Socionormative Influence in Software Adoption and Usage

Jason S. Snook

Dissertation submitted to the faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY
in
Computer Science & Applications

PhD Committee Members:

Dr. Andrea Kavanaugh (Co-chair)
Dr. Roger Ehrich (Co-chair)
Dr. Rebecca Scheckler
Dr. Deborah Tatar
Dr. Dan Dunlap

April 22, 2005
Blacksburg, Virginia

Keywords: Technology Acceptance Model, Social Influence, Motivation

Socionormative Influence in Software Adoption and Usage

Jason S. Snook

(ABSTRACT)

Each year, companies will spend millions of dollars developing or migrating to new software systems in their business processes. Much of the focus of development and implementation has been based upon customer need (i.e., requirements), and rightly so. Equally important to requirements, however, are the users' perceptions of the software. Does a user actually think a piece of software would help them meet the need identified? Does the user think it would be easy for them to implement this software as a solution? What do the people around the user think and how does that opinion affect theirs? It is important to understand what factors determine whether a potential user will adopt a software application and how much they will use it? A commonly used model for explaining this is the Technology Acceptance Model. Davis (1989) found that subjective belief about a software system is most closely related to the actual intention to use it. Specifically, Davis uses Perceived Usefulness and Perceived Ease of Use in the Technology Acceptance Model to model intention to use a software system statistically.

Neither of these subjective views are formed by a potential user in isolation. The opinions and behavior of others can potentially exert a great deal of influence on an individual's perception of these factors. Davis himself points out the omission of social influence in the original Technology Acceptance Model was due to measurement difficulties rather than to its potential value in the model. Difficulty in measuring social influence is evidenced by the lack of a definitive scale of social influence. By its

common use in many studies, Subjective Norm has become the "defacto standard" for measuring social influence but this has not resulted in a consistently significant measure of social influence. The goal of this current study is two-fold. The primary goal is to incorporate a validated scale of social influence into the original Technology Acceptance Model which preserves the model's parsimony while significantly increasing its explained variance. Secondarily, in doing so, a modified scale based upon Subjective Norms will be verified and tested. In response to a recognized shortcoming of Subjective Norm, a cognitive element will be included into the modified scale.

In this current study the modification of Subjective Norm was developed based upon existing research on the topic. The Technology Acceptance Model is augmented by the proposed scale and tested over four surveys. Two systems are chosen for study because of the nature of their use; use of one (Filebox) is voluntary, and use of the other (Blackboard) is compulsory. The results of the survey were consistent across all four surveys, with the model predicting over 40% of the variation in behavior every time. Including the modified scale of Subjective Norm significantly increased the explained variance of the model (i.e., R^2) in every survey. The results verify the reliability and validity of the modified scale of Subjective Norm. These four studies make a strong case for including this scale of social influence as a regular scale in the Technology Acceptance Model for future research. Future directions for studying the scale and the resulting model are also discussed. The resulting behavioral model is a valuable tool that will give software developers and managers more forethought and insight into the development of and migration to specific software systems.

Acknowledgements

At the completion of this project, I feel very much indebted to a number of people, without whom, I would have found my task either impossible or far less enjoyable than it has been. The story of this project very much has an epic quality to it, at least in my mind, with many plot twists along the way. This has included a switch of advisors half way through and the addition of another committee member further along the way. I would like to thank one of my current advisors, Andrea Kavanaugh and my former advisor Mary Beth Rosson, for their guidance over the last 5+ years. Over the course of graduate school, I have had much to learn about being a quality researcher. As I finish graduate school, I am undeniably the product of their mentorship and for that, I am very much grateful. I would also like to thank Roger Ehrich for stepping in as a co-advisor and helping me with many of the administrative aspects of this project. Deborah Tatar has provided a great deal of valuable insight to me on the quantitative aspects of this project as has Rebecca Scheckler on the qualitative aspects. Dan Dunlap, who graciously joined my committee in the latter stages of the project, has been helpful in looking for assumptions in my analysis or conclusions that may have otherwise weakened my findings. The members of my committee are scholars of the highest degree. A more talented and well-balanced committee would be, in my opinion, hard to find.

In addition to the hard work of my committee, I would also like to thank Than Than Zin who graciously helped me learn the language of a statistician. Her comments and advice have greatly improved the overall quality of my analysis as well as the subsequent reporting of the results. I would also like to thank the Virginia Tech Office of Institutional Research and Planning Analysis (www.irpa.vt.edu) for providing the generous student sample which made the final survey possible.

My other acknowledgements are of a more personal nature. My fiancée, Katie, has been my constant source of encouragement and inspiration. She has been my constant companion through my many fluctuations between euphoria and foul emotion during the course of this project. Being her husband will be an honor that will far outshine all of my

achievements thus far or ever. My final acknowledgement is my biggest. Everything I have ever accomplished, I owe to the example of my Lord and Savior Jesus Christ. Mere vanity or self-worship can only compel a person to the limits of his or her own imagination. God has propelled me far beyond that to a place I could have never imagined myself. Let my accomplishments be His and let my honor go to no one but Him.

Table of Contents

List of Tables

List of Figures

1. Introduction

Within the last two decades, applications of behavioral theory in software adoption research have begun to elicit powerful models of adoption and use that can explain and predict user behavior with increasing accuracy. While some factors that contribute significantly to usage behavior are supported by a large body of research, other potentially significant factors still need to be investigated more fully by the research community. One such factor is social influence. While a large body of research does, of course, exist on social influence, many opportunities for productive research in this area remain.

Many of the behavioral models that will be discussed in this dissertation have produced valuable results upon which this current study builds. One such model which most directly influences the current study is the Technology Acceptance Model (Davis 1989; Davis et al. 1989). The Technology Acceptance Model is an adaptation of a more general model of behavior known as the Theory of Reasoned Action. Because of the difficulty in measuring social influence, however, Davis excluded this factor from his initial model. Since then, several attempts have been made to reintroduce such a measure into the Technology Acceptance Model. These attempts have been either non-significant or significant only in compulsory situations (Yeaman 1988; Davis et al. 1989; Mathieson 1991; Malhotra et al. 1999; Venkatesh et al. 2000; Venkatesh et al. 2003).

The main contribution of this current research study is to offer a validated scale of social influence that fits well into the Technology Acceptance Model. This scale will be a modification of one that has typically been used to measure social influences in these models but often with little success (Subjective Norm). The development of this scale will closely follow the method used by Davis in developing scales for Usefulness and Ease of Use in the original Technology Acceptance Model (Davis 1986). The goal will be a scale that preserves the parsimony of the original Technology Acceptance Model while significantly adding to its predictive power. Such a scale would show significance

across a number of mediating variables, particularly voluntariness, since noncompulsory behavior may still be socially influenced in less salient ways.

This dissertation will begin with a review of a group of related motivational models that have developed over the past 30 years. Next, a more focused review will outline current knowledge on the measurement of social influence with suggestions for the inclusion and combination of several social theories to elicit a stronger model of software adoption and use. In Chapter 3, a revised model will be proposed based upon the research reviewed previously. All of the methods used to develop and test this model will be included. In Chapter 4, the results of the research are reported. Chapter 5 provides a discussion of the results and directions for future research.

2. Prior Research

As stated in the previous section, several concepts of behavioral theory are fairly well established in the literature that will be reviewed in this chapter. The theories and models which include and verify these concepts are the basis for the research model this current study will use. Another point of note in much of the research reviewed below is the weakness of social influence (typically measured by Subjective Norm) as it is used in these models historically. This chapter will not only show its shortcomings, however, but also suggest areas where it can be improved. Based upon these suggestions, this current study will implement a modified version of Subjective Norm into the Technology Acceptance Model that significantly increases the model's predictive power while preserving its parsimony.

2.1 Studies of Attitude and Behavior

2.1.1 Diffusion of Innovation

Everette Rogers' *Diffusion of Innovations* theory has been a seminal work for researchers studying attitude and motivation since 1962 (Rogers 2003). Diffusion of Innovations theory postulates that, for any new technology or behavior, there are five principle

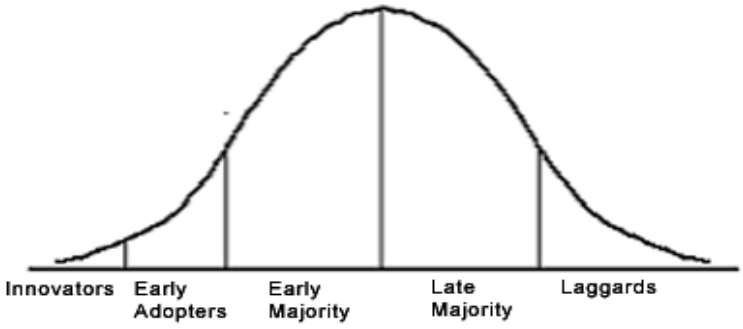

Figure 2-1 – Rogers' Innovation Curve

categories of adopters. These groups can be seen on a bell-shaped curve with those that are fastest and slowest to adopt a new innovation representing either end of the curve (see Figure 2-1). From right to left, the categories represent an increasing propensity to adopt

an innovation and take on the risks associated with doing so. For a detailed discussion of each of these groups refer to Rogers (1995, p. 257).

More relevant to our current discussion, Rogers also describes five perceived attributes of an innovation that can affect its rate of adoption. The first, Relative Advantage, refers to the degree to which a new innovation is perceived as being better than the process or technology it would replace. Compatibility refers to how consistent an innovation is with existing values, past experiences, and needs. Complexity refers to the perceived difficulty of understanding and utilizing a new innovation. Trialability refers to perceived opportunities to experiment with an innovation on a temporary basis. Observability refers to the visible outcomes of an innovation and whether those outcomes are visible by the actor and others around him/her.

A number of studies have used these factors to explain innovation adoption. Previous studies, Rogers claims, have explained 49 to 87 percent of the variation in adoption rates using these attributes (Rogers 2003). In subsequent sections of this chapter we will discuss research that has taken advantage of these concepts and adapted them to information technology adoption.

2.1.2 Social Cognition Theory

Social Cognition Theory is a collection of concepts that together describes how humans learn and acquire new behaviors and character traits (Bandura 1986). Several of these concepts are relevant to this current project. Two key concepts of the theory are self efficacy and outcome expectations. Self efficacy refers to a subject's judgment of their own ability to successfully perform an action (Bandura 1986, pp. 319-392). Knowledge of the capabilities required to complete an action is, however, different from actually believing one, in fact, has those capabilities. It is this latter notion that is correctly regarded as self efficacy although the former is a component of it. Outcome expectations refer to the specific consequence a subject believes to result from a given behavior (Bandura 1986, pp. 391). To put it another way, if self efficacy is the belief that one can kick the game-winning field goal, the outcome expectation is not the ball going through

the uprights (that's still the action) but rather the applause and praise one receives as a *result* of the action.

In addition to the above concepts which explain how behavior is enacted, *observational learning* explains how specific behaviors are learned and acquired in the first place (Bandura 1977; Bandura 1986). Observations of others' actual behavior are one of the most effective ways of learning and subsequently adopting a new behavior one's self. In fact, social cognitive theory postulates that *most* behavior is acquired and adapted, not by personal trial and error but, by vicariously observing other people's behavior and the corresponding consequences of those actions (Bandura 1986, p. 19). Diffusion of Innovation Theory's notion of observability in the previous section is closely related to this, focusing on demonstrated actions and observable outcomes.

Tying these concepts together, studies have shown that the modeling of specific behaviors can reinforce subjects' confidence in enacting that behavior and the subsequent benefit of doing so (Bandura 1977; Bandura 1982; Bandura 1986). As will be seen in later sections, self efficacy and outcome expectations are firmly established as key **component**s of several later models of behavior (Compeau et al. 1991; Compeau et al. 1995). Vicarious learning, however, is more underutilized as a motivator for behavior. While the perception of other's attitudes and opinions has been commonly used in behavioral research, observations of actual behavior have been comparatively underutilized. Bandura's theory, however, would stress the importance of observed behavior in the formation of learned traits, providing strong motivation for the inclusion of such a measure in this current study's research model (see Chapter 3).

2.1.3 Theory of Reasoned Action

Many current research models of attitude and behavior have their roots in Fishbein and Ajzen's Theory of Reasoned Action (Fishbein et al. 1975; Ajzen et al. 1980). Fishbein and Ajzen describe general behavior via aspects of subjective belief. Specifically, Fishbein and Ajzen identified intrinsic attitudes and extrinsic social motivators as major

predictors of a person's intention to perform a certain behavior (see Figure 2-2). The Theory of Reasoned Action postulates that the intention to behave a certain way is influenced by a person's attitude toward that behavior and the Normative Influences either for or against the behavior. In turn, attitude and Normative Influence (also called Subjective Norm) are each shaped by the subjective beliefs discussed below. The two elements of note in the model are (1) the combined relationship of Attitude and Subjective Norm to Behavioral Intention (A + SN = BI) and (2) the relationship between intention and actual behavior (BI = B). Intention as a moderating variable between subjective belief and actual behavior has traditionally been a strong finding in many studies and meta-studies of the Theory of Reasoned Action (Burnkrant et al. 1988; Sheppard et al. 1988; Ajzen 1991; Taylor et al. 1995). This is primarily because one's favorable attitude toward an actual behavior does not guarantee that action will be carried out (Fishbein et al. 1975). A person may have a favorable attitude toward buying a certain brand new car and may still never do so. Conversely, a couple may have an unfavorable attitude towards birth control and still may use it (Simons et al. 2001). For this reason, the inclusion of actual intention to adopt a behavior helps to mitigate this paradoxical gap. In fact, the exclusion of Behavioral Intention typically lowers the explained variance of many of the models of this general form. In a meta-analysis of 87 research projects utilizing Theory of Reasoned Action, the average correlation between behavioral intention and actual behavior was .53 ($p < .01$) (Sheppard et al. 1988).

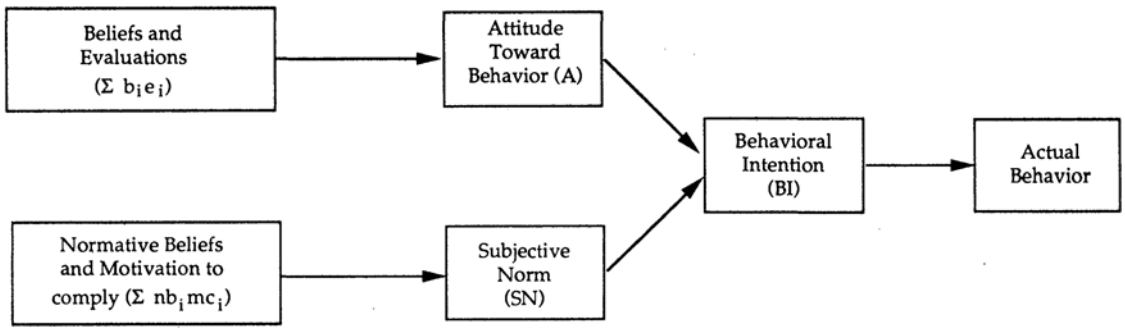

Figure 2-2 – Theory of Reasoned Action

The two major factors of Theory of Reasoned Action (Figure 2-2) are Attitude and Subjective Norms which are themselves composites of several other factors. Attitude is typically represented in the following form:

$$\sum_{i=1}^{n} b_i e_i$$

where b_i is the belief that performing a certain behavior will produce a given outcome or consequence and e_i is the evaluation of that consequence (i.e. whether it is favorable or not). In this way, Theory of Reasoned Action's attitude construct resembles the Social Cognitive Theory's concept of outcome expectation (Bandura 1986) (discussed further in Section 2.1.1).

The Subjective Norm construct is likewise a composite of two factors represented in the following form:

$$\sum_{j=1}^{n} NB_j MC_j$$

where NB_j is the belief that the referent *j* thinks the individual should or should not perform the behavior specified and MC_j is the Motivation to Comply with referent *j*. Table 2-1 shows the general form of the scale item for each of these factors.

Normative influence…
"People who _____ think I should _____."
Motivation to Comply…
"Generally speaking, I want to do what _____ think I should do."

Table 2-1 - Traditional example of Subjective Norm scale from Fishbein and Ajzen (1975) and Ajzen and Fishbein (1980)

Historically, Fishbein and Ajzen's model typically accounts for 40% to 50% of the variation in Behavioral Intention (Sheppard et al. 1988; Ajzen 1991; Godin et al. 1996; Hale et al. 2002). Theory of Reasoned Action, and the major models derived from it, (see Sections 2.1.4 through 2.1.6) will provide the major theoretical basis for the model presented in this current study.

2.1.4 Theory of Planned Behavior

Subsequent studies of Theory of Reasoned Action examined additional variables and paths in efforts to improve the explained variance of Fishbein and Ajzen's original model. Ajzen and Madden (1986) later studied the effect of perceived feasibility to perform a behavior, calling the new variable Perceived Behavioral Control. Their examination of the resulting model, eventually renamed the Theory of Planned Behavior, significantly increased the model's ability to account for variation in intention and actual behavior (Ajzen et al. 1986; Ajzen 1987; Ajzen 1991; Madden et al. 1992). Perceived Behavioral Control addresses one of the main limiting conditions of Theory of Reasoned Action by taking into account compulsory factors that stand as barriers to behavior (Sheppard et al. 1988). Perceived Behavioral Control is formally defined as "the individual's perception of his or her control over performance of the behavior" (Mathieson 1991). Availability of resources or support necessary to complete a task may affect the perceived feasibility of a behavior and subsequent performance of it. Madden et al. (1992) conducted a study comparing Theory of Planned Behavior with its predecessor Theory of Reasoned Action (Madden et al. 1992). Researchers studied 94 undergraduate business students with regard to 10 common activities. Overall, the addition of Perceived Behavioral Control to the original Theory of Reasoned Action model increased the predictive strength of the model by an average of 10 percent. However, the strength of Perceived Behavioral Control was somewhat dependent on how volitional the behavior was. If respondents felt a high degree of control over the situation, Perceived Behavioral Control had less of a direct effect on the actual behavior.

2.1.5 Technology Acceptance Model

In a further adaptation of Theory of Reasoned Action, Davis (1989) proposed a model called the Technology Acceptance Model which specifically described the adoption and use of technology (Davis 1989; Davis et al. 1989) (see Figure 2-3). Like the Theory of Reasoned Action, Davis proposed that subjective belief plays a major role in a user's

intention to use certain technologies. Technology Acceptance Model measures belief using two constructs: Perceived Usefulness and Perceived Ease of Use.

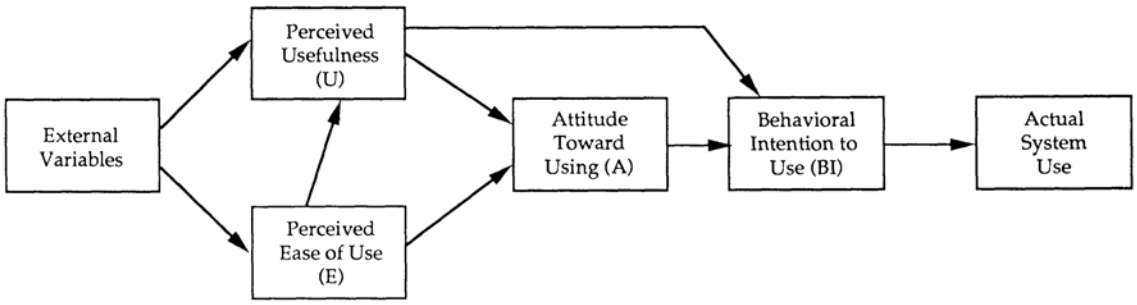

Figure 2-3 – Technology Acceptance Model

Perceived Usefulness is defined by Davis as the "degree to which a person believes that using a particular system would enhance his or her job performance." (Davis 1989) This definition could be expanded from job functions to include any task, be it academic, social, or otherwise. Following a "path of least resistance" model, users can be expected to use technologies that they believe will help them with their tasks. Perceived Usefulness is similar to Bandura's (1986) concept of Outcome Expectations in Social Cognitive Theory which measures the perceived benefit (or outcome) of a particular behavior.

Perceived Ease of Use is a scale measuring the amount of effort a person believes a system requires to use. Thus, adoption is contingent on the perceived benefits of using a system outweighing the effort to actually use it. Intuitively, users are more prone to adopt a technology they are confident they can use. Perceived Ease of Use is informed greatly by another one of Bandura's (1986) notions, namely self-efficacy. Self-efficacy provides a framework for measuring a person's belief in their ability to complete a task or achieve a goal. While empirically the two concepts are distinct, they are related enough that the effect of self-efficacy can be mediated by the Perceived Ease of Use scale (Venkatesh et al. 2000).

Technology Acceptance Model contains two other mediating variables, one of which is Attitude and the other is Behavioral Intent. Attitude is defined as an "individual's positive or negative feelings about performing the target behavior." (Davis et al. 1989)

Behavioral Intention is describes a user's intention to use a certain technology. In short, Technology Acceptance Model uses Perceived Ease of Use and Perceived Usefulness to predict usage through the mediating variables Attitude and Behavioral Intention (Figure 2-3). Beyond just *describing* use, the Technology Acceptance Model provides a model that can *explain* and even *predict* use. The Technology Acceptance Model benefits not only from much of the research conducted on the Theory of Reasoned Action (Fishbein et al. 1975; Ajzen et al. 1980) but also from many studies of the Technology Acceptance Model itself. The weight of existing research goes far to show the statistical validity of the model. Davis (1989) used two six-item scales to measure Perceived Usefulness and Perceived Ease of Use with resulting reliabilities of .98 and .94 respectively. Subsequent research did, however suggest that Attitude was an unnecessary mediating variable for Behavioral Intention and is normally not used in the model in more recent studies (Davis et al. 1989; Thompson et al. 1991; Taylor et al. 1995; Venkatesh et al. 2003).

2.1.6 Unified Theory of Acceptance and Use of Technology

More recently, Venkatesh and Morris (2003) conducted a survey of the major models of technology diffusion and usage. Including many of the aforementioned studies, the authors (including Davis) analyzed and tested eight distinct models of usage. These models were the Theory of Reasoned Action, the Technology Acceptance Model, the Motivational Model, the Theory of Planned Behavior, a model combining the Technology Acceptance Model and the Theory of Planned Behavior, the Model of PC Utilization, Innovation Diffusion Theory, and Social Cognitive Theory.

Recognizing the redundancy between elements of these models, the authors developed a harmonization of the models based upon the distinct and significant elements of them all. The result was a model they called the Unified Theory of Acceptance and Use of Technology (UTAUT) (see Figure 2-4). The model has three significant predictors of system use which are mediated by behavioral intention; these are: Performance Expectancy, Effort Expectancy, and Social Influence.

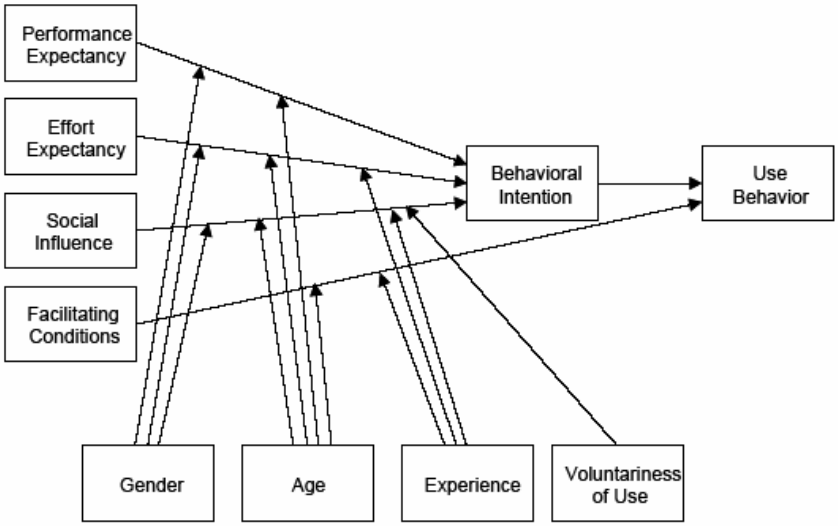

Figure 2-4 – Unified Theory of Acceptance and Use (from Venkatesh and Morris (2003))

Performance Expectancy was defined as "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" (Venkatesh et al. 2003). This scale is most closely related to Perceived Usefulness in Technology Acceptance Model (Davis 1989; Davis et al. 1989). Effort expectancy is defined as "the degree of ease associated with the use of the system" (Davis 1989, p. 450). This scale is most closely related to Perceived Ease of Use in the Technology Acceptance Model (Davis 1989; Davis et al. 1989). Facilitating conditions, defined as "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" (Davis 1989, p. 453), had a significant direct effect on actual use but only when moderated by age and experience (i.e. older users with more experience). This scale is closely related to Perceived Behavioral Control in Theory of Planned Behavior (which was the major innovation of this model over Theory of Reasoned Action) (Ajzen et al. 1986; Ajzen 1991). Four moderating variables (gender, age, experience, and volition) also significantly added to the strength of the model. Using samples taken at three separate times, UTAUT explained approximately 50% of the variation in Behavioral Intention. When the samples over the three time periods were pooled, the explained variance of the model (R^2) increased to over 70%. Although some

question exists about their pooling of samples collected over time, the authors provide several appendices to justify pooling the samples.

Social Influence is defined, as it traditionally is in user acceptance literature, as "the degree to which an individual perceives that [other influential people] believe he or she should use the new system" (Davis 1989, p. 451). The primary factor of the authors' Social Influence scale was Subjective Norm with two additional factors (Social Factors and Image). Social Factors refers to the internalization of an individual's subjective culture and interpersonal interactions (Thompson et al. 1991), having to do with both the opinions and the behavior of others. Image refers to the perceived social outcomes of a behavior (Moore et al. 1991), very similar to Bandura's notion of Outcome Expectation (see Section 2.1.2). Of particular interest to this current study was the fact that *none* of these constructs were significant in voluntary situations (Venkatesh et al. 2003). In this study and in an earlier one conducted by Venkatesh, he contends that the effects of social influence in voluntary situations affect the perception of technology and are thereby fully mediated by the other attitudinal measure of the model (Venkatesh et al. 2000; Venkatesh et al. 2003). In neither study, however, was it hypothesized initially that social influence would not be significant in voluntary situations. In fact, Fishbein and Ajzen first proposed Theory of Reasoned Action (with SN as one of its primary factors) specifically for the prediction of volitional behavior (Terry et al. 1996). Neither has it been an expectation or a finding of other related studies using some measure of social influence that it would *only* be significant in mandatory situations (Fishbein et al. 1975; Davis 1989; Davis et al. 1989; Ajzen 1991; Mathieson 1991; Taylor et al. 1995). This current study contends that the scale of social influence introduced by Fishbein and Ajzen (1975), and used in similar form ever since, is important but inadequate. While many of the social influence scales used in the models described above measure a subject's perception of attitudes, they do not consider actual observed behavior. This current study will test a modification of Subjective Norm that includes an Observed Behavior subscale according to Bandura's (1986) Social Cognition Theory.

2.1.7 Survey of Social Influence Research

A common factor in many of the models and theories is some notion of social (or normative) influence. Not only do these models include a scale of social influence in their models but they do so in a very similar manner. Subjective Norm (SN) is the scale typically used in many of the motivational models discussed above. Ajzen and Fishbein (1975) define Subjective Norm as a person's belief that other influential people think he or she should (or should not) perform the behavior in question. Fishbein first adapted the notion of Subjective Norm into Theory of Reasoned Action based upon Dulany's Theory of Propositional Control (Dulany 1961; Dulany 1964; Fishbein 1967; Dulany 1968; Fishbein et al. 1975). Dulany's theory had two factors, Behavioral Reinforcement and Motivation to Comply. Dulany's first factor, Behavioral Reinforcement, measures the expected response of others to a particular action, similar to Bandura's notion of Outcome Expectations (see Section 2.1.2). Fishbein adapts this slightly to measure the perception of other peoples' attitudes toward a particular behavior, calling it Normative Beliefs. Dulany's second factor, Motivation to Comply, measures the propensity to conform to others' sentiments and is used similarly by Fishbein. Fishbein describes Subjective Norm then as the product of *Normative Beliefs* and the *Motivation to Comply*. Subject norms are formed by the opinions of important or relevant referents and one's propensity to comply with those views.

Subjective Norm is almost universally acknowledged as an important factor in motivation, but it has consistently added little to the overall predictive strengths of the models which contained them (Yeaman 1988; Davis et al. 1989; Mathieson 1991; Venkatesh et al. 2003). Ajzen (1991) found that in over half of the 19 existing studies on TPA at the time, subjective norm was not significant in predicting intention (Ajzen 1991). Farley et al. (1981) found across 37 different tests of Theory of Reasoned Action that attitude explained approximately 50% more of the variance than Subjective Norm did for Behavior Intention (Farely et al. 1981). In two separate studies, Fishbein (1980, 1982) found that intrinsic attitudes were stronger and more important in determining intention than extrinsic Normative Influences as measured by Subjective Norm (Fishbein

1980; Fishbein 1982). In his exclusion of Subjective Norm from Technology Acceptance Model, Davis (1986, 1989) recommends using Kelman's processes of social influence to include it (Kelman 1958). Following this recommendation, Malhotra (1999) tested Technology Acceptance Model with Kelman's process of social influence on a subject pool of 208 but this modification turned out to be nonsignificant (Malhotra et al. 1999). A refinement of Subjective Norm, as it is historically used for the past 30 years, seems to be more appropriate than excluding it from the models. One reason for the weakness of Subjective Norm as a predictive variable may be that other aspects of social influence are missing from it.

As mentioned in the previous section, one reason identified in prior research for the weakness of Subjective Norm measures is in it's operationalization solely as a perception of other peoples' attitudes (Terry et al. 1996). Opinion is oftentimes hard to observe. Depending upon the attitude, many behaviors may elicit very observable opinions from others, such as cell phone use while driving. But for other behaviors (e.g., the general use of a cell phone) it may be difficult to assert a perception of other people's opinions confidently. The absence of a strong cognitive element has been pointed out by several authors as a major shortcoming of the operationalization of SN (Grube et al. 1986; Kashima et al. 1992; Nucifora et al. 1993; Terry et al. 1996; Forgas et al. 2001).

Albert Bandura's theory of social cognition provides a cognitive dimension to subjective norm (Bandura 1977; Bandura 1986). Social Cognition Theory describes how modeled behavior functions as a powerful influence on behavior. Within Social Cognition Theory, *observation learning* is the vicarious process by which one could see others model the behavior in question. Furthermore, *identification* suggests that people are most influenced by those they are most endeared to, either as a result of similarities to one's self or a degree of emotional attachment (Bandura 1986). Social Identity/Social Categorization Theory rests on a similar premise that endearment and commonality within a group directly correlate with the size of the influence (Abrams et al. 1990; Turner 1991). Research on social networks also finds that the social proximity of an influencer affects the amount of the influence (Rice et al. 1990).

In light of Bandura's theory of social cognition, Terry and Hogg (1996) (p. 778) suggested broadening Theory of Reasoned Action's traditional understanding of subjective norm to include the perceived behavior of others (sometimes called behavioral norms). In a test of the Theory of Reasoned Action that included measures of perceived behavior, Nucifora et al. (1993) found the behavior of significant others, in this case the sexual partner, to be a significant predictor of intention to use condoms. Grube et al. (1986), in their study of underage smoking behavior, also found that the perceived behavior of significant others was a significant determinant of intention. The modified scale designed and tested in this study will contain the traditional factors of Subjective Norm (Normative Influence and Motivation to Comply) *plus* a cognitive factor called Observed Use.

2.2 Research Hypotheses

The basic research question addressed in this current study is "what factors motivate the use of a technical system?" Several of the models mentioned above were created specifically to investigate this question. What they lack is a variable that consistently explains the effect of social influence on technology adoption. This particular project is focused on technology adoption behavior but the need for a modified scale of social influence may be relevant for other areas of behavior and innovation research.

The main goal of this current study is to design, test, and integrate a modified scale of Subjective Norm into the traditional Technology Acceptance Model. The design and testing of this scale would be a significant advance over previous work if it were significant both for compulsory *and* for voluntary systems since the latter is rarely achieved in most research studies. The three factors that this modified Subjective Norm scale will include are Normative Influence, Motivation to Comply (sometimes referred to as "susceptibility to Normative Influence"), and Observed Use (otherwise known as "reciprocal determinism" or "behavioral norm") (see Figure 2-5 below). The aim of including this modified scale of Subjective Norm into the Technology Acceptance Model

is to strengthen the predictive power of the original model while preserving its parsimony (Taylor and Todd 1995, Bagozzi 1992, Mulaik et al. 1989). Many models that have attempted to expand upon the predictive power of Davis' original model have done so at the cost of the model's parsimony which contributed to its elegance and original strength. In a comparison of their own model with Technology Acceptance Model, Taylor and Todd (1995) make the observation that it took the inclusion of seven more

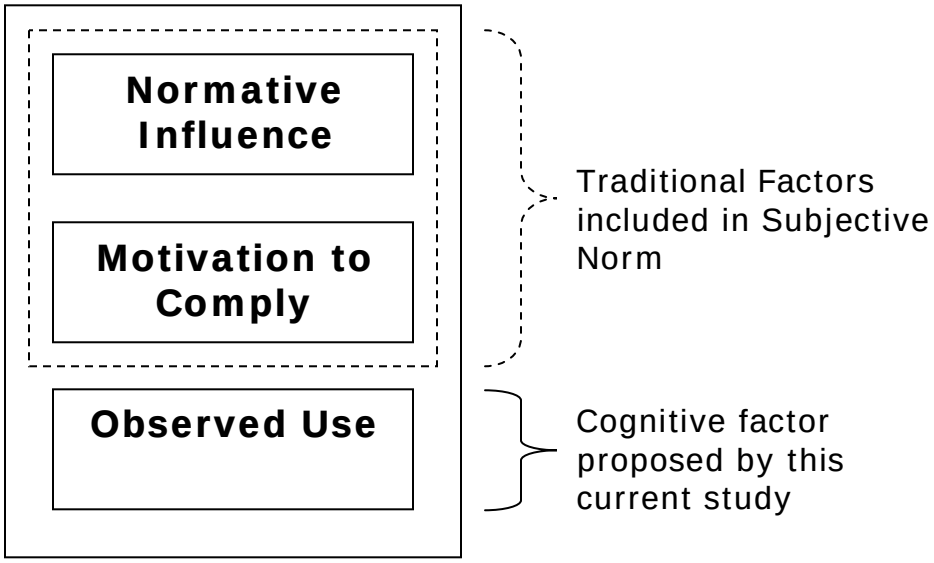

Figure 2–5 – Modified scale of Subjective Norm showing three subscales

constructs to the Technology Acceptance Model to explain just 2% more of the variance in Behavioral Intention. While there does exist a trade-off between parsimony and comprehensive understanding of the behavior being modeled, more often the former is preferable (Muliak et al. 1989; Bagozzi 1992). One of the goals of this study is to significantly increase the predictive power of Technology Acceptance Model with the addition of *just one* variable. In doing so, this current study will reclaim an important factor (social influence) missing from the Theory of Reasoned Action from which it was derived.

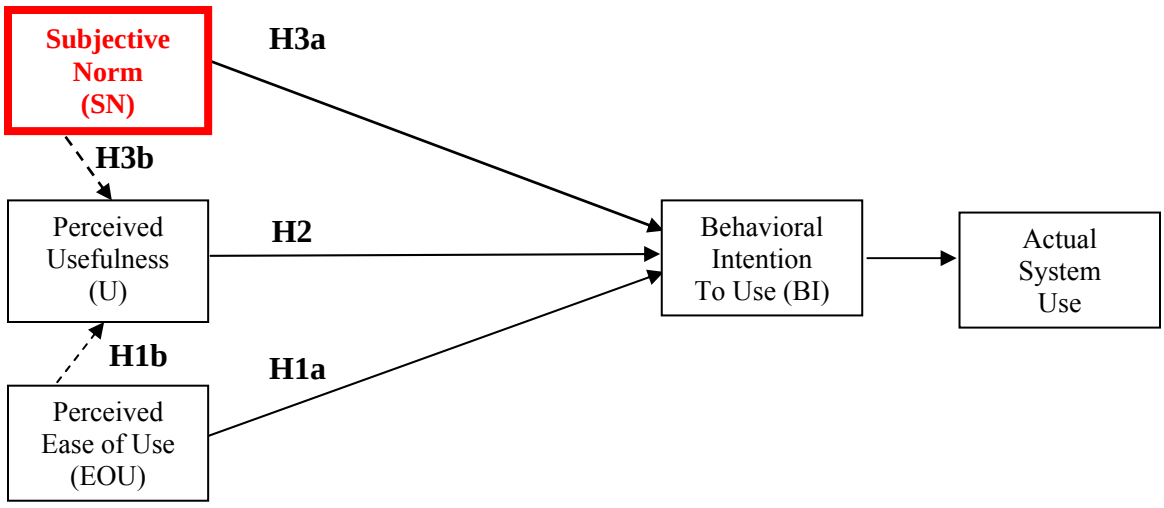

Figure 2-6 – Proposed Research Model

The revised model outlined above adds the modified Subjective Norm scale as a predictor of Behavioral Intention (Figure 2-5). Consistent with existing literature on the topic, Perceived Ease of Use and Perceived Usefulness will continue to be significant predictors of BI (hypotheses H1a and H2). Perceived Ease of Use will also continue to have an indirect effect on Behavioral Influence via Perceived Usefulness (hypotheses H1b). An indirect effect is the effect one variable has on another through the mediation of an intervening variable (Pedhazur 1997). Subjective Norm will also be a significant predictor of Behavioral Influence (hypothesis H3a). Since a socially accepted technology will likely be of greater usefulness to the subject, it is also hypothesized that Subjective Norm will have an additional indirect effect on Behavioral Influence via Perceived Usefulness (hypothesis H3b). This indirect effect is attributable to the fact that technical systems favored and used by many are more useful to an individual as a result (Markus 1987; Rice et al. 1990; Thompson et al. 1991; Kraut et al. 1998). The following two chapters will outline the procedure used (Chapter 3) to test these hypotheses and the results (Chapter 4) that verify them.

3. Methods and Procedures

The development of the modified scale of Subjective Norm in this current study followed a very similar method to the development of the Perceived Usefulness and Perceived Ease of Use scales in Davis (1986). This chapter reports the process of developing the scale, acquiring the samples used, and describes the statistics used to analyze the data.

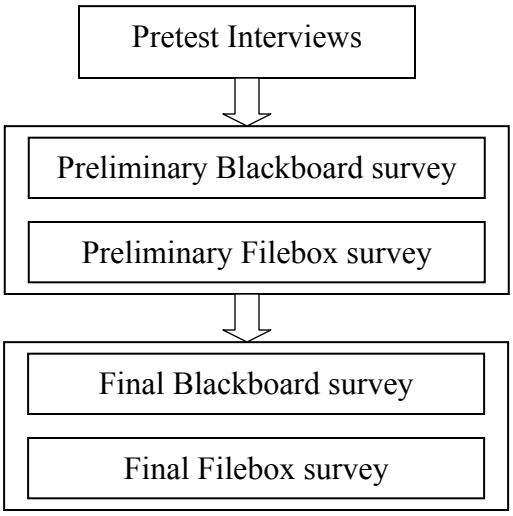

Figure 3-1 – Order of research steps for current study

After developing an initial scale for social influence based upon the relevant literature (see Section 4.1), a preliminary survey tested the modified scale of Subjective Norm with the rest of the existing model. Based upon the results from this preliminary survey (see Section 4.2), the survey was modified slightly and tested a final time (see Section 4.3). For both the preliminary survey and the final survey, two systems were (Blackboard and Filebox) were tested for a total of four surveys conducted in this study (see Figure 3.1).

3.1 Scale Development

Much early effort was devoted to developing a quality candidate scale before any refinement took place. The development of the modified scale of Subjective Norm was guided by a common method of measurement development used to ensure strong content

validity – specifically, the Domain Sampling Model (Bohrnstedt 1970; Nunnally 1978; Davis 1986). The model posits that, within the collection of relevant research literature, there is a hypothetical *domain* of all possible items which have been employed to measure the desired variable. If a random sample of these items was taken from the domain it should, theoretically, estimate the measurement that would be obtained if *all* the items in the domain had been included (Nunnally 1978). Since samples are almost never truly random and since the *entire* domain of possible items is almost impossible to define, it can be argued that a representative sample could be used as well (Davis 1986).

Normative Influence subscale items
People who influence my behavior would think I should use <tech>. [1, 5, 6]
People who are important to me would think I should use <tech>. [1, 5, 6, 7, 9]
People whom I respect would think I should use <tech>. [7, 9]
People whom I care about would think I should use <tech>. [1, 2, 7]
People who are in authority over me would think I should use <tech> [1, 11, 12]
People who I work with would think I should use <tech>. [1, 7, 11, 12]
Motivation to Comply subscale items
Generally speaking, I do what my classmates/coworkers think I should do. [1, 2, 7]
Generally speaking, I do what my friends think I should do. [1, 2, 7]
Generally speaking, I do what my professors/supervisors think I should do. [1, 2, 7]
Observed Use subscale items
Overall, my friends use <tech> (not at all…heavily). [2, 4]
Overall, my professors/supervisors use <tech> (not at all…heavily) [4, 11, 12]
Overall, my classmates/coworkers use <tech> (not at all…heavily) [4, 8, 11, 12]
I regularly see the people around me using <tech>. [4, 8, 10]
I regularly see the people around me *benefit* from using <tech>. [8]

Table 3-1 – Candidate scale for Subjective Norm with related articles

Note. [1] Taylor and Todd (1995), [2] Batra et al. (2001), [3] Xia (2000), [4] Venkatesh and Davis (2000), [5] Venkatesh (2000), [6] Ajzen and Fishbein (1980), [7] Moore and Benbasat (1991), [8] Mathieson (1991), [9] Kraut et al. (1998), [10] Schmitz and Fulk (1991), [11] Griffin (1983)

To help define the relevant body of literature from which to draw possible scale items, the following conceptual definition was adapted from traditional definitions from social psychology:

Social Influence is the process by which an individual's thoughts, feelings, and behaviors affect, or are affected by, others (Allport 1954; Feldman 1995).

Cook and Campbell (1979) refer to this as "preoperational explication of constructs," meaning that the development of a theoretical scale is tailored to a preconceived notion of the concept it is measuring (Cook et al. 1979). The domain of relevant literature for social influence included research studies from various fields including Computer Science, Management Information Science, Sociology, Psychology, and others (Ajzen et al. 1980; Griffin 1983; Mathieson 1991; Moore et al. 1991; Schmitz et al. 1991; Taylor et al. 1995; Kraut et al. 1998; Venkatesh et al. 2000; Venkatesh et al. 2000; Xia et al. 2000; Batra et al. 2001). From these studies, a collection of candidate items was developed (see Table 3-1). The resulting candidate scale benefits from over 20 years of cumulative research on social influence that significantly increased our chances of achieving high content validity in the final scale. Overlaps in meaning between the candidate items were intended not only because they are measuring the same underlying concept but also to mitigate variations in subjects' understanding of any one particular question thus improving the overall reliability of the scale (Davis 1986, pp. 76 & 83).

Normative influence…
"People who _____ think I should _____."
Motivation to Comply…
"Generally speaking, I want to do what _____ think I should do."

Table 3-2 - Traditional example of Subjective Norm scale from Fishbein and Ajzen (1975) and Ajzen and Fishbein (1980)

As explained, this project will enhance the traditional Subjective Norm scale (see Table 3-2) by adding a cognitive element to it. The scale proposed in this study also expands on the two existing elements of Subjective Norm by covering more sources of social influence. Measures of social influence have traditionally included perceptions of other people's thoughts and opinions. This research will posit that a measure of social

influence should consider not only what other people are thinking but what they are actually doing. The addition of Observed Use as a factor in this scale will help to measure not only perceptions of other peoples' thoughts but assesses their actions as well.

Following the procedure outlined in Davis (1985), a series of interviews were conducted as a preliminary validation of the current scale. Two considerations motivate such a validation. First, the items in our scale may not all be in the content domain we are trying to measure. Secondly, there may be too much coverage of certain aspects of the content domain. Pretest interviews were used to further improve upon the construct validity of the scale. Interviewees were asked to evaluate the semantic correspondence between our conceptual definition for Subjective Norm and the candidate items intended to measure it before the first survey was administered.

Scale ranking interviews provided useful insight into the strength of candidate items to be included in a final scale measuring social influence. A preliminary survey was then administered to test the validity and reliability of the scale in a survey. A scale is said to have high validity if it measures what it is supposed to measure *accurately*; it is said to have high reliability if it measures the same effect multiple times *consistently*. The survey would include all of the elements of the hypothetical model including scales for Perceived Ease of Use, Perceived Usefulness, the modified scale of Subjective Norm, Intention to Use, and actual use. This would indicate the internal consistency of the modified Subjective Norm scale as well as its performance within the Technology Acceptance Model.

Several modifications were made to the candidate scale during the course of developing the full survey. Consistent with the majority of the research in this area, a 7-point Lickert scale would be used for each scale item. Neutral was included as an option in the scale since social influence could be positive, negative, or indeed negligible. Since scale items would be combined to make composite measures for each element of the model, some questions were also reworded so they could all use a common scale. One example of rewording a question for the different scale is shown in Figure 3-1.

Overall, my classmates use Blackboard...

☐ Frequently ☐ Regularly ☐ Occasionally ☐ Rarely ☐ Not at all

was reworded to…

I regularly see my classmates using Blackboard

☐ Strongly agree ☐ Agree ☐ Slightly Agree ☐ Neutral

☐ Slightly Disagree ☐ Disagree ☐ Strongly Disagree

Figure 3-2 – Adjustments to Normative Influence Questions in survey

Scales for Ease of Use and Usefulness were taken from Venkatesh and Davis (2000). The complete list of survey questions can be found in Appendix C.

Since Blackboard could be regarded as a compulsory system students must use for class, a voluntary system was chosen for a second survey to see how the scale would perform. Several extra questions were included at the end of the Blackboard survey querying users on their use of several other systems made available to them by the university. These systems were Filebox, Webmail, myVT, and Addison.

Filebox (www.filebox.vt.edu) is an online interface by which students are provided with 30 MBs of storage space for personal and/or academic use. Webmail (www.webmail.vt.edu), in this case, refers to the university's own internet-based email system available to all students and faculty. myVT (www.my.vt.edu) is a customizable web portal which can include a range of relevant information for a student including weather, news, and an academic calendar. Addison (addison.lib.vt.edu) is the online interface for the university's library catalogue which lists books, journals, periodicals, and other media available.

Respondents were asked to rate their frequency of use for each of the systems on a 5-point scale (frequently, regularly, occasionally, rarely, or not at all). It was unnecessary to use the 7-point Lickert scale used in the rest of the survey since these questions had no relation to the scale items and would not be used in the model. Results from these

questions are shown below in Table 3-3. The system with the maximum amount of variance in use would be the optimal test for the model since low or non-use was just as important to be able to explain as high use. Ideally, usage statistics for at least one system would be spread evenly across all five possible levels. Filebox showed this distribution most closely.

	"I use <system>…" (% rounded to nearest whole number)				
System	**Frequently**	**Regularly**	**Occasionally**	**Rarely**	**Not at all**
Filebox	15	14	25	23	24
Webmail	59	18	15	5	2
myVT	4	29	11	29	55
Addison	4	8	37	31	19

Table 3-3 – Reported usage of four common system available at VA Tech.

Results from the preliminary (Blackboard and Filebox) surveys gave quantifiable support for the statistical strength of the modified Subjective Norm scale. However, several improvements could still be made before the final survey was conducted. Once again, the final survey would be conducted for both the Blackboard and Filebox systems. Implementation of the final (Blackboard and Filebox) surveys would not only provide a second iteration of the survey to verify the first iteration, but it would also address any major deficiencies in the completed parts of the project. The success of the preliminary gave strong evidence for the validity of the research model and an indication of which questions to consider deleting from the modified Subjective Norm scale. Both the survey and the systems being analyzed were kept the same with only a few exception in order to make the results between the preliminary and final survey comparable.

The entire Subjective Norm scale would be included as well, even scale items that were identified previously as ones likely to be trimmed. Final recommendations for scale items to remove would come after the final survey, hopefully supported by the collective findings from the entire current study. Turning to questions and variables outside of the research model, one question was added to address one of the project's major research

considerations. In the selection of systems to test, attention had thus far been given to the volitional or compulsory systems. Since perception is the key to many of the variables this model attempts to measure, it was appropriate also to measure perceptions of how volitional a system actually was according to the respondent. In fact, several other research projects have included voluntariness as one the key moderating variables for the motivational models they were developing (Moore et al. 1991; Venkatesh et al. 2003). These studies utilized a common variable on a 7-point scale for measuring voluntariness that we were able to use in this study ("My use of the system is voluntary."). Venkatesh et al. 2003, identifies this variable as one of four key moderating variables for their modification of Technology Acceptance Model, the others being experience, gender, and age, all of which are already included in the final survey.

All other elements of the final survey were left unchanged, including the selection of systems that would be tested. The final survey would be conducted first on Blackboard then secondly on Filebox. Not only were additional changes deemed unnecessary, but more changes would have made it difficult to compare the results from the two preliminary surveys with the results from the two final surveys.

3.2 Sampling

By drawing a representative sample of items from the research literature on social influence using the domain sampling model, we began with some initial confidence in the candidate scale's construct validity. With an initial candidate scale developed directly from the literature, a series of interviews preceded the use of the scale in an actual survey.

Over the course of two weeks in February 2004, interviews were conducted on the candidate scale. An opportunity sample was taken from an introductory programming course taught by the investigator. This population provided a range of years and majors (e.g., freshman through senior, Computer Science majors, Philosophy majors, etc…) thereby giving some diversity to the sample. Twenty interviews were scheduled with two no-shows and one interview misrecorded yielding 17 usable interviews. Interviews

followed a protocol (Appendix A) which included a brief overview of the project and a copy of the conceptual definition mentioned above. For recording purposes, each candidate question was assigned a random number on one of the 14 notecards. Participants were told the number was random and had no bearing on how they ranked the items. Each participant was asked to rank the fourteen candidate items according to their perception of each question's helpfulness in measuring social influence according to the conceptual definition. Upon coming to a ranking they were confident of (there was no time limit), participants were asked to record their ranking using the random numbers for identification on a sheet they had filled out with basic information prior to the interview.

Subsequent to the pretest interviews, the candidate scale was included in a preliminary survey which would test its statistical performance with the rest of the model. A subject pool was obtained from a previous survey conducted approximately one year ago. In this related survey focusing on Internet use, a random sample of 2,200 people was contacted and 512 surveys were returned for a response rate of 23%. Of these 512 surveys, approximately 150 consented to being a part of a future related survey. Those that consented were contacted via email to fill out the preliminary survey online for this current study. The scale was tested using the Blackboard system as the subject technology. One hundred and two surveys were returned within one week of the initial emailing. The average respondent age was 20 years, with a standard deviation of 1.6. Fifty-eight percent of respondents were male and 62% of respondents lived off campus. Sixty-five percent of respondents were upperclassmen. No major skews in the respondent pool were found that would produce any serious bias in the data.

To further verify these findings, respondents to the preliminary Blackboard survey above were asked if they would be willing to fill out the same survey on another system a week later. A total of 85 out of the 102 respondents indicated their willingness to do so. One week after the initial deployment of the preliminary Blackboard survey, the preliminary Filebox survey was sent out to the 85 respondents who had agreed to participate again. Sixty-one responses were collected and analyzed. Similar analysis steps were used to

verify the consistency of the findings between the two preliminary surveys. Strong consistency between the results of these two preliminary surveys provided good evidence of the model's reliability.

A major need for the final surveys was a higher quality sample of users to truly test the viability of the behavioral model. While the sample for the preliminary survey was *based upon* a random sample of participants from a previous study that agreed to be followed up in the future, the sample for the final survey should be a *truly* random sample of the entire university population. Also, the size of the sample could be increased. While the two preliminary surveys had cumulatively yielded 163 respondents, the sample for the final survey would start out at 2,500 and hopefully yield a final sample of 500-1000 respondents.

Several possible sources for obtaining the desired sample were identified, including a financial management class of approximately 200 and a random sample of on-campus residents from the Office of Student Programs. These options had a number of drawbacks, however. The pools were too small, nonrandom, and unrepresentative of the student population being studied. A contact was found via one of the aforementioned sources for the Office of Institutional Research and Planning Analysis (www.irpa.vt.edu). This office was able to provide a high quality sample that was large enough, representative, and truly random. A sample of 2,500 names was obtained three weeks after an initial meeting, providing time to prepare the email and the survey that would be sent to the subject pool (see Appendix D and E for these items respectively).

The first email was sent to the entire sample on a Sunday afternoon around 2pm. This time was optimal because students would likely be home and working, but with less urgency than during the actual week. One reminder email was sent three days later on Wednesday, and the survey was closed that following Sunday. A total of 689 surveys were returned for a response rate of 28%. Of the 689 respondents, 290 agreed to fill out a final survey for Filebox in addition to the final Blackboard survey. The email for the final Filebox survey was sent out exactly one week after the Blackboard survey was

closed. Reminder emails were sent out on the following Wednesday and Sunday. Of the 290 that agreed to a second survey, 203 actually did so for a response rate of 70%. Statistical analysis of the survey results are explained in Section 3.3 and reported in the next Chapter 4.

3.3 Statistical Analysis

A heavy focus of this research study is on statistical analyses of the survey data collected. For this reason, the following section will help to motivate and explain each of the statistical procedures commonly used in this study as reported in Chapter 4. In cases where a statistical term or method is used once, the explanation for that procedure will be included there. One of the main goals of was to produce a modification of the historical Subjective Norm scale with strong validity and reliability. A scale is said to have high validity if it measures what it is supposed to measure accurately; it is said to have high reliability if it measures the same effect multiple times consistently. By introducing this modified scale of Subjective Norm into the Technology Acceptance Model, this study's other main goal was to significantly increase the predictive strength of the overall model.

The predictive strength of the model is determined using regression analysis. Regression analysis is used to determine the relationship between a set of independent variables (in this case Behavior Intention to use a software system) and a dependant variable (in this case Perceived Ease of Use, Perceived Usefulness, and Subjective Norm) (see http://library.dfaus.com/glossary/). Another way to explain this relationship is how closely the independent variables come to predicting the actual value of the dependant variable. The difference between the actual and predicted value of the dependant variable is called variance. A model is said to have a higher explained variance (or R^2) as the difference between these two values shrinks.

The results which are included in the regression analysis include B, SE B, β, and R^2. B is the coefficient for each independent variable in the model and indicates the predictive

strength for that single independent variable on the dependant variable. SE B is the standard error of B, which was just mentioned, and indicates the mean amount of variance attributed to a specific independent variable. Beta (or β) indicates the proportion of the variance explained by a specific independent variable in proportion to the other independent variables. A Beta coefficient can be used to compare the predictive strengths of two independent variables. As explained above, R^2 is the amount of variance in the dependant variable explained by all the independent variables together.

Most of the regression results reported in this study involved a 2-step process. Step 1 is the initial set of independent variables used to in the regression analysis to predict the dependant variable (which is Behavioral Intention to use a system in every case). Step 2 is a regression analysis involving the initial set of independent variables from Step 1 plus one or more additional independent variables. For example, Step 1 includes Perceived Ease of Use and Usefulness to predict Behavioral Intention; Step 2 would use these two variables plus Subjective Norm to predict intention. The goal of adding independent variables to the regression model in Step 2 is to significantly increase the explained variance (R^2) between Steps 1 and 2.

Cronbach alphas, Correlation Analysis, and Factor Analysis were also used to empirically verify the strength of the survey items under consideration. Cronbach alphas were used to measure internal consistency of the scales. Internal consistency is the degree to which items from the same scale are correlated with one another (i.e., "the homogeneity of a set of items") (Atkinson et al. 2000). Correlation Analysis is used to determine the linear relationship between two variables (see http://www.netnam.vn/unescocourse/statistics/11_6.htm). A strong correlation between two variables would indicate the two values increase or decrease in similar fashion with one another. Factor analysis will help measure the convergent and divergent validity specifically of the modified Subjective Norm scale. Convergent validity can be described as the extent to which items within the same scale are correlated with each other (i.e., items are "loaded" on the same factor). Divergent validity, on the other hand, is the extent to which unrelated scale items (i.e., different factors) are poorly correlated with one another (Campbell et al. 1959).

According to Campbell and Fiske (1959), a valid scale should measure what it is intended to measure and nothing else. For example, the Subjective Norm scale used in this study contains three distinct subsets (or factors) of variables: Normative Influence, Motivation to Comply, and Observed Use. Scale items from the Normative Influence subscale should theoretically correlate strongly with the first factor and poorly with the other two. Correlation coefficients of .7 or above are typically satisfactory to indicate loading on a particular factor.

4. Results

4.1 Preliminary Scale Development

During the scale ranking interviews, participants were asked to record their ranking of the candidate items (see Section 3.1); these rankings are compiled in Table 4-1 below. The items are partitioned into three subscales measuring three distinct factors of social influence. (1) is Normative Influence (2) is Motivation to Comply and (3) is Observed Use. These are indicated in Table 4-1 in the Subscale column. Note that the ranking from interview 8 was recorded incorrectly and, thus, not included in the cumulative rankings.

		Scale Item Rankings for Each Interview																	
Assigned Item #	Subscale	1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	**Item Total**
11	3	1	2	1	1	1	10	1	1	1	1	1	3	5	1	5	1	1	**37**
14	3	2	1	2	2	7	2	5	6	13	4	8	6	6	5	2	4	4	**79**
4	1	9	9	3	3	6	11	6	10	3	9	4	12	11	8	1	7	6	**118**
6	3	3	6	14	13	12	5	2	3	8	5	12	5	3	4	6	6	12	**119**
9	1	7	13	5	8	2	7	10	14	6	6	9	2	8	10	4	5	3	**119**
1	3	5	7	12	10	9	12	8	13	7	3	7	8	7	6	8	2	2	**126**
12	1	14	12	8	12	13	1	4	8	2	10	6	7	2	2	9	11	7	**128**
7	3	4	11	13	14	11	3	3	11	14	2	10	4	1	7	7	3	11	**129**
2	2	10	4	9	11	10	4	9	7	10	11	3	9	10	3	3	9	8	**130**
5	1	6	10	4	4	4	8	12	2	5	7	13	10	9	12	12	10	9	**137**
3	1	8	14	7	7	3	14	11	5	4	8	3	11	12	11	11	12	13	**154**
10	2	12	3	6	6	5	13	14	4	9	12	2	14	14	14	14	8	5	**155**
13	1	13	5	10	5	14	9	7	9	12	14	14	1	4	9	10	13	10	**159**
8	2	11	8	11	9	8	6	13	12	11	13	11	13	13	13	13	14	14	**193**

Note. Factor 1 – Normative Influence. Factor 2 – Motivation to Comply. Factor 3 – Observed Use.

Table 4-1 – Cumulative rankings for scale items from interviews

In addition to the cumulative rankings, the median and mean rankings were calculated. Table 4-2 shows a listing of the actual scale items, the subscale each item corresponds to, the random number assigned to each item, and the rankings for each item. The scale items in Table 4-2 are ordered by their median rank using the mean rank as a tie-breaker. The strongest performing scale items were from the Observed Use subscale, while scale items measuring Motivation to Comply tended to rank low. This observation will be

notable in subsequent stages of this current study. Three questions (#13, 3, 8) had a median rank greater than 10, meaning they were consistently ranked by interviewees among the least helpful items in the candidate scale. Taking a look at these scale items, the common concept among them appears to be peer compulsion. All of the scale items refer to individuals commonly viewed as peers. They also deal with compliance with other's expectations or desires. In Davis' research, a ranking such as this was used similarly to find low ranking scale items for the purpose of eliminating them from the scale for

Scale items	Assigned Number	Median Ranking	Mean Ranking	Item Total
I regularly see the people around me benefit from using Blackboard [3]	11	1	2.2	37
I regularly see the people around me using Blackboard. [3]	14	4	4.6	79
Overall, my classmates/coworkers use Blackboard (not at all … heavily) [3]	6	6	7	119
People who influence my behavior would think I should use Blackboard [1]	4	7	6.9	118
People whom I respect think I should use Blackboard. [1]	9	7	7	119
Overall, my friends use Blackboard (not at all …heavily) [3]	1	7	7.4	126
Overall, my professors/supervisors use Blackboard (not at all … heavily) [3]	7	7	7.6	129
People who are in authority over me would think I should use Blackboard. [1]	12	8	7.5	128
Generally speaking, I do what my professors/supervisors think I should do. [2]	2	9	7.6	130
People who are important to me would think I should use Blackboard. [1]	5	9	8.1	137
Generally speaking, I do what my friends think I should do. [2]	10	9	9.1	155
People who I work with would think I should use Blackboard [1]	13	10	9.4	159
People whom I care about would think I should use Blackboard [1]	3	11	9.1	154
Generally speaking, I do what my classmates/coworkers think I should do. [2]	8	12	11.4	193

Note. [1] Normative Influence, [2] Motivation to Comply, [3] Observed Use

Table 4-2 – Average rankings for scale items from interviews

subsequent iterations of the project. After consideration of this approach, it was decided to retain all items; they would be candidates for exclusion in the final scale but would be included in the remainder of the surveys so their continued behavior could be observed throughout the rest of the study.

4.2 Preliminary Survey Results

4.2.1 Blackboard Results

The proposed Subjective Norm scale in Table 4-2 was combined with the rest of the research model into a full survey. The details of its administration and collection can be found in Section 3.2. From the data collected, a composite score for each subscale was

produced by taking the mean of the items associated with it in the survey. Composite scores were created for Perceived Usefulness, Perceived Ease of Use, Subjective Norm, and Intention. Recalling the hypothetical model, it is anticipated that Intention to Use (I) is a function of Perceived Ease of Use (U), Perceived Usefulness (U), and the modified Subjective Norm scale (SN) (I = EOU + U + SN). Regression analysis indicated the model was strong, predicting over 60% of the variance in intention (denoted as R^2 in the note for Table 4-3). However, adding the modified Subjective Norm scale to the model (see Step 2 in Table 4-3) did not produce a significant change in the explained variance of Behavioral Intention; although it did approach significance (see Table 4-3). Some weakness in the full Subjective Norm scale was expected though, since it was anticipated that some scale items would need to be eliminated.

Variable	B	SE B	β
Step 1			
Perceived Ease of Use	0.90	0.07	0.78*
Perceived Usefulness	0.12	0.09	0.08
Step 2			
Perceived Ease of Use	0.81	0.09	0.71*
Perceived Usefulness	0.11	0.09	0.08
Subjective Norm (plus Observed Use)	0.24	0.14	0.13

Note. $R^2 = .65$ for Step 1; $\Delta R^2 = .01$ for Step 2 (ps = .09). *$p < .05$.

Table 4-3 – Initial regression analysis for Preliminary Blackboard survey

As previously mentioned, there are three distinct subscale of social influence included in this modified Subjective Norm scale, each with its own distinctive wording. Those subscales include Normative Influence ("People who are _____ think I should ____"), Motivation to Comply ("Generally speaking, I do what _____ thinks I should do"), and Observed Use ("I regularly see ____ using ____"). As explained in Section 3.3, Factor Analysis would measure the convergent and divergent validity of the three factors of the Subjective Norm scale. Convergent validity measures whether scale items within each of the factors mentioned above are correlated with each other (i.e., loaded on the same factor), and discriminant validity is the extent to which scale items from different factor are independent of one another (i.e., did not load on other factors).

Factor Analysis of the modified Subjective Norm scale items with a varimax rotation showed loading on three very distinct factors. As explained in Section 3.3, scale items

Scale Item	Factor		
	1	2	3
People who are in authority over me think I should use Blackboard.	.62	.06	.12
People who influence my behavior think I should use Blackboard.	.82	.15	.33
People who are important to me think I should use Blackboard.	.90	.16	.13
People who I respect think I should use Blackboard.	.88	.06	.14
People who I care about think I should use Blackboard.	.88	.05	.11
People who I work with think I should use Blackboard.	.84	.03	.23
Generally speaking, I do what my professors think I should do.	.24	.46	.02
Generally speaking, I do what my friends think I should do.	.02	.87	.15
Generally speaking, I do what my classmates think I should do.	.03	.87	.07
I regularly see the people around me benefit from using Blackboard.	.50	.04	.47
I regularly see the people around me using Blackboard.	.11	.07	.95
I regularly see my classmates using Blackboard.	.12	.10	.93
I regularly see my friends using Blackboard.	.15	.07	.92
I regularly see my professors using Blackboard.	.16	.09	.76

Note. Factor 1 - Normative Influence. Factor 2 - Motivation to Comply. Factor 3 - Observed Use

Table 4-4 – Rotated Factor Analysis on Subjective Norm scale items

should exhibit strong convergent and divergent validity. This means that a scale item would correlate (or "load") strongly with the factor it is intended to be associated with and poorly with the other factors. The scale items, in fact, did load strongly on the factors they were expected to, either (1) Normative Influence, (2) Motivation to Comply, or (3) Observed Use (see Table 4-4).

Subscale	Cronbach Alpha	Subscale Items
Normative Influence N = 102 Mean = .22, SD = 1.07	.91	People who are in authority over me think I should use Blackboard.
		People who influence my behavior think I should use Blackboard.
		People who are important to me think I should use Blackboard.
		People who I respect think I should use Blackboard.
		People who I care about think I should use Blackboard.
		People who I work with think I should use Blackboard.
Motivation to Comply N = 102 Mean = .84, SD = .90	.65	Generally speaking, I do what my professors think I should do.
		Generally speaking, I do what my friends think I should do.
		Generally speaking, I do what my classmates think I should do.
Observed Use N = 102 Mean = .93, SD = 1.29	.89	I regularly see the people around me benefit from using Blackboard.
		I regularly see the people around me using Blackboard.
		I regularly see my classmates using Blackboard.
		I regularly see my friends using Blackboard.
		I regularly see my professors using Blackboard.

Table 4-5 – Descriptive statistics for Subjective Norm and its subscales

Items loaded strongly on the three factors that comprise the proposed Subjective Norm scale with the exception of one item that cross loaded on two factors ("I regularly see the people around me benefit from using Blackboard."). Cross loading means that the factor correlated equally as strong on more than one factor, indicating weak divergent validity. Looking at the internal consistency of the overall Subjective Norm scale, the Cronbach alpha was .87. Each of the factors in the scale, Normative Influence, Motivation to Comply, and Observed Use, had alphas of .91, .65, and .89 respectively (see Table 4-5). Recalling Section 3.3, Cronbach alphas indicate how strongly items within the same subscale are correlated with each other.

Variable	B	SE B	β
Step 1			
Normative Influence	0.41	0.13	0.28*
Motivation to Comply	**-0.16**	**0.15**	**-0.09**
Observed Use	0.60	0.11	0.48*

Note. *p < .05.

Table 4-6 – Regression analysis for individual factors of Subjective Norm

Looking at a regression analysis of the three Subjective Norm factors (see Table 4-6), Normative Influence and Observed Use were significant predictors of intention (p < .05). However, the beta coefficient for Motivation to Comply indicated that it was not a

Subscale	1	2	3	4
1. Normative Influence	_	.22*	.36**	.43**
2. Motivation to Comply		_	.21*	**.07**
3. Observed Use			_	.56**
4. Intention				_

Note. *p< .05. **p< .01.

Table 4-7 – Correlation analysis for individual factors of Subjective Norm

significant contributor to the explained variance of Behavioral Intention. A correlation analysis on the three Subjective Norm factors and Behavioral Intention also shows a weak relationship between Motivation to Comply and Behavioral Intention. Table 4-7

shows the only nonsignificant correlation is between Motivation to Comply and Behavioral Intention (r = .07).

Results of the factor analysis, regression analysis, and correlation analysis discussed above (see Tables 4-4, 4-6, and 4-7) indicate a strong relationship between at least two of the factors of Subjective Norm (Normative Influence and Observed Use) and Behavioral

Variable	B	SE B	β
Step 1			
Perceived Ease of Use	0.90	0.07	0.78*
Perceived Usefulness	0.12	0.09	0.08
Step 2			
Perceived Ease of Use	0.81	0.09	0.71*
Perceived Usefulness	0.11	0.09	0.08
Subjective Norm (plus Observed Use)	**0.24**	**0.14**	**0.13**

Note. R^2 = .65 for Step 1; ΔR^2 = .01 for Step 2 (ps = .09). *p < .05.

Table 4-8a - Regression analysis with full Subjective Norm scale

Variable	B	SE B	β
Step 1			
Perceived Ease of Use	0.90	0.07	0.78*
Perceived Usefulness	0.12	0.09	0.08
Step 2			
Perceived Ease of Use	0.78	0.09	0.68*
Perceived Usefulness	0.11	0.09	0.07
Subjective Norm (Motivation to Comply excluded)	**0.29**	**0.12**	**0.18***

Note. R^2 = .65 for Step 1; ΔR^2 = .02 for Step 2 (ps < .05). *p < .05.

Table 4-8b – Regression Analysis with two factor Subjective Norm scale

Intention. However, those same results (see Tables 4-4, 4-6, and 4-7) also raised some concerns about the Motivation to Comply subscale as a significant predictor of Behavioral Intention. These scale items were among the lowest ranking questions in the pretest interviews (see Section 4.1). In this current survey, Motivation to Comply had the lowest Cronbach alpha by far (.65), a nonsignificant beta coefficient predicting intention (r = .07), and a nonsignificant correlation coefficient as well (see Table 4-8). This indicates that Motivation to Comply has both weak internal consistency and a weak predictive relationship with Behavioral Intention. Previously, regression analysis showed

that the full Subjective Norm scale was not a significant predictor of intention (see Table 4-8a). However, with Motivation to Comply taken out of the scale, the beta coefficient for Subjective Norm becomes significant (see Table 4-8b).

4.2.2 Filebox Results

In the second preliminary survey based upon Filebox, an initial regression analysis showed results very similar to the prior Blackboard survey (see Table 4-9). While the predictive strength for the present model was just slightly lower than the Blackboard model, Subjective Norm is now significant before any modification to the scale took place.

Variable	B	SE B	β
Step 1			
Perceived Ease of Use	0.68	0.12	0.54*
Perceived Usefulness	0.46	0.12	0.35*
Step 2			
Perceived Ease of Use	0.52	0.14	0.41*
Perceived Usefulness	0.37	0.13	0.28*
Subjective Norm (plus Observed Use)	0.44	0.22	0.24*

Note. $R^2 = .59$ for Step 1; $\Delta R^2 = .02$ for Step 2 (ps < .05). *p < .05.

Table 4-9 – Initial regression analysis for Preliminary Filebox survey

Continuing with the previous procedure, factor analysis also produced similar results. Subjective Norm scale items factored on Normative Influence, Observed Use, or Motivation to Comply in almost identical fashion to the data in the previous Blackboard survey (see Table 4-10).

Scale Item	Factor		
	1	2	3
People who are in authority over me think I should use Blackboard.	.87	-.04	.15
People who influence my behavior think I should use Blackboard.	.96	-.12	.15
People who are important to me think I should use Blackboard.	.94	-.08	.20
People who I respect think I should use Blackboard.	.95	-.06	.23
People who I care about think I should use Blackboard.	.91	-.09	.27
People who I work with think I should use Blackboard.	.87	-.02	.38
Generally speaking, I do what my professors think I should do.	-.07	.45	-.05
Generally speaking, I do what my friends think I should do.	-.04	.91	.09
Generally speaking, I do what my classmates think I should do.	-.03	.90	-.06
I regularly see the people around me benefit from using Blackboard.	.35	-.03	.81
I regularly see the people around me using Blackboard.	.14	-.03	.95
I regularly see my classmates using Blackboard.	.24	-.02	.91
I regularly see my friends using Blackboard.	.17	.03	.92
I regularly see my professors using Blackboard.	.39	-.33	.53

Note. Factor 1 - Normative Influence. Factor 2 - Motivation to Comply. Factor 3 - Observed Use

Table 4-10 – Rotated Factor Analysis on Subjective Norm scale items

With scale items factoring consistently between the two surveys, a regression analysis similar to the one in the preliminary Blackboard survey was conducted. Motivation to Comply continued to show a statistically weak relationship to Behavioral Intention. Similar to the previous Blackboard survey, Normative Influence and Observed Use were both significant predictors of Behavioral Intention while Motivation to Comply was not significant (see Table 4-11).

Variable	B	SE B	β
Step 1			
Normative Influence	0.29	0.14	0.22*
Motivation to Comply	-0.20	0.20	-0.09
Observed Use	0.71	0.13	0.59*

Note. $^{*}p < .05$.

Table 4-11 - Regression analysis for individual factors of Subjective Norm

Subscale	1	2	3	4	5
1. Normative Influence	-	-.10	.50**	.86**	.52**
2. Motivation to Comply		-	**-.01**	**.11**	**-.12**
3. Observed Use			-	.85**	.70**
4. Social Influence				-	.68**
5. Intention to Use					-

Note. *p< .05. **p< .01.

Table 4-12 - Correlation analysis for individual factors of Subjective Norm

Motivation to Comply also showed a weak relationship to the other factors of Subjective Norm and Behavioral Intention in the correlation analysis shown above (see Table 4-12). While all other factors in the matrix correlate significantly, Motivation to Comply correlated with nothing in the matrix including the Subjective Norm scale which contains it. As in the previous analysis, excluding Motivation to Comply from the Subjective Norm scale significantly increased the variance explained (R^2) by the overall model (see the Note in Table 4-13).

Variable	B	SE B	β
Step 1			
Perceived Ease of Use	0.68	0.12	0.54*
Perceived Usefulness	0.46	0.12	0.35*
Step 2			
Perceived Ease of Use	0.49	0.14	0.39*
Perceived Usefulness	0.35	0.13	0.27*
Subjective Norm (Motivation to Comply excluded)	0.40	0.17	0.28*

Note. R^2 = .60 for Step 1; ΔR^2 = .03 for Step 2 (ps <.05). *p < .05.

Table 4-13 – Regression Analysis with two factor Subjective Norm scale

Preliminary survey analysis shows the potential of a modified Subjective Norm scale that is significant for compulsory *and* voluntary systems. This latter significance would be a strong improvement upon previous attempts to implement such a scale. These results provide impetus for the final surveys which will help verify the significant findings of the preliminary surveys.

4.3 Final Survey Results

As a validation of the findings from the preliminary surveys, analysis for this data set will closely follow the analysis from the previous two surveys. This will serve either to refute or to verify those findings on a higher quality sample. One supplement to this will be an analysis of the moderating variables mentioned in the previous section (voluntariness, gender, age, and experience). How these variables act on the model will give insight into the generalizability of the research model.

4.3.1 Blackboard Results

With several adjustments to the initial survey and a much higher quality sample (see Section 3.3), a final run of the survey was conducted. Cronbach alphas for the overall Subjective Norm scale (0.90) and for each of its factors remained high with the exception of Motivation to Comply (see Table 4-14)

Subscale	Cronbach Alpha	Subscale Items
Normative Influence N = 683 Mean = .74, SD = 1.09	.93	People who are in authority over me think I should use Blackboard.
		People who influence my behavior think I should use Blackboard.
		People who are important to me think I should use Blackboard.
		People who I respect think I should use Blackboard.
		People who I care about think I should use Blackboard.
		People who I work with think I should use Blackboard.
Motivation to Comply N = 683 Mean = .91, SD = .95	.75	Generally speaking, I do what my professors think I should do.
		Generally speaking, I do what my friends think I should do.
		Generally speaking, I do what my classmates think I should do.
Observed Use N = 682 Mean = 1.41, SD = .98	.86	I regularly see the people around me benefit from using Blackboard.
		I regularly see the people around me using Blackboard.
		I regularly see my classmates using Blackboard.
		I regularly see my friends using Blackboard.
		I regularly see my professors using Blackboard.

Table 4-14 – Descriptive statistics for Subjective Norm and its subscales

As in the preliminary survey analysis, an initial regression analysis was conducted first without Subjective Norm and next with it included (see Table 4-15).

Variable	B	SE B	β
Step 1			
Perceived Ease of Use	0.45	0.03	0.54*
Perceived Usefulness	0.14	0.04	0.12*
Step 2			
Perceived Ease of Use	0.32	0.03	0.34*
Perceived Usefulness	0.11	0.04	0.10*
Subjective Norm (plus Observed Use)	0.35	0.04	0.29*

Note. $R^2 = .36$ for Step 1; $\Delta R^2 = .05$ for Step 2 (ps < .05). *p < .05.

Table 4-15 - Initial regression analysis for the final Blackboard survey

The model summary above indicates that the original model is a significant predictor of the dependent variable and that adding Subjective Norm significantly increases the variance explained (R^2) by the overall model. As in the preliminary surveys, adding the full Subjective Norm increases the variance explained by the model from 36% to 41%. A basic expectation throughout the project has been that some items would and should be eliminated from the Subjective Norm scale. The first step was to see how the 14 scale items for Subjective Norm loaded with one another. Factor analysis was again used to examine this (see Table 4-16). Results show the scale items, again, loading on three distinct factors. Using a varimax rotation to eliminate some cross loading for several

Scale Item	Factor		
	1	2	3
People who are in authority over me think I should use Blackboard.	.59	.12	.17
People who influence my behavior think I should use Blackboard.	.78	.19	.59
People who are important to me think I should use Blackboard.	.90	.15	.15
People who I respect think I should use Blackboard.	.91	.12	.16
People who I care about think I should use Blackboard.	.90	.16	.17
People who I work with think I should use Blackboard.	.82	.17	.18
Generally speaking, I do what my professors think I should do.	.19	.55	.18
Generally speaking, I do what my friends think I should do.	.12	.90	.09
Generally speaking, I do what my classmates think I should do.	.17	.89	.07
I regularly see the people around me benefit from using Blackboard.	.47	.21	.52
I regularly see the people around me using Blackboard.	.15	.11	.89
I regularly see my classmates using Blackboard.	.13	.11	.91
I regularly see my friends using Blackboard.	.18	.11	.88
I regularly see my professors using Blackboard.	.24	.07	.60

Note. Factor 1 - Normative Influence. Factor 2 - Motivation to Comply. Factor 3 - Observed Use

Table 4-16 – Rotated Factor Analysis on Subjective Norm scale items

items, the factors again load on the type of question (i.e. Normative Influence, Motivation to Comply, and Observed Use). The factor loading, the initial cross loading, and even the necessary varimax rotation all happened similar to the preliminary survey results, further verifying the consistency of the model over multiple surveys.

Such conclusive results from the factor analysis above gave clear guidance to analyze Subjective Norm on these three distinct factors. A regression analysis was run with Intention as the dependent variable and the three Subjective Norm factors as the independent variables (see Table 4-17). The results below indicate several notable things. First, Motivation to Comply, which was a weak factor in the preliminary surveys, was again not significant in the prediction of user intention. Secondly, while both were significant, the standardized coefficient for Observed Use was nearly four times stronger than Normative Influence.

Variable	B	SE B	β
Step 1			
Normative Influence	0.12	0.03	0.13*
Motivation to Comply	0.04	0.04	0.04
Observed Use	0.50	0.04	0.50*

Note. *p < .05.

Table 4-17 - Regression analysis for individual factors of Subjective Norm

The weakness of Motivation to Comply is further verified by the correlation table of the same factors below (see Table 4-18). With a sample size this large, most correlations will be significant. However, the correlation coefficient for Motivation to Comply and Intention (.257) is the weakest correlation to user intention. This weakness will be more conclusively shown in the follow-up survey discussed later (see Section 4.3.2).

Subscale	1	2	3	4	5
1. Normative Influence	-	.38**	.49**	.88**	.39**
2. Motivation to Comply		-	.34**	.62**	**.26****
3. Observed Use			-	.79**	.58**
4. Social Influence Scale				-	.54**
5. Intention to Use					-

Note. *p< .05. **p< .01.

Table 4-18 - Correlation analysis for individual factors of Subjective Norm

With the regression analysis just mentioned, and the results from the preliminary surveys, it would again seem reasonable to exclude Motivation to Comply from the Subjective Norm scale and then check the performance of the resulting model. Removing Motivation to Comply from the scale again produced a significant increase in the variance explained (see Table 4-19). The omission of Motivation to Comply from the Subjective Norm scale resulted in a gain in statistical strength across all four surveys.

Variable	B	SE B	β
Step 1			
Perceived Ease of Use	0.45	0.03	0.54*
Perceived Usefulness	0.14	0.04	0.12*
Step 2			
Perceived Ease of Use	0.31	0.03	0.34*
Perceived Usefulness	0.11	0.04	0.10*
Subjective Norm (Motivation to Comply excluded)	0.34	0.04	0.31*

Note. $R^2 = .36$ for Step 1; $\Delta R^2 = .06$ for Step 2 (ps < .05). *p < .05.

Table 4-19 - Regression Analysis with two factor Subjective Norm scale

One final point of interest for the model, as mentioned previously, is moderating variables. Venkatesh et al. (2003) states that value could be added to a model such as this by studying its generalizability across different levels of voluntariness, experience, gender, and age. By including these variables in this current survey, we can test their effect on the research model.

Since many of the survey items being compared used different scales, z-scores were made for each item in order to standardize their measure and make them comparable. A z-score indicates how far and in what direction a scale value deviated from the mean of all the scales values. The items of interest would be the elements of the research model (Perceived Usefulness, Perceived Ease of Use, Subjective Norm, and Behavioral Intention) and the moderating variables (voluntariness, experience, gender, and age). Before checking the moderating variable in the regression equation, a correlation analysis was run to check for multicolinearity. In other words, if two independent variables in the regression equation were highly correlated, their individual effect on the dependent variable (in this case Behavioral Intention) would be diminished. Each moderating

variable showed a moderate correlation with the original elements of the model. This gave some early indication that the individual effects of the moderating variables may be weak. Next, a new regression equation was run with 7 independent variables (Perceived Usefulness, Perceived Ease of Use, Subjective Norm, and the moderating variables) and Behavioral Intention as the dependent variable. Results from the regression analysis were consistent with the correlation analysis. Overall, adding the four additional moderating variables raised the variance explained by the model only a hundredth of a percent. The coefficients for two of the moderating variables (experience and voluntariness) were nonsignificant and the other two (age and gender) were only slightly significant at a standard beta coefficient of .069. With such a small effect size for the moderating variables, it made no sense to add them to the original research model. Adding four variables had produced a nonsignificant increase of .01 to the R^2, or explained variance of the model.

4.3.2 Filebox Results

The final Filebox survey provided one last opportunity to see the performance of the research model. Survey results here, some of the strongest yet, were the final verification of the findings from the previous three surveys. In addition to being the fourth test of the

Variable	B	SE B	β
Step 1			
Perceived Ease of Use	0.61	0.08	0.41*
Perceived Usefulness	0.63	0.07	0.47*
Step 2			
Perceived Ease of Use	0.40	0.09	0.27*
Perceived Usefulness	0.55	0.07	0.41*
Subjective Norm (plus Observed Use)	0.50	0.11	0.26*

Note. $R^2 = .60$ for Step 1; $\Delta R^2 = .04$ for Step 2 (ps < .05). *p < .05.

Table 4-20 - Initial regression analysis for final Filebox survey

model overall, it was also a verification specifically of the previous Filebox survey on a larger, truly random sample. As before, the initial regression analysis showed a significant increase in R^2 with the addition of the full Subjective Norm scale. The

predictive strength for this regression equation was back over 0.6 as it had been in the first two surveys (see Table 4-20).

Variable	B	SE B	β
Step 1			
Normative Influence	0.37	0.10	0.25*
Motivation to Comply	0.02	0.11	0.01
Observed Use	0.67	0.09	0.50*

Note. *p < .05.

Table 4-21 - Regression analysis for individual factors of Subjective Norm scale

Factor analysis with a varimax rotation was conducted on the modified Subjective Norm scale showing the scale items loading on the same factors as before, namely Normative Influence, Motivation to Comply, and Observed Use. Regression and correlation analysis of each of these factors with Behavioral Intention showed Motivation to Comply to be a non-significant factor (see Table 4-21 and 4-22).

Subscale	1	2	3	4	5
1. Normative Influence	-	.28**	.63**	.90**	.57**
2. Motivation to Comply		-	.11	.39**	.13
3. Observed Use			-	.86**	.66**
4. Social Influence Scale				-	.66**
5. Intention to Use					-

Note. *p< .05. **p< .01.

Table 4-22 - Correlation analysis for individual factors of Subjective Norm scale

Removing Motivation to Comply from the Subjective Norm scale improves the performance of the entire model, raising R^2 from .638 to .647 (see Table 4-23). Not only is the scale more concise as a result, but the explained variance of the model is increased as well.

Variable	B	SE B	β
Step 1			
Perceived Ease of Use	0.61	0.08	0.41*
Perceived Usefulness	0.63	0.07	0.47*
Step 2			
Perceived Ease of Use	0.37	0.09	0.25*
Perceived Usefulness	0.54	0.07	0.40*
Subjective Norm (plus Observed Use)	0.47	0.09	0.29*

Note. $R^2 = .60$ for Step 1; $\Delta R^2 = .05$ for Step 2 (ps < .05). *p < .05.

Table 4-23 - Regression Analysis with two factor Subjective Norm scale

4.4 Summary of the Findings

With four surveys demonstrating the proposed statistical model now completed, a brief mention of the consistency of the findings across all surveys is important before discussion of the results in the next chapter. Each analysis began with an initial look at the regression equation including Perceived Ease of Use, Perceived Usefulness, Behavioral Intention, and the full Subjective Norm scale (see Table 4-24). Table 4-24 shows the explained variance for the model in each of the surveys. The standardized coefficients show the predictive strength of the individual factors relative to one another.

		Standardized Coefficients		
Survey	R^2	U	EOU	SN
Preliminary Blackboard	.66*	.71*	.08	.13
Preliminary Filebox	.61*	.41*	.28*	.24*
Final Blackboard	.41*	.34*	.10*	.29*
Final Filebox	.64*	.27*	.41*	.26*

Note. *p<.05

Table 4-24 – Summary of regression results across four surveys

In all but the first survey, the full Subjective Norm scale was a significant predictor of Intention to Use, but even there it approached significance (p = .019). In all but one of the surveys, the explained variance of the statistical model was over 60%. Before any further analysis or refinement of Subjective Norm, the model had already performed generally better than the historical Technology Acceptance Model which typically

predicts about 40% of the variance in Behavioral Intention (Venkatesh et al. 2000). One observation of note here is how the explained variance of the Final Blackboard survey was a full 20% lower than the other three models. This will be investigated further at the end of the section.

For all four surveys, factor analysis showed all fourteen scale items loading on the same three factors. Prior to a varimax rotation of the data, the same scale items even cross loaded on the same factors. Next, a regression analysis was conducted with the three factors of the modified Subjective Norm scale as independent variables and Intention as the dependent variable. For every survey, Normative Influence and Observed Use were significant predictors of Intention while Motivation to Comply was not. Further analysis also showed that, across all four surveys, Motivation to Comply correlated poorly or not at all with Normative Influence, Observed Use, Behavioral Intention, and even Subjective Norm which included Motivation to Comply as a factor!

The aforementioned results provided strong motivation for excluding Motivation to Comply from the final Subjective Norm scale. Removing these three scale items increased the performance of the statistical model in all cases as we can see from the increased R^2 in the second column (see Table 4-25).

Survey	R^2 (w/ original scale)	R^2 (w/ refined scale)
Preliminary Blackboard	.659*	.668
Preliminary Filebox	.628	.634
Final Blackboard	.413	.419
Final Filebox	.638	.647

Table 4-25 – Change in explained variance with Motivation to Comply removed

For any one of the surveys conducted, the results show strong evidence for the validity of the modified Subjective Norm scale and the subsequent research model containing it. The consistency of these strong results across four surveys, however, argues even more convincingly for the merits of the modified scale of Subjective Norm proposed by this current project.

While the other three surveys resulted in an explained variance of over 60%, the Final Blackboard survey predicted 42% of the variance in Behavioral Intention. This is of particular interest because the Final Blackboard survey was based on the largest and highest quality sample. It would be easy to dismiss the reported R^2 of the other three surveys had they not all been over 60%. Considerable effort went into investigating if there was anything unique about the Final Blackboard sample that would result in such different results. We first checked the demographics of the samples for any unique features of the Final Blackboard sample. Not only would something theoretically need to be unique to the Final Blackboard sample, but the other three samples should be consistent with each other. For example, the gender ratios for the other samples are slightly skewed while the Final Blackboard sample was evenly split. But within the three other samples, the gender skew was not always in the same direction. In addition to this, gender was found to be a nonsignificant meditating [delete mediating] factor for the Final Blackboard sample in Section 4.3.1. The Final Blackboard sample failed to show any significant uniqueness along any other demographic factor that we checked (see Table 4-26).

	Preliminary Blackboard	Preliminary Filebox	**Final Blackboard**	Final Filebox
Age (avg.)	20.6 (1.6)	20.6 (1.5)	**19.5 (1.9)**	20.0 (2.9)
Gender (m/f)	57% / 41%	64% / 34%	**50% / 50%**	43% / 57%
On/Off Campus	39% / 61%	61% / 39%	**56% / 43%**	51% / 49%
Class (fresh/soph/jun/ senior/grad)	6/28/24/35/5%	3/33/28/34/0%	**35/22/20/22/0%**	27/20/24/27/1%
Net Experience (median)	6-7 years	8-9 years	**8-9 years**	10+

Table 4-26 – Demographic statistics for the four surveys

Looking at the four variables involved in the regression equation (Perceived Usefulness, Perceived Ease of Use, Subjective Norm, and Behavioral Intention), outliers existed for each, but when they were eliminated, the explained variance actually went down even further. Up to this point, no characteristics have been found to explain a lower R^2 for the

Final Blackboard survey other than to say that it is, of course, statistically possible that the explained variance could be lower than 60% one quarter of the time.

5. Discussion

This chapter will return to the previous discussion, first of related work and then of the original hypotheses and contributions this study hoped to make.

5.1 Relation to other studies

The Technology Acceptance Model developed by Davis in the 80's remains one of the most well-tested behavioral models. However, Davis and others have recommended adding a measure of social influence to this model. Over the course of 20 years, attempts to add such a measure to the model have typically been either nonsignificant or only significant for compulsory systems.

Two thirds of the scale that this project used for measuring social influence has common roots in much of the previous work on which this study was based. Normative Influence and Motivation to Comply started out as a measure of Subjective Norm in the Theory of Reasoned Action. When Theory of Reasoned Action was adapted to Technology Acceptance Model, many attempts were made to use these two factors as a measure of social influence in their revised models. Many of these studies found Subjective Norm to be either nonsignificant or only significant for compulsory systems. It is the author's opinion that a strong cognitive factor was missing from the traditional Subjective Norm scale. While Normative Influence focused on the perception of other peoples' opinions and Motivation to Comply focused on one's attitude toward those influences, neither of these factors account for actual behavior.

Adding Observed Use as a factor to the Subjective Norm scale tested extremely well in the four surveys reported above. Of specific interest, in relation to other related work discussed in Chapter 2, is the significance of the modified Subjective Norm scale in the hypothetical model. Consistent with other studies using a social influence scale, Subjective Norm was a significant predictor of intention for compulsory systems. In this case, the compulsory system was Blackboard. Unlike other studies attempting to develop

a scale for social influence, Subjective Norm was a significant predictor of intention in both studies using a *voluntary* system (in this case, Filebox).

5.2 Hypotheses and Contributions

The strength of this study's findings certainly serves as strong verification for all of the hypotheses mentioned in Section 2.2. Recalling those hypotheses, Perceived Ease of Use and Perceived Usefulness were predicted to continue being significant predictors of BI (hypotheses H1a and H2). Perceived Ease of Use would have an indirect effect on Behavioral Influence via Perceived Usefulness (hypotheses H1b). Subjective Norm will also be a significant predictor of Behavioral Influence (hypothesis H3a). It was also hypothesized that Subjective Norm would have an additional indirect effect on Behavioral Influence via Perceived Usefulness (hypothesis H3b).

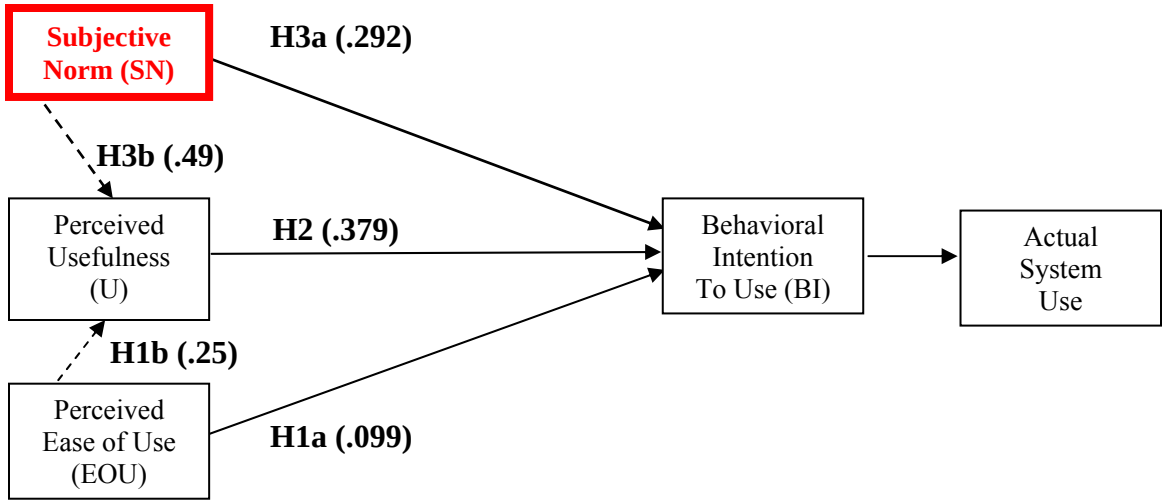

Figure 5-1 – Research Model with corresponding hypotheses and coefficients from the final Blackboard survey.

Looking at the regression coefficients from the final Blackboard survey in Figure 5-1, all three variables were significant predictors of intention (Hypotheses H1a, H2, and H3a). Ease of Use performed rather poorly in several of the other surveys but was still normally significant. Existing research literature indicates that Perceived Ease of Use has historically proven to be the weaker variable in the statistical model, but it is usually still

significant. Subjective Norm and Perceived Ease of Use also had strong indirect effects on intention (Hypotheses H1b and H3b). As explained in Section 3.3, an indirect effect is the effect one variable has on another through the mediation of an intervening variable (Pedhazur 1997). The indirect effect of Subjective Norm (.186) through Perceived Usefulness makes intuitive sense since a technology that was socially accepted would, by that virtue, most likely be more useful. Perceived Ease of Use's indirect effect (.095) on intention was as strong as its direct effect because an easy to use technology would be more useful.

In all four surveys, the statistical model accounted for over 40% of the variation in behavioral intent. Three of four surveys actually accounted for over 60% of the variance. Evidence from this current study indicates that the inclusion of the modified scale of Subjective Norm into the Technology Acceptance Model is a significant improvement over the original model.

While no hypotheses were made about which Subjective Norm scale items would be the most likely candidates for refinement (so as not to bias their testing), it did come as a surprise that all questions pertaining to Motivation to Comply behaved so poorly. While the performance of Motivation to Comply in this research project was undoubtedly weak, the merit of such a factor in a scale of social influence is still worthy of more research and will be discussed further later in this paper.

The resulting Subjective Norm scale developed by this project can be seen as a major contribution to behavioral research. By adding a modified scale of Subjective Norm to Technology Acceptance Model, the explained variance of the model was increased while, at the same time, preserving its parsimony. The ability to study the factors of user adoption and use with such quantitative accuracy is valuable in two ways. First and foremost, the existing Technology Acceptance Model with Subjective Norm added to it gives developers and researchers insight into the different factors involved in user adoption and use of technology. If one factor of the model is strong and yet adoption is still low, other factors of the model can be studied as possible negative contributors.

Secondly, developers, managers, and researchers can use the model within a user population as an indication of potential software adoption *prior* to deployment. Thus, before significant resources are expended for developing or deploying a new software system, the potential success of that software in the targeted user population can be predicted. Also, because much of the wording for the Subjective Norm scale items is not specific software use, it could be expected that this scale of social influence may have applications outside of software adoption and use.

5.3 Scale Refinement

Throughout this research project, analysis of the proposed Subjective Norm scale carried with it the expectation that some scale items might be eliminated at the end of the project. Generally, all of the scale items performed strongly except for one specific type of question. The theoretical potential of the Motivation to Comply questions and possibilities for reworking that factor of the Subjective Norm scale will be covered in Section 5.4. However, the Motivation to Comply scale items as they exist in this study have been shown rather conclusively to be weak contributors to the explained variance of the research model. Discussion of scale refinement was held until the end of the project so that, it was hoped, the weight of results from several surveys could provide some strong evidence as to which items to eliminate.

Recalling the results reported in the previous chapter, Motivation to Comply consistently performed poorly within every regression and correlation analysis conducted. Eliminating these three questions increased the explained variance of the model in every instance while, at the same time, reducing the number of questions necessary to do so. Until further research can find a successful implementation of the concept (refer to Section 5.4), it would seem advisable to use the Subjective Norm scale without the Motivation to Comply subscale.

5.3.1 Followup Interviews

In light of the above results, it was clear that Motivation to Comply performed poorly within the Subjective Norm scale. However, this did not preclude its value in measuring social influence, nor should it. Measuring a subject's propensity to comply with outside influences was as important, if not more so, than their observance or awareness of those influences. What remained unclear is why Motivation to Comply performed poorly in the scale. One hypothesis for this is that subjects are unwilling to self report compliance to others but other hypotheses were certainly possible.

Followup interviews were planned as a result to probe into subjects' perception of the overall scale, focusing specifically on their impressions of the Motivation to Comply questions. A fairly obvious sample to draw from for these followup interviews was the sample originally interviewed for the scale rankings at the beginning of this study (see Sections 3.1 and 4.1). Of the 18 persons interviewed for the pretest interviews, 11 agreed to another interview. Ten surveys were subsequently completed after one no-show.

At the outset of the interview, each subject was asked their general impression of the Subjective Norm scale items they had regarded as least helpful in the original interview. Since most of the subjects had put at least one of the Motivation to Comply questions in the bottom four or five of their rankings, opinions about these particular questions were generally offered without much probing by the interviewer. Approximately half of the people interviewed did think respondents would have at least some level of difficulty answering truthfully regarding their compliance with outside social influences as hypothesized. In the words of one interviewee, "You'd like to think you're more independent, that you have free will and you think freely." Although the problem of self reporting compliance did come up as hypothesized, it was not as prevalent as expected nor was it the only observation gleaned from the interviews.

Several other observations were worthy of note. One was the generality of the Motivation to Comply questions. Several interviewees mentioned that the phrases

"Generally speaking" and end with "think I should do" that frame the scale items were not specific enough. One subject mentioned confusion over whether these questions were asking about ethical or moral opinions or about opinions over software use – two very different issues and areas of social influence.

Another observation was the independence of Motivation to Comply from the other factors of the Subjective Norm scale. From the very beginning of this project, Motivation to Comply was recognized as a distinct factor of Subjective Norm. Compliance with social pressures bears an obvious distinction from the observance of those influences (measured by Normative Influence and Observed Use). Far beyond just being distinct, compliance and observance have the potential to operate in the scale in very different ways. Several interviewees indicated a strong awareness of the social pressures around them but an equally strong will not to acquiesce to those pressures. In such a situation, these two parts of the scale would behave in the exact opposite manner to each other and lower the apparent internal consistency of the overall scale.

5.4 Applications for Design

At the conclusion of this discussion a few points on the practical application of this model would be helpful. At the start of this dissertation, it was stated that a great deal of time and money are spent by companies and organizations each year to either develop new technology or implement existing technology in their business process. The value of motivation models is in their potential to predetermine user acceptance before deployment of a technology. The value of the model is not, however, just a predetermination of acceptance or non-acceptance but in the factors involved in adoption. If the model indicates a product will not be readily accepted by the target user population, designers can get a sense of whether the problem is usability, ease of use, or social influences. Perhaps a system is perceived by potential users to be easy to use but its need or benefit is not as so apparent. The system may either not be needed, or its benefit may need to be conveyed more clearly by designers and management. Perhaps a system

meets an obvious need for the user, but its users are unsure of their ability to learn the system. Offering training classes to users may mitigate this difficulty. In the case of a new system not yet available to users, and therefore not yet used by any other users, Subjective Norm may be weak. Managers may either need to focus on the ease of use and usefulness of the system to compel adoption or make the initial migration to the system compulsory. Perhaps as a result of the model, negative social influencers are identified and handled accordingly. Use of this behavioral model has the potential of returning a large amount of information back to designers that can improve the success of technology deployment.

From a research standpoint as well, work in Human-Computer Interaction has focused fairly heavily on usability for much of its existence. Existing research in the Technology Acceptance Model, and this current study as well, show Ease of Use to be of only tertiary importance with Usefulness being the most important predictor of use. Meanwhile Software Engineering has focused heavily on requirements analysis [rather than collection] and design for just as long. Collaboration between these two areas (usability and requirements analysis/design) of Computer Science research may cumulatively result in increased adoption rates among users. This research suggests that the use of the Technology Acceptance Model with the modified scale of Subjective Norm suggested in this study may result in more successful software development and deployment.

5.5 Future Work

With increased specificity and independence from the other factors of the Subjective Norm scale, Motivation to Comply holds promise as a strong predictive element of social influence in the model. Some rewording of the Motivation to Comply scale items may specifically focus on compliance with opinions of software usage. One possible rewording for consideration by future researchers would be to change

"Generally speaking, I do what my friends think I should do."

to

"My friends have a big influence on the software I use."

Not only might this rewording mitigate some of the self reporting issues indicated but it is also more specific about what the question pertains to (in this case, software use).

Another possibility would be to insert observation and compliance of social influences as two separate variables in the model. Where Normative Influence and Observed Use measure observed opinion and behavior, respectively, a second variable could measure compliance with the opinions of others (i.e., Motivation to Comply) and with the behavior of others (i.e. other peoples' use of certain software). This latter measure of compliance would most likely bear a resemblance to Perceived Behavior Control from the Theory of Planned Behavior (see Section 2.1.3) (Taylor et al. 1995). Table 5-1 shows what the revised scale might look like.

Observance	
Normative Influence	People who are in authority over me think I should use Blackboard. People who influence my behavior think I should use Blackboard. People who are important to me think I should use Blackboard. People who I respect think I should use Blackboard. People who I care about think I should use Blackboard. People who I work with think I should use Blackboard.
Observed Use	I regularly see the people around me benefit from using Blackboard. I regularly see the people around me using Blackboard. I regularly see my classmates using Blackboard. I regularly see my friends using Blackboard. I regularly see my professors using Blackboard.
Compliance	
Motivation to Comply	My professors have a big influence on the software I use. My classmates have a big influence on the software I use. My friends have a big influence on the software I use.
Perceived Behavior Control (Ajzen 2002)	I have a lot of control over how much I use Blackboard. It is mostly up to me whether or not I use Blackboard.

Table 5-1 – Suggested Revision of Subjective Norm

Future studies might also consider restoring Attitude in the Technology Acceptance Model. Many researchers of previous studies that found scales of social influence to be non-significant for volitional systems have proposed that the effect of social influence was entirely mediated by Attitude. Rather than suggesting that Attitude be permanently

restored in the Technology Acceptance Model, future researchers might simply consider including it for the sole purpose of seeing whether it moderates the effect of Subjective Norm. Since Attitude is already regularly excluded from most implementations of the Technology Acceptance Model this may be a moot point, but it may still be of some research interest.

6. References

Abrams, D. and M. Hogg (1990). "Social Identification, self-categorization, and social influence." European Review of Social Psychology **1**: 195-228.

Ajzen, I. (1987). Attitudes, traits, and actions: Dispositional prediction of behavior in personality and social psychology. Advances in experimental social psychology. L. Berkowitz. New York, Academic Press. **20:** 1-63.

Ajzen, I. (1991). "The Theory of Planned Behavior." Organizational Behavior and Human Decision Processes **50**: 179-211.

Ajzen, I. (2002). Constructing a TpB Questionnaire: Conceptual and Methodological Considerations, Ajzen, Icek. **Accessed 2005 (http://www.people.umass.edu/aizen/pdf/tpb.measurement.pdf)**.

Ajzen, I. and M. Fishbein (1980). Understanding Attitudes and Predicting Social Behavior. Englewood Cliffs, NJ, Prentice-Hall.

Ajzen, I. and T. J. Madden (1986). "Prediction of Goal-Directed Behavior: Attitudes, Intentions, and Perceived Behavior Control." Journal of Experimental Social Psychology **22**: 453-474.

Allport, G. (1954). The Nature of Prejudice. Reading, MA, Addison Wesley.

Atkinson, Atkinson, et al. (2000). Introduction to Psychology. Fort Worth, Harcourt College Publishers.

Bagozzi, R. P. (1992). "The Self-Regulatation of Attitudes, Intentions, and Behavior." Social Psychology Quarterly **55**(2): 178-204.

Bandura, A. (1977). Social Learning Theory. Englewood Cliffs, NJ, Prentice-Hall.

Bandura, A. (1982). "Self-Efficacy Mechanism in Human Agency." American Psychologist **37**(2): 122-147.

Bandura, A. (1986). Social Foundations of Thought and Action: A Social Cognitive Approach. Englewood Cliffs, NJ, Prentice Hall.

Batra, R., P. M. Homer, et al. (2001). "Values, Susceptibility to Normative Influence, and Attribute Importance Weights: A Nomological Analysis." Journal of Consumer Psychology **11**(2): 115-128.

Bohrnstedt, G. W. (1970). Reliability and validity assessment in attitude measurement. Attitude Measurement. G. F. Summers. Chicago, Rand-McNally**:** 80-99.

Burnkrant, R. E. and T. J. Page (1988). "The Structure and Antecedents of the Normative and Attitudinal Components of Fishbein's Theory of Reasoned Action." Journal of Experimental Social Psychology **24**: 66-87.

Campbell, D. T. and D. W. Fiske (1959). "Convergent and Discriminant validation by the multitrait multimethod matrix." Psychological Bulletin **56**: 81-105.
Compeau, D. and C. Higgins (1991). A Social Cognitive Theory Perspective on Individual Reactions to Computing Technology. Proceedings of the International Conference on Information Systems (ICIS), New York, NY.
Compeau, D. and C. Higgins (1995). "Application of Social Cognitive Theory to Training for Computer Skills." Information Systems Research **6**(2): 188-143.
Cook, T. D. and D. T. Campbell (1979). Quasi-Experimentation: Design and analysis issues for field settings. Boston, Houghton Mifflin.
Davis, F. D. (1986). A Technology Acceptance Model for Empirically Testing New End-User Information Systems: Theory and Results. MIT Sloan School of Management. Cambridge, MA.
Davis, F. D. (1989). "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology." MIS Quarterly **13**(3): 319-340.
Davis, F. D., R. P. Bagozzi, et al. (1989). "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models." Management Science **35**(8): 982-1003.
Dulany, D. (1961). "Hypotheses and habits in verbal "operant conditioning"." Journal of Abnormal and Social Psychology **63**: 251-263.
Dulany, D. (1964). The seperable effects of the information conveyed by a reinforcer. Paper read at the Psychonomic Society meetings.
Dulany, D. (1968). Awareness, rule, and propositional control: A confrontation with S-R behavior theory. Verbal Behavior and S-R Behavior Theory. D. Horton and T. Dixon. Englewood Cliffs, N.J., Prentice Hall**:** 340-387.
Farely, J., D. Lehmann, et al. (1981). "Generalizing from "imperferct" replication." Journal of Business **54**: 597-610.
Feldman, R. (1995). Social Psychology. Englewood Cliffs, NJ, Prentice Hall.
Fishbein, M. (1967). Attitude and the prediction of behavior. Attitude and the prediction of behavior. M. Fishbein. New York, Wiley**:** 477-492.
Fishbein, M. (1980). A Theory of Reasoned Action: Some applications and implications. Nebraska Symposium on Motivation 1979. H. Howe and M. Page. Lincoln, NE, University of Nebraska Press**:** 65-116.
Fishbein, M. (1982). Social Psychology Analysis of Smoking Behavior. Social Psychology and Behavioral Medicine. J. Eiser. New York, Wiley**:** 179-197.
Fishbein, M. and I. Ajzen (1975). Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research. Reading, MA, Addison-Wesley.
Fishbein, M. and I. Ajzen (1975). Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research. Reading, MA, Addison-Wesley.
Forgas, J. and K. Williams (2001). Social Influence: Direct and Indirect Processes. Philidelphia, PA, Psychology Press.
Godin, G. and G. Kok (1996). "The Theory of planned behavior: A review of its applications to health-related behaviors." American Journal of Health Promotion **11**: 87-98.
Griffin, R. W. (1983). "Objective and Social Sources of Information in Task Redesign: A Field Experiment." Administrative Science Quarterly **28**(2): 184-200.

Grube, J., M. Morgan, et al. (1986). "Attitudes and normative beliefs as predictors of smoking intentions and behaviours: A test of three models." British Journal of Social Psychology **25**: 81-93.

Hale, J., B. Householder, et al. (2002). The Theory of Reasoned Action. The Persuasion Handbook: Developments in Theory and Practice. J. Dillard and M. Pfau. Thousand Oaks, CA, Sage Publications**:** 259-286.

Kashima, Y., C. Gallois, et al. (1992). Predicting the Use of Condoms: Past Behavior, Norms, and the Sexual Partner. AIDS: A Communication Perspective. T. Edgar, M. Fitzpatrick and V. Freimuth. Hillsdale, NJ, Lawrence Erlbaum Associates**:** 21-46.

Kelman, H. (1958). "Compliance,Identification, and Internalization: Three Processes of Attitude Change?" Journal of Conflict Resolution **2**: 51-60.

Kraut, R. E., R. E. Rice, et al. (1998). "Varieties of Social Influence: The Role of Utility and Norms in the Success of a New Communication Medium." Organization Science **9**(4): 437-453.

Madden, T. J., P. S. Ellen, et al. (1992). "A Comparison of the Theory of Planned Behavior and the Theory of Reasoned Action." Personality and Social Psychology Bulletin **18**(1): 3-9.

Malhotra, Y. and D. F. Galletta (1999). Extending the Technology Acceptance Model to Account for Social Influence: Theoretical Bases and Empirical Validation. Proceedings of the 32nd Hawaii International Conference on System Sciences.

Markus, M. (1987). "Toward a critical mass theory of interactive media: universal access, interdependence and diffusion." Communication Research **14**: 491-511.

Mathieson, K. (1991). "Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior." Information Systems Research **2**(3): 173-191.

Moore, G. C. and I. Benbasat (1991). "Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation." Information Systems Research **2**(3): 192-222.

Muliak, S., L. James, et al. (1989). "Evaluation of Goodness of Fit Indices in Structural Equation Models." Psychological Bulletin **105**(3): 430-445.

Nucifora, J., C. Gallios, et al. (1993). Influences on Condom Use among Undergraduates: Testing the Theries of Reasoned Action and Planned Behavior. The Theory of Reasoned Action: Its Application to AIDS-Preventive Behaviour. D. Terry, C. Gallios and M. McCamish. Tarrytown, New York, Pergamon Press.

Nunnally, J. C. (1978). Psychometric Theory. New York, McGraw-Hill.

Pedhazur, E. J. (1997). Multiple Regression in Behavioral Research. United States, Thompson Learning, Inc.

Rice, R. E., A. Grant, et al. (1990). "Individual and Network Influences on the Adoption and Perceived Outcomes of Electronic Messaging." Social Networks **12**: 27-55.

Rogers, E. (2003). Diffusion of Innovations. New York, Free Press.

Schmitz, J. and J. Fulk (1991). "Organizational Colleagues, Media Richness, and Electronic Mail: A test of the Social Influence Model of technology use." Communication Research **18**(4): 487-523.

Sheppard, B., J. Hartwick, et al. (1988). "The Theory of Reasoned Action: A Meta-Analysis of Past Research with Recommendations for Modifications and Future Research." Journal of Consumer Research **15**(3): 325-343.
Simons, H., J. Morreale, et al. (2001). Persuasion in Society. Thousand Oaks, CA, Sage Publishing.
Taylor, S. and P. A. Todd (1995). "Assessing IT Usage: The role of prior experience." MIS Quarterly **19**(4): 561-570.
Taylor, S. and P. A. Todd (1995). "Understanding information technology usage: A test of competing models." Information Systems Research **6**: 144-176.
Terry, D. and M. Hogg (1996). "Group Norms and Attitude-Behavior Relationship: A Role for Group Identification." Personality and Social Psychology Bulletin **22**(8): 776-793.
Terry, D. and M. Hogg (1996). "Group norms and the attitude-behavior relationship. A role for group identification." Personality and Social Psychology Bulletin **22**: 776-793.
Thompson, R., C. Higgins, et al. (1991). "Personal Computing: Towards a Conceptual Model of Utilization." MIS Quarterly **15**(1): 125-143.
Turner, J. (1991). Social Influence. Milton Keynes, UK, Open University Press.
Venkatesh, V. and F. D. Davis (2000). "A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies." Management Science **46**(2): 186-204.
Venkatesh, V. and M. G. Morris (2000). "Why don't men ever stop to ask for dirrections? Gender, social influence, and their role in technology." MIS Quarterly **24**(1): 115-139.
Venkatesh, V., M. G. Morris, et al. (2003). "User Acceptance of Information Technology: Toward a Unified View." MIS Quarterly **27**(3): 425-478.
Xia, W. and G. Lee (2000). The influence of persuasion, training and experience on user perceptions and acceptance of IT innovation. Proceedings of the twenty first international conference on Information systems, Brisbane, Queensland, Australia.
Yeaman, A. R. J. (1988). Attitudes, Learning and Human-Computer Interaction: An Application of the Fishbein and Ajzen Model of Attitude-Behavior Consistency. Proceedings of the Annual Meeting of the Association of Educational Communinications and Technology, New Orleans, LA.

Appendix A – Scale Ranking Interview Protocol

How are you? Are you rested, refreshed, feeling sharp today?

I want to start off by getting you to read and sign this form. It basically says that your participation in this interview is voluntary and that your feedback will be kept strictly confidential. After you fill this out, I have another form with some background questions on it. You'll see there's no space for your name, you'll be known only by the ID number in the upper right-hand corner.

<Fills out the forms>

Alright, now I want to give you just a quick overview of the project I'm working on. Then I'll explain what feedback I'm interested in getting from you. Would you say that you are familiar with using the Internet? Well my research is interested in not only how people use the Internet by why they use different technologies. By technology, I'm going to mean software or applications that connect to the Internet. An example would be IM, do you use IM? Some people love it, some people hate it. Some people use it a lot, some a little. I'm interested in the factors that motivate people to use Internet technologies. Do you have any questions so far?

What I'm specifically interested in for this part of the study is the role social influence plays on your Internet usage. In other words, what effect do the people around you have on (1) what programs you use and (2) how often you use them? Does that make sense?

What I've put together are a series of 14 questions that will give me a sense of the effect people around you have on your Internet use. This is a draft though, some of these questions I'll keep, and others I'll trim depending on how well they measure what I want them to measure. That's where you come in. I would like your help in figuring out which of these questions are the best measures of social influence and which are the least helpful.

<Take out the notecards and the Subjective Norm definition on another piece of paper>

Here is the definition of social influence that we're using for the study. What I've done is put each of the questions I'm thinking about using on a separate notecard. You'll notice that each card has a number in the upper right corner. These numbers were assigned in random order. What I would like you to do is place these questions in order of which you think would best measure social influence according to this definition. There is no right or wrong order so take your time and put them in the order you think is best. You'll notice all of the questions refer to Blackboard as an example, but this scale will be used for a variety of different systems so focus on the question itself. Do you have any questions?

<Answer questions and let subject order notecards on the table.>

All done? Do you need any more time? Alright, great! What I need you to do now is go back to the form I gave you earlier and write down the order you put the cards in according to the number on the each card. You'll notice there's a space for that on the bottom of the form. Go from left to right, starting with the question you find most applicable and ending with the question you found least relevant.

<Completes the form. Take it and turn it over, record subject's answers to the following questions>

Great, that's about it. I just have a few more questions I want to ask you and we'll be done.
• What are some of the programs you use the most?
• Who do you think has the most influence on the software you use?

• Would you have changed the rank of any of the questions if we had mentioned a system other than Blackboard?
• Are there any other social factors that we should include or that we should pay more attention to?

Alright, we're all done. Thank you so much for your time and input. You did a great job and your input was really helpful. Have a great day!

Appendix B – Scale Ranking Interview Information Sheet

The Role of Social Influence in Technology Usage.
Principle investigator: Jason S. Snook **ID: _____**

Gender: Male _____ Female _____

Age: _____

Year: _____ (Freshman/Sophomore/Junior/Senior)

Major(s): _____

How many years have you used the Internet? _____

On a scale of 1 to 10, how confident do you feel using the Internet?

1	2	3	4	5	6	7	8	9	10
Not Very Confident									Extremely Confident

On a scale of 1 to 10, how independent would you consider yourself to be?

1	2	3	4	5	6	7	8	9	10
Dependent				Interdependent					Independent

Please use the spaces below to record your scale ranking:

_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

Most Applicable **Least Applicable**

Appendix C – Preliminary Survey

Motivation towards software use

Hello and thank you for participating in this study. The following survey measures a number of factors attributable to application usage (i.e. whether or not you use a particular computer application). As a result of this survey, these questions will be refined to better measure application usage.

Please take as much time as you need to fill out the questions in each section. You must be a current student at Virginia Tech. This survey should take no longer than about 10 minutes to complete.

Blackboard - The following set of questions is in regard to the Blackboard system (www.learn.vt.edu).

Perceived Usefulness of Blackboard

Using Blackboard improves my performance in my classes
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
Using Blackboard in my classes increases my productivity.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
Using Blackboard enhances my effectiveness in my classes.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
I find Blackboard useful in my classes.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree

Perceived Ease of Use of Blackboard

My interaction with Blackboard is clear and understandable.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
Interacting with Blackboard does not require a lot of mental effort.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
I find Blackboard to be easy to use.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
I find it easy to get Blackboard to do what I want it to do.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree

Social Influence to Use Blackboard

People who are in authority over me think I should use Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
People who influence my behavior think I should use Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
People who are important to me think I should use Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
People who I respect think I should use Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
People who I care about think I should use Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
People who I work with think I should use Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree

Generally speaking, I do what my professors think I should do.

Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
Generally speaking, I do what my friends think I should do.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
Generally speaking, I do what my classmates think I should do.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree

I regularly see the people around me benefit from using Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
I regularly see the people around me using Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
I regularly see my classmates using Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
I regularly see my friends using Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
I regularly see my professors using Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree

Intention to use Blackboard

I intend to use Blackboard for class
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
I intend to use Blackboard frequently for class
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree

Actual Use of Blackboard

I am a regular user of Blackboard
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
On average, I would say I am on Blackboard...
Several times a day About once each day Several times a week
About once a week Less than once a week Not at all
How long have you used Blackboard?
less than 6 months 6-12 months 12-18 months 19-24 months more than 2 years

A couple of questions about you...

How old are you?

Gender?
Male Female
Do you live...?
On-campus Off-campus
What class are you in?
Freshman Sophomore Junior Senior Graduate
How long have you been using the Internet?
Less than one year 1-2 years 3-5 years 6-7 years 8-9 years 10+ years

Use of other online systems

In the following questions, please indicate how much you use that particular system. If you have trouble recalling the system mentioned, feel free to hit the link next to it to see the system.

I use Filebox (www.filebox.vt.edu)
Frequently Regularly Occasionally Rarely Not at all
I use Webmail (www.webmail.vt.edu)
Frequently Regularly Occasionally Rarely Not at all

I use MyVT (www.my.vt.edu)
Frequently Regularly Occasionally Rarely Not at all
I use Addison (addison.lib.vt.edu)
Frequently Regularly Occasionally Rarely Not at all

**Would you be willing, in a week or so, to fill out a survey like this again about another system? (it would be greatly appreciated)
Yes No
If so, what is your email?

Appendix D – Final Survey Email

Hello,

Virginia Tech's Center for Human-Computer Interaction is conducting a short survey to look at your use of online systems. We're interested in what factors motivate you to use certain applications on the Internet. In this case, the system we're studying is Blackboard. Could you take 5 minutes and fill out the survey at:

http://filebox.vt.edu/users/jsnook/research/

Please fill this out regardless of how much/little you use Blackboard. It should take no more than about 5 minutes, we promise.

Thanks in advance for your help!

Jason S Snook
PhD Candidate
Computer Science

NOTE: This research project has been approved, as required, by the Institutional Review Board for Research Involving Human Subjects at Virginia Polytechnic Institute and State University and by the Department of Computer Science at Virginia Polytechnic and State University. IRB Approval Expiration Date: April 7, 2005

Appendix E – Final Survey

Motivation for Software Use and Non-Use on the Internet

Thank you so much for your participation. Please take as much time as you need to fill out all of the questions in each section. Every student is encouraged to take this survey regardless of how much you use the system. This survey should take no longer than about 5 minutes to complete.

Blackboard - The following set of questions is in regard to the Blackboard system (www.learn.vt.edu).

Perceived Usefulness of Blackboard

Using Blackboard improves my performance in my classes
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
Using Blackboard in my classes increases my productivity.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
Using Blackboard enhances my effectiveness in my classes.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
I find Blackboard useful in my classes.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree

Perceived Ease of Use of Blackboard

My interaction with Blackboard is clear and understandable.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
Interacting with Blackboard does not require a lot of mental effort.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
I find Blackboard to be easy to use.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
I find it easy to get Blackboard to do what I want it to do.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree

Social Influence to Use Blackboard

People who are in authority over me think I should use Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
People who influence my behavior think I should use Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
People who are important to me think I should use Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
People who I respect think I should use Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
People who I care about think I should use Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
People who I work with think I should use Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree

Generally speaking, I do what my professors think I should do.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
Generally speaking, I do what my friends think I should do.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree

Generally speaking, I do what my classmates think I should do.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree

I regularly see the people around me benefit from using Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
I regularly see the people around me using Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
I regularly see my classmates using Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
I regularly see my friends using Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
I regularly see my professors using Blackboard.
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree

Intention to use Blackboard

I intend to use Blackboard for class
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
I intend to use Blackboard frequently for class
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree

Actual Use of Blackboard

I am a regular user of Blackboard
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree
On average, I would say I am on Blackboard...
Several times a day About once each day Several times a week
About once a week Less than once a week Not at all
How long have you used Blackboard?
less than 6 months 6-12 months 12-18 months 19-24 months more than 2 years

My use of Blackboard is voluntary
Strongly agree Agree Slightly agree Neutral Slightly disagree Disagree Strongly disagree

A couple of questions about you...

How old are you?

Gender?
Male Female
Do you live...?
On-campus Off-campus
What class are you in?
Freshman Sophomore Junior Senior Graduate
How long have you been using the Internet?
Less than one year 1-2 years 3-5 years 6-7 years 8-9 years 10+ years

Use of other online systems

In the following questions, please indicate how much you use that particular system. If you have trouble recalling the system mentioned, feel free to hit the link next to it to see the system.

I use Filebox (www.filebox.vt.edu)
Frequently Regularly Occasionally Rarely Not at all
I use Webmail (www.webmail.vt.edu)
Frequently Regularly Occasionally Rarely Not at all

I use MyVT (www.my.vt.edu)
Frequently Regularly Occasionally Rarely Not at all
I use the library website (www.lib.vt.edu)
Frequently Regularly Occasionally Rarely Not at all

**Would you be willing, in a week or so, to fill out a survey like this again about another system? (it would be greatly appreciated)
Yes No
If so, what is your email?

Appendix F – Followup Interview Protocol

Hello! It's good to see you! How've you been? Thanks again for agreeing to sit down one more time and help me out with this project. As I told you, I don't expect this to take more than 20 minutes.

Well you probably remember from the last time we met that I am working on a project for my dissertation. Do you remember anything about what it was about?

<Brief summary of the research project (objectives and goals)>

If you remember from last time, you ranked 14 questions for a scale measuring social influence using these note cards. Here is the technical definition of social influence that we're working from and here are the questions in the order that you originally ranked them.

<Place a copy of the definition in front of them and the note cards with the questions on them in the order they originally ranked them>

I want to ask you a couple follow up questions about the ranking that you came up with. Take a look at the questions that you ranked the lowest, particularly the last three or four. These were the questions you indicated would be the least helpful in measuring social influence. What was it about these questions that made you feel this way?

<Record comments and observations>

Now I want to ask you for your thoughts on three questions in particular.

<Pull out the Motivation to Comply questions>

What are your thoughts on these questions?

<Record comments and observations>

Do you think questions such as these would be or should be important in measuring social influence? Do you have any suggestions for me as to how I could reword them? If so, how does this rewording make the question better than it was?

<Record comments and observations>

Do you have any other thoughts or advice for me? Thanks so much for your time. You've been a huge help to me in this project and I really do appreciate it. Have a nice day, bye!