MODELING UTILIZATION OF PLANNED INFORMATION TECHNOLOGY

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Implementations of information technology solutions to address specific information problems are only successful when the technology is utilized. The antecedents of technology use involve user, system, task and organization characteristics as well as externalities which can affect all of these entities. However, measurement of the interaction effects between these entities can act as a proxy for individual attribute values. A model is proposed which based upon evaluation of these interaction effects can predict technology utilization. This model was tested with systems being implemented at a pediatric health care facility. Results from this study provide insight into the relationship between the antecedents of technology utilization. Specifically, task time provided significant direct causal effects on utilization. Indirect causal effects were identified in task value and perceived utility contructs. Perceived utility, along with organizational support also provided direct causal effects on user satisfaction. Task value also impacted user satisfaction in an indirect fashion. Also, results provide a predictive model and taxonomy of variables which can be applied to predict or manipulate the likelihood of utilization for planned technology.

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INTRODUCTION

Overview

Statement of the Problem

Appropriate allocation of information technology is a critical activity for information intensive organizations. Benefits of information technology advances are only realized through selective allocation of resources to those who most require the technology and are able to utilize it. When allocation of information technology occurs in a haphazard fashion, a low quality of technology utilization results. This low utilization quality is demonstrated through non-utilization, mis-utilization, or under-utilization of the technology. Failure to successfully utilize core information technology represents a significant loss of investment for information intensive organizations.

Implementation of a successful information technology allocation method assumes that a means of measuring both information requirement and technology utilization exists. The combination of these measures in a meaningful theoretical model with identifiable antecedents and causative factors can provide practical application for those who must make decisions in regard to information technology acquisition and allocation.

Purpose of the Study

This study seeks to describe a utilization model that could be generally applied to quantify information requirements and information technology utilization. In addition, through examination of the antecedent variables of utilization, a predictive model is derived to allow for projecting utilization of planned information technologies. This study specifically focuses on utilization of these technologies during the early stages of the information system life cycle. Based upon the specifications of this model development, a probabilistic taxonomy of utilization predictors is described. Also, a set of operative heuristics for practical application of this model is proposed.

Significance of the Study

This research introduces a utilization prediction model to the information science and business fields. This model holds potential benefit for researchers requiring a global, quantifiable approach to the measure of information technology utilization. Also, organizations making information technology decisions can use the proposed model to better determine areas for the greatest potential return on technological investments. Factors within the model also provide quantification of individual variables of interest. The measurement of the interaction of system, user, task, and organizational variables brings together previously disparate constructs into a system of related measures.

Background

Application of Information Technology

Information technology is by definition designed to effectively and efficiently process information. Framing a potential problem-solution in a quantifiable model requires the ability to individually quantify problems that arise in information processing. The universe of information problems can be viewed as a multidimensional problem space in which any one information problem is represented by a single point in that space. Corresponding to each point in the problem space is a unique solution space consisting of all possible solutions to the specific point in problem space.

When faced with a specific information problem that requires a solution, the individual will navigate through a unique solution space in an attempt to decide on a specific method of solving the problem. Four primary forces along with the interaction of these forces can describe this solution space:

1. The individual - defined as the one who will use the solution; thus the "*user*,"
2. The problem - defined as the information "*task*" to be performed or resolved,
3. The potential solution - which will be defined as the "*system*" to be applied whether technological or otherwise, and
4. The *organization* – the institution that is planning for the use of information solutions.

These forces were recognized and included in a multidimensional model of human-computer interaction (HCI) proposed by Jagodzinski and Clarke in 1988. To the traditional array of variables associated with HCI studies, such as terminal dialogue characteristics, their model added “users’ attitudes, beliefs and personal objectives . . . in complex interaction with the host organisation’s objectives and norms, with its task structures, and with the general information and misinformation about computers that exists in the world in general (p. 410).” While many of their measures lack robustness, their theoretical model and approach illustrate the significance of the primary forces and their interactions.

The relative strength of any force in determining a solution is a result of the combined characteristics of the forces and their interactions. The number of all possible characteristics involved in describing a point, while not infinite, is formidable. An attempt to characterize a solution space and to predict outcomes of problem and solution space mappings through measurement of single attributes is an untenable undertaking. While conceivable within the confines of a controlled environment, practical application of such a methodology is destined for failure due to the resources required to map points and predict possible interactions. Also, erroneous deductions due to omissions of measurements of pertinent attributes are extremely likely since the relative importance of any one attribute is a dynamic variable temporally dependent upon interactions between forces in both problem and solution spaces.

Defining a tenable methodology for mapping any solution space is dependent upon the ability to identify a small number of reliable measures which accurately reflect the dimensions of a solution space and which can be generally applied to a solution space independent of the problem space. The only logical candidates for such measures must be those that focus on describing the interactions between primary forces, since characteristics of these forces define the parameters of the interactions. The interactions of the forces are then extensions of the attributes of the individual forces and effects from each force attribute resonate throughout the interactions themselves.

Information Industries

As technological solutions proliferate, there is an increasing need for organizations to focus on those solutions that best fit the specific mission and objectives of the organization. Generally, two approaches have been followed in matching organizational need to potential technology.

Some organizations choose to acquire highly specialized systems that narrowly focus on solving problems specific to the organization. Whether these systems are targeted by industry, market segment or other means, they typically are extremely structured and not designed with flexibility in terms of application to problems in a particular environment. The second approach is to acquire very general technological tools designed to be customized by the end user. This approach has the advantage of flexibility of application, but requires a higher degree of user resource investment and skills.

After implementation of an information system, many organizations experience unexpected problems. Often employees either refuse to use the system, under-utilize the system, or misuse the system. Refusal can be viewed as an avoidance of the area within a solution space identified by the organization as desirable. Under-utilization represents failure to maintain position at a desired point in solution space. Finally, misuse can be described as a failure to adequately apply the desired point in solution space to the resolution of the initial problem.

Interactions of Forces Driving Technology Application

Six interactions can be identified from the four primary forces previously identified:

1. USER-SYSTEM: this interaction has historically been related to the field of Human-Computer Interactions (HCI) and can be globally represented by a measure of system satisfaction.
2. USER-TASK: this interaction can be represented by a measure of information requirement.
3. USER-ORGANIZATION: an interaction which encompasses not only the user's particular place within the organization, but also the user's attitudes; job satisfaction is linked to this interaction.
4. SYSTEM-TASK: an interaction that has only recently received formal attention, this can be characterized through a measure of task-technology fit.
5. SYSTEM-ORGANIZATION: an interaction that involves the degree to which the organization champions, endorses, or requires use of a system, i.e. the organizational support for the system.
6. TASK-ORGANIZATION: this interaction describes the value an organization places on a particular activity or information and typically reflects the impact the task has on the organization's continued existence.

Figure 1 graphically describes these interactions.

As can be seen in this diagram, the user forms the focus for all interactions that occur in this model. Three interactions involve users directly: job satisfaction, system satisfaction, and task need. While the remaining three interactions by definition do not involve the user, the perception of these interactions by the user are directly related to utilization. An example of this relationship can be shown in that users' perceptions of the organization's support for a system typically affect utilization more than the actual degree of organizational support. Also, users' perceptions are often easier to measure than actual constructs such as organizational support.

The three areas labeled as "2" through "4" represent the user's perception of each of the interactions immediately outlying the respective areas. Thus, area 2 represents

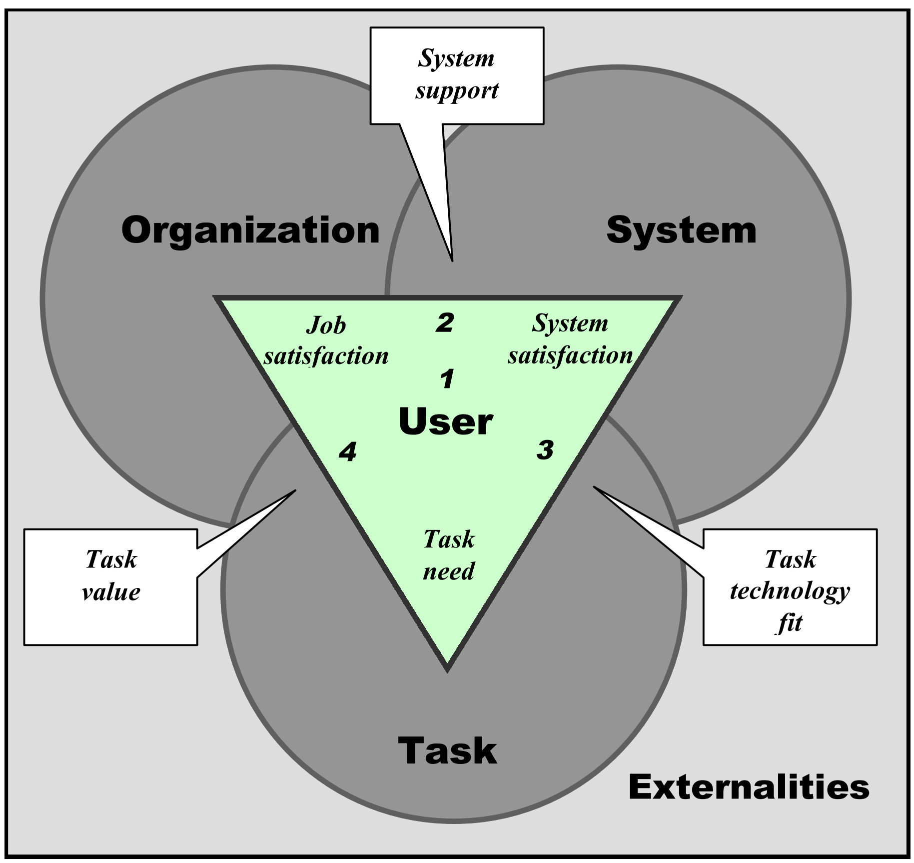


Figure 1: Relational Diagram of Primary Forces and their Interactions

the user's perception of the organization's support for the system. Likewise, area 3 represents the user's perception of Perceived-Utility and area 4 represents the user's perception of the value of the task to the organization. The remaining area, number 1, is the confluence of all primary forces: user, system, task and organization. This interaction, while difficult to quantify, can best be conceptualized as an overall user satisfaction measure centered within a specific situational context.

Another significant feature of this model is that external factors can affect any of these interactions. A few examples of external factors affecting the organization might include market forces, workforce availability and resource costs. For the individual user, external forces could include such factors as extra-organizational activities, lifestyle, or family obligations. External factors affecting the task construct typically involve improved methods or processes that increase or decrease the significance of the task.

Research Questions

The following questions are addressed by this study; the hypotheses needed to explore these questions are included in Table 1, hypotheses related to question 1 include::

1. Does the magnitude of utilization of an information system change predictably according to changes in primary force interactions?
2. Can self-reported utilization measures act as a proxy for actual utilization monitoring?

Table 1: Research questions and associated hypotheses

Question 1: *Does the magnitude of utilization of an information system change predictably according to changes in primary force interactions*?	Hypothesis 1: Regarding the antecedents of utilization.	
	1.1	As user satisfaction [User-System interaction] and organizational support [Organization-System interaction] increase, utilization will increase.
	1.2	As user satisfaction [User-System interaction] increases, utilization will increase.
	1.3	As organizational support [Organization-System interaction] increases, utilization will increase.
	1.4	In the presence of negative user satisfaction [User-System interaction], utilization will decrease.
	1.5	In the presence of negative organizational support [Organization-System interaction], utilization will decrease.
	Hypothesis 2: Regarding the antecedents of user satisfaction.	
	2.1	As task time [User-Task interaction] and perceived utility [System-Task interaction] increase, user satisfaction [User-System interaction] will increase.
	2.2	As task time [User-Task interaction] increases, user satisfaction [User-System interaction] will increase.
	2.3	As perceived utility [System-Task interaction] increases, user satisfaction [User-System interaction] will increase.
	2.4	In the presence of negative task time [User-Task interaction], user satisfaction [User-System interaction] will decrease.

Table 1 (continued): Research questions and associated hypotheses

Question 1: *Does the magnitude of utilization of an information system change predictably according to changes in primary force interactions?*	2.5 In the presence of negative perceived utility [System-Task interaction], user satisfaction [User-System interaction] will decrease.
	2.6 Negative job satisfaction will reduce user satisfaction [User-System interaction].
	Hypothesis 3: Regarding the antecedents of organizational support.
	3.1 As organizational value [Task-Organization interaction] and perceived utility [System-Task interaction] increase, organizational support [Organization-System interaction] will increase.
	3.2 As organizational value [Task-Organization] interaction increases, organizational support [Organization-System interaction] will increase.
	3.3 As perceived utility [System-Task interaction] increases, organizational support [Organization-System interaction] will increase.
	3.4 In the presence of negative organizational value [Task-Organization interaction], organizational support [Organization-System interaction] will decrease.
	3.5 In the presence of negative perceived utility [System-Task interaction], organizational support [Organization-System interaction] will decrease.
	Hypothesis 4: Regarding the antecedents of task time.
	4 As organizational value [Task-Organization interaction] increases, task time [User-Task interaction] will increase.
Question 2: *Can self-reported utilization measures act as a proxy for actual utilization monitoring?*	Hypothesis 5: Regarding self report of utilization versus actual use.
	5 Self-report is correlated with actual use of a system.
	Hypothesis 6: Regarding comparison of self report across systems.
	6 Correlations between self-reported utilization and actual utilization will be higher for non–required use systems than for required use systems.

Limitations and Assumptions

For this study certain limitations are recognized; specifically, this study was performed within a single institution. Since this is, by its nature, a pilot study wherein an original model was proposed and limited testing of that model was undertaken, a single-institution trial seemed the most sensible approach. This study identifies more questions than answers; however, the contribution of significant research questions to the field, particularly centered around a meaningful theoretical model, is of notable value.

A second limitation of this study involves the systems included. Only two systems were examined in this research. The criteria for inclusion excluded all other information systems. However, this limitation is more a benefit than a hindrance. Since the limitation exists because of the strict nature of the inclusion criteria, greater confidence can be placed in the outcomes of the research.

CHAPTER 2

REVIEW OF THE LITERATURE

Background

The following studies provide important background information for the research and the development of the model proposed in this study. Many of these studies equate measures of use with information systems "success." However, utilization is not the only measure of systems success that has been researched. Galletta and Lederer (1989) identified two categories of implementation outcomes which reflect common success measures (see Figure 2): economic outcomes and personal outcomes. Economic outcome variables were oriented around organizational impact, while personal outcomes reflected both user and system impacts.

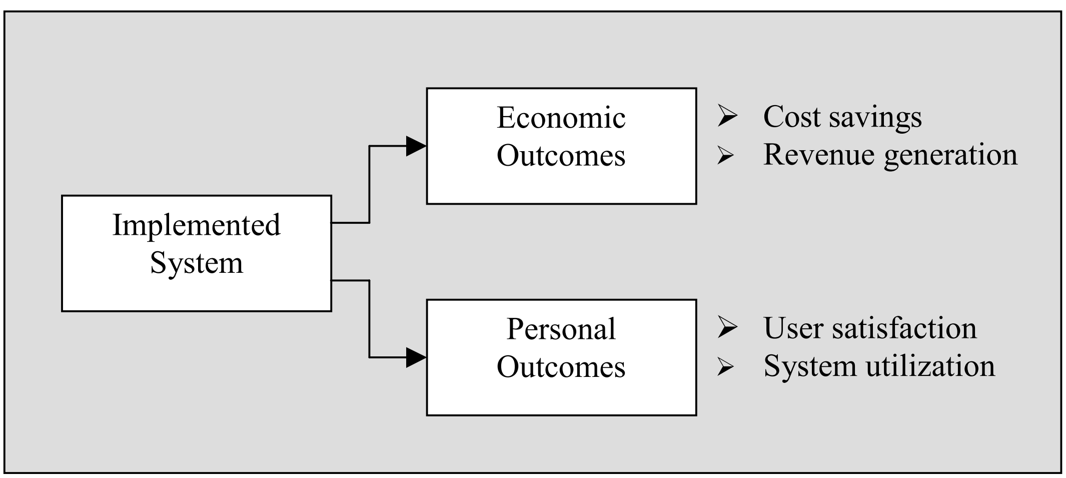


Figure 2: Galletta and Lederer (1989) Model of Information System Outcomes

Most studies have focused on identifying specific independent variables related to system success rather than categorizating these variables under more general outcome categories. Although a number of variables have been proposed and examined, somewhat of a consensus about the more salient variables has been reached. The studies included in this review reflect the breadth of independent variables which have been examined. Mainly the literature concentrating on the variables which have been most robust across populations and methodologies is presented.

Conrath and Sharma (1993) noted that the four most common measures of information systems success found in the literature include (p. 269):

1. User satisfaction: "an esthetic evaluation measure"
2. System effectiveness: "the effectiveness of an information system in meeting the organization's needs"
3. Value: "perceived worth"
4. Utilization: "reported estimates of system usage"

Each of these measures has demonstrated significance in establishing the success of an information system; however, Conrath and Sharma proposed an instrument that combined global assessments of each of these measures, positing that measures of the multi-faceted success construct appear to be more successfully derived by a multidimensional instrument.

DeLone and McLean (1992) identified a total of six dimensions of Information Systems (IS) success. Four of the six dimensions coincide with Conrath and Sharma's measures. DeLone and McLean's list includes user satisfaction and utilization (use) along with organizational effectiveness (compared to system effectiveness) and individual impact (compared to value). The two dimensions not specified by Conrath and Sharma include system quality and information quality. Pitt, Watson and Kavan (1995) also identified a third quality dimension, service quality. Their “Augmented IS Success Model” appears in Figure 3. This model proposes a reciprocal interaction between use and user satisfaction and proposes that the most significant factors affecting these interactive elements are system quality, information quality and service quality.

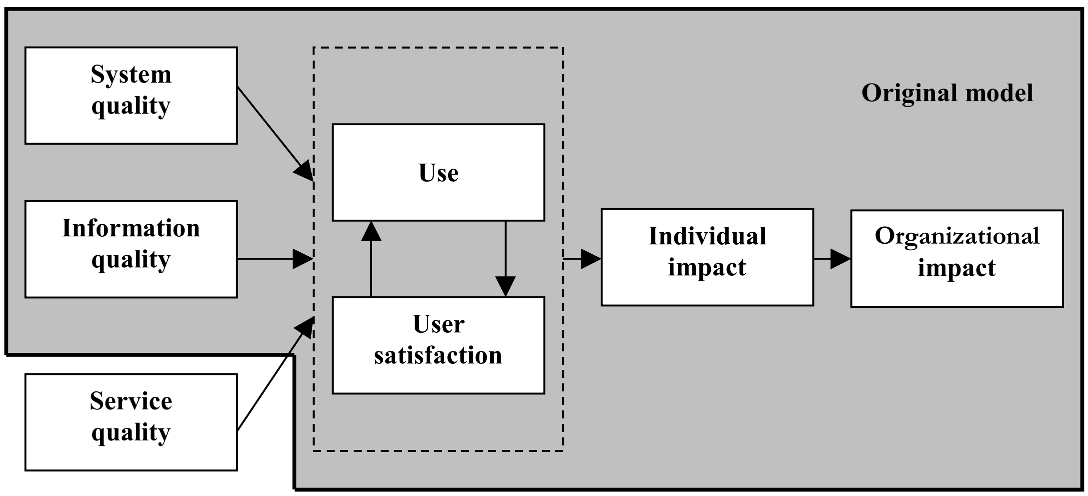


Figure 3: Pitt, Watson and Kavan’s 1995 Augmented IS Success Model (adapted from DeLone and McLean, 1992)

Research in Information Technology Utilization

Utilization of information systems, while seemingly a straightforward concept, has been variously defined in the literature. Most studies have defined utilization simply as accessing a system. However, access has been measured through a number of methods:

- Binary use: a system is used or not used;
- Proportional use: the proportion of times a system is chosen for use versus not chosen (Goodhue & Thompson, 1995);
- Variety of use: number of different systems used (Igbaria, Pavri & Huff, 1989);
- Sophistication of use: the level of expertise of the user (Igbaria, Pavri & Huff, 1989);
- Magnitude of use: frequency and duration of system access (Schiffman, Meile, & Igbaria, 1992);
- Application: the extent to which information retrieved from a system is applied to information problems (Barkin & Dickson, 1977).

Information technology utilization studies historically have focused on the development of models that relate utilization primarily to user characteristics. For example, Schiffman, Meile, and Igbaria (1992) examined users according to their classification in Rockart and Flannery's taxonomy (non-programmers, command-level users, end-user programmers, functional support people, end-user support personnel, and data processing programmers). They found that such a classification was related to four measures of system utilization: frequency of use, time of use, number of software applications, and the number of business tasks.

Zmud (1979) also approached the technology utilization and success question from the primary perspective of user characteristics. His early review of the IS “success” literature allowed development of a model which recognized the impact of attitudinal and cognitive influences on individual differences. These influences affected success directly and indirectly through the involvement of users in system design characteristics. Zmud also observed that the user satisfaction construct demonstrated consistent positive associations with usage.

Some studies have also attempted to fit system characteristics into a theoretical model; however, very few have recognized the more global orientation which incorporates user, system, task, and organization attributes in a single model. Part of this deficiency may be due to the difficulty in measuring enough representative attributes to sufficiently represent a useful model. Borovits and Giladi’s (1993) research, while based in a systems orientation, does attempt to bridge to a more global perspective by incorporating “peopleware” as a component of systems success. Also, they recognize that system performance can be considered on several levels, including the organizational level, the IS level, the application level, and the job level. However their proposed model is limited to measurement of utilization through a proportional approach combined with cost information. Thus the model lacks incorporation of organizational, task and a majority of user factors.

Other studies, while maintaining a user orientation, have indirectly incorporated measures reflecting other primary factors. Igbaria and Parasuraman (1991) identified five dimensions underlying attitudes towards computers which affected use: “perceived utility; limited hardware/software capacity; problems in use; time requirements; and user-friendliness (p. 563).” The interactions of user-system, and system-task can clearly be seen in several of these dimensions. Robey (1979) also listed determinants of system use found in the literature. Among the determinants reviewed by Robey were “user attitudes and perceptions, technical quality of the system, performance, situational and personal factors, and decision style (p. 528).”

The combined effect of these user attributes and user perceptions over time is directly influenced by specific experiences with various computer systems. This is the basis for the 1994 research by Thompson, Higgins and Howell which tested a conceptual model directly linking past experience with personal computers to current utilization of personal computers (Figure 4). The results of their analysis indicated that:

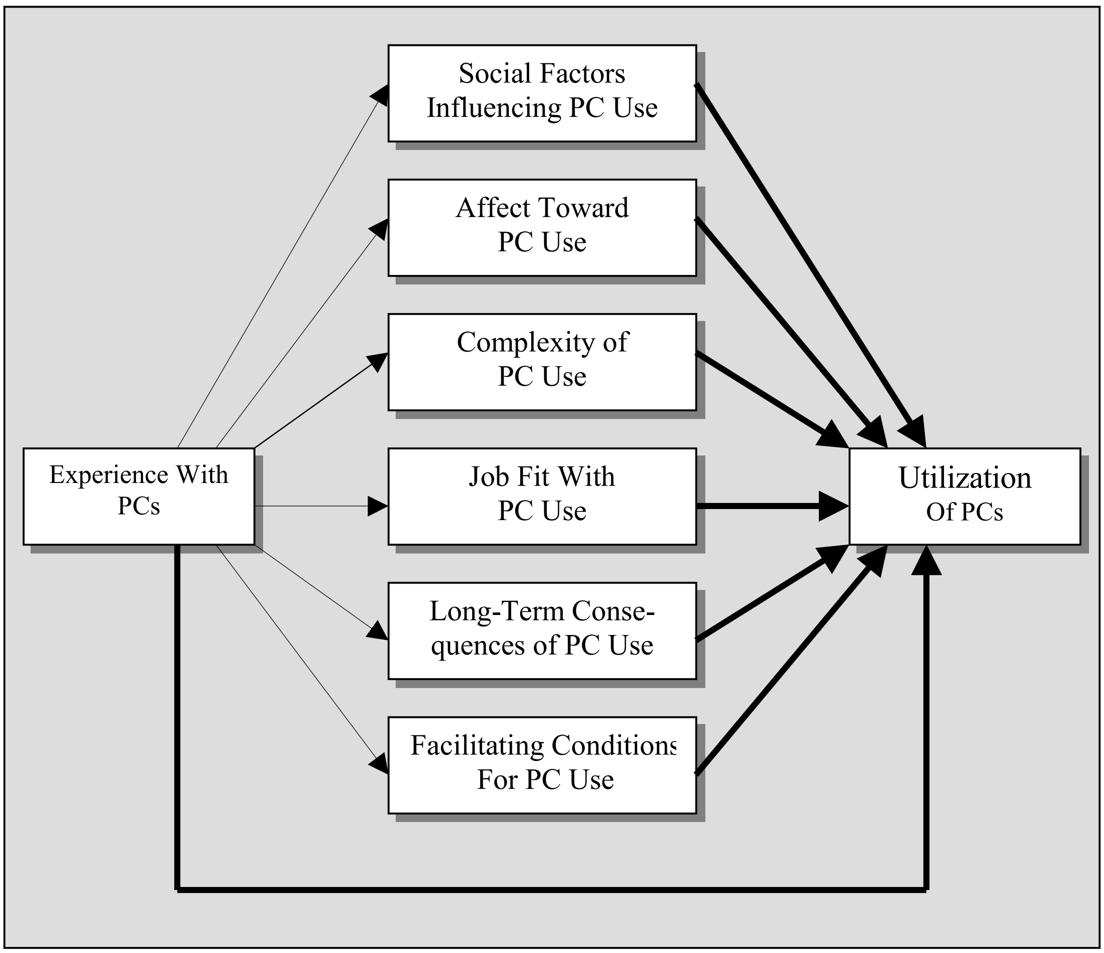
> The direct influence of experience was both statistically and substantively significant (b = 0.23). . . The combined indirect effects of experience on utilization was 0.22, dispersed as relatively small effects through the intervening variables . . . This implies that indirect effects may be added to provide additional understanding, but may provide little information with respect to additional prediction of behavior (p. 181).

These findings support the idea that variability in effects of utilization are less likely to be well accounted for by granular measurements of primary force characteristics than by measurements of primary force interactions.

Figure 4: Thompson, Higgins and Howell's (1994) Model of

Factors Influencing the Utilization of Personal Computers

(darker lines indicate hypothesized direct effects)



In the 1970's the Theory of Reasoned Action (TRA) was the first theoretical perspective in utilization research to gain widespread acceptance (Compeau & Higgins, 1995). This theory posits that "individuals would use computers if they could see that there would be positive benefits (outcomes) associated with using them (p. 189)." While this theory has demonstrated widespread validity, it does not sufficiently account for all variables necessary to explain utilization. Some researchers have suggested that beliefs about outcomes are actually tempered by the user's expectations about their own capabilities in regard to the technology (Igbaria & Iivari, 1995). A variable added to the pool of explanatory factors of utilization to reflect this expectation about one's own capabilities was "self-efficacy." Taken from the Social Cognitive Theory of Albert Bandura, self-efficacy is "the belief that one has the capability to perform a particular behavior (Compeau & Higgins, 1995, p. 189)." In reference to technology use, self-efficacy "refers to a judgment of one's capability to use a computer." Other factors influencing utilization which have been identified from Social Cognitive Theory include encouragement by others, others' use of technology, organizational support, outcome expectations, affect and anxiety. Diffusion of innovation theory and adoption characteristics have also been combined with the TRA model to predict system utilization (Moore & Benbasat, 1996).

In 1986 Fred Davis introduced an adaptation of TRA that he called the Technology Acceptance Model (TAM). This adaptation was specifically designed to model user acceptance of information systems in general (see Figure 5). In Davis, Bagozzi and Warshaw's (1989) words:

> The goal of TAM is to provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behavior across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified. . . . A key purpose of TAM, therefore, is to provide a basis for tracing the impact of external factors on internal beliefs,

> attitudes, and intentions. . . TAM posits that two particular beliefs, perceived usefulness and perceived ease of use, are of primary relevance for computer acceptance behaviors (p. 985).

The TAM model has drawn widespread validation from a number of studies (Mathieson, 1991; Adams, Nelson & Todd, 1992; Chau, 1996, Malhotra, 1997; Hendrickson & Collins, 1996). The Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) constructs have also shown robustness in multiple studies (Adams, Nelson & Todd, 1992; Keil, Beranek & Konsynski, 1995; Taylor & Todