12.     }
13.
14.     public String t(int i){
15.         // \t is the tab character, for pretty formatting
16.         String a = "";
17.         while(i > 0){
18.             a += "\t";
19.             i--;
20.         }
21.         return a;
22.     }
23.
24.     public String returnYear(String s){
25.       System.out.println(s);
26.       Pattern p = Pattern.compile("[0-9]{4}");
27.       Matcher m = p.matcher(s);
28.       if (m.find()){
29.         return m.group();
30.       }
31.       else return "";
32.     }
33.
34.     public String[] splt(String s){
35.         //if a cell in csv file has commas, excel places quotes around the cell info
36.         //we want to match the csv commas but not commas in the line
37.         //this regex does the trick
38.         return s.split(",(?=(?:[^\"]*\"[^\"]*\")*(?![^\"]*\"))");
39.     }
40.     public String stripquotes(String s){
41.         //if a line in a csv file has commas, excel places quotes around the cell
42.         //we want to strip the quotes
43.         return s.replaceAll("\"", "");
44.     }
45.     public void wrt(String s, String id){
46.         //write section titles - google leaves these out
47.         System.out.println(t(2) + "<tr>\n" + t(3) + "<td id=\"" + id + "\" class=\"nam
    e\">" + s + "</td>\n"
48.                                 + t(2) + "</tr>");
49.     }
50.
51.     /*Read a statement of cash flows from a CSV file and output it in the mousetracker
     format.*/
52.     public void importStatementofCashFlows(){
53.         String[] headerLine = splt(a.nextLine());
54.       System.out.println("<table id=\"statement_cash_flows\" class=\"tbl\" cellspacing
    =\"0\" cellpadding=\"0\">");
55.       System.out.println(t(1) + "<thead>");
56.       System.out.println(t(2) + "<tr>");
57.       System.out.println(t(3) + "<th id=\"info\" class=\"name\">" + stripquotes(header
    Line[0]) + "</th>");
```

```
58.       for(int i = 1; i < headerLine.length; i++){
59.         System.out.println(t(3) + "<th id=\"year_" + i + "\">" + returnYear(headerLine
    [i]) + "</th>");
60.       }
61.       System.out.println(t(1) + "</thead>");
62.       System.out.println(t(1) + "<tbody>");
63.       while(a.hasNextLine()){
64.             System.out.println(t(2) + "<tr>");
65.             String[] line = splt(a.nextLine());
66.             System.out.println(t(3) + "<td class=\"name\">" + stripquotes(line[0]) + "
    </td>");
67.             for(int i = 1; i<line.length; i++){
68.                 System.out.println(t(3) + "<td class=\"year " + i + "\">" + stripquote
    s(line[i]) + "</td>");
69.             }
70.             System.out.println(t(2) + "</tr>");
71.             if (line[0].equals("Total Assets")){
72.                 wrt("Liabilities", "liabilities_head");
73.             }
74.             else if(line[0].equals("Total Liabilities")){
75.                 wrt("Owner's Equity", "equity_head");
76.             }
77.         }
78.
79.       System.out.println(t(1) + "</tbody>");
80.       System.out.println("</table>");
81.
82.     }
83.
84.     /*Read an income statement and print out a table that's in the correct format.*/
85.     public void importIncomeStatement(){
86.       String[] headerLine = splt(a.nextLine());
87.       System.out.println("<table id=\"income_statement\" class=\"tbl\" cellspacing=\"0
    \" cellpadding=\"0\">");
88.       System.out.println(t(1) + "<thead>");
89.       System.out.println(t(2) + "<tr>");
90.       System.out.println(t(3) + "<th id=\"info\" class=\"name\">" + stripquotes(header
    Line[0]) + "</th>");
91.       for(int i = 1; i < headerLine.length; i++){
92.         System.out.println(t(3) + "<th id=\"year_" + i + "\">" + returnYear(headerLine
    [i]) + "</th>");
93.       }
94.       System.out.println(t(1) + "</thead>");
95.       System.out.println(t(1) + "<tbody>");
96.
97.
98.       //iterate through while the file has more lines
99.       while(a.hasNextLine()){
100.              System.out.println(t(2) + "<tr>");
101.              String[] line = splt(a.nextLine());
102.              System.out.println(t(3) + "<td class=\"name\">" + stripquotes(line[0])
     + "</td>");
103.              for(int i = 1; i<line.length; i++){
104.                  System.out.println(t(3) + "<td class=\"year " + i + "\">" + stripq
    uotes(line[i]) + "</td>");
105.              }
106.              System.out.println(t(2) + "</tr>");
107.              if (line[0].equals("Total Assets")){
108.                  wrt("Liabilities", "liabilities_head");
109.              }
110.              else if(line[0].equals("Total Liabilities")){
111.                  wrt("Owner's Equity", "equity_head");
112.              }
113.          }
114.
115.         System.out.println(t(1) + "</tbody>");
116.         System.out.println("</table>");
```

```
117.
118.         }
119.         public void importBalanceSheet(){
120.             //make header first line
121.             String[] headerLine = splt(a.nextLine());
122.             System.out.println("<table id=\"balance_sheet\" class=\"tbl\" cellspacing=
    \"0\" cellpadding=\"0\">");
123.             System.out.println(t(1) + "<thead>");
124.             System.out.println(t(2) + "<tr>");
125.             System.out.println(t(3) + "<th id=\"info\" class=\"name\">" + stripquotes(
    headerLine[0]) + "</th>");
126.             for(int i = 1; i < headerLine.length; i++){
127.                 System.out.println(t(3) + "<th id=\"year_" + i + "\">" + returnYear(st
    ripquotes(headerLine[i])) + "</th>");
128.             }
129.             System.out.println(t(1) + "</thead>");
130.             System.out.println(t(1) + "<tbody>");
131.
132.             //insert asset column head
133.             wrt("Assets", "asset_head");
134.
135.             while(a.hasNextLine()){
136.                 System.out.println(t(2) + "<tr>");
137.                 String[] line = splt(a.nextLine());
138.                 System.out.println(t(3) + "<td class=\"name\">" + stripquotes(line[0])
     + "</td>");
139.                 for(int i = 1; i<line.length; i++){
140.                     System.out.println(t(3) + "<td class=\"year " + i + "\">" + stripq
    uotes(line[i]) + "</td>");
141.                 }
142.                 System.out.println(t(2) + "</tr>");
143.                 if (line[0].equals("Total Assets")){
144.                     wrt("Liabilities", "liabilities_head");
145.                 }
146.                 else if(line[0].equals("Total Liabilities")){
147.                     wrt("Owner's Equity", "equity_head");
148.                 }
149.             }
150.             System.out.println(t(1) + "</tbody>");
151.             System.out.println("</table>");
152.         }
153.
154.         public static void main(String[] args) throws FileNotFoundException{
155.             System.out.println(System.getProperty("user.dir"));
156.             ImportFinancialStatement b = new ImportFinancialStatement(new File(args[1]
    ));
157.             String a = args[0];
158.             if (a.equals("bs")){
159.                 b.importBalanceSheet();
160.             }
161.             else if (a.equals("is")){
162.                 b.importIncomeStatement();
163.             }
164.             else if (a.equals("scf")){
165.                 b.importStatementofCashFlows();
166.             }
167.             return;
168.         }
169.     }
```

REFERENCE LIST

Barth, Mary E. 2007. "Standard-Setters, Measurement Issues, and the Relevance of Research." *Accounting and Business Research, Kingston Upon Thame*s 37 (3): 7-9.

Bloomfield, R., Christensen, T.E., Jamal, K., Moehrle, S., Ohlson, J., Penman, S., Previts, G., Stober, T., Sunder, S., and R.L. Watts. 2009. Response to the Financial Accounting Standards Board's and the International Accounting Standard Board's Joint Discussion Paper Entitled, "Preliminary Views on Financial Statement Presentation." *Johnson School Research Paper Series* No. #32-09.

Chen, M-C., Anderson, J.R. and M-H Sohn. 2001. What can a mouse cursor tell us more? Correlation of eye/mouse movements on web browsing. Paper presented at the ACM Computer-Human Interaction Conference, 2001, in Seattle, Washington.

Clor-Proell, S.M., Proell, C. and T. Warfield. 2010. Financial Statement Presentation and Nonprofessional Investors' Interpretation of Fair Value Information. Working Paper.

Financial Accounting Standards Board (FASB). 2001. Summary of User Interviews: Reporting Financial Performance by Business Users. Staff Paper. Norwalk, CT: FASB.

___. 2001. Proposal for a New Agenda Project: Reporting Information about the Financial Performance of Business Enterprises. Proposal. Norwalk, CT: FASB.

___. 2008. Preliminary Views on Financial Statement Presentation. Discussion Paper. Norwalk, CT: FASB.

___. 2009. Field test summary: preparer survey responses. Agenda Reference 17D.

___. 2009. FASRI Experimental Study. Staff Paper. Norwalk, CT: FASB. Agenda Reference 9A.

___. 2009. Analyst Field Test Results. Staff Paper. Norwalk, CT: FASB. Agenda Reference 9B.

Gilman, Stephen. 1925. Analyzing Financial Statements. New York: Ronald Press Company.

Maines, L., and L. McDaniel. 2000. Effects of comprehensive income volatility on non-professional investors' judgments: the role of presentation format. *The Accounting Review* 75 (2): 179 – 207.

Mundstock, George. 2003. The Trouble with FASB. *The North Carolina Journal of International Law and Commercial Regulation* 28: 813.

Nielsen, J. 5 August 2001. "First Rule of Usability? Don't Listen to Users." Alertbox. http://www.useit.com/alertbox/20010805.html (accessed October 7, 2010).

Nielsen, J. 8 June 2009. "Guesses vs. Data as Basis for Design Recommendations." Alertbox. http://www.useit.com/alertbox/guesses-data.html

Nielsen, J. 26 July 2010. "Interviewing Users." Alertbox. http://www.useit.com/alertbox/interviews.html (accessed November 26, 2010).

Sutton, Robert, and Jeffrey Pfeffer. 2006. *Hard Facts, Dangerous Half-Truths And Total Nonsense: Profiting From Evidence-Based Management.* Cambridge: Harvard Business Press.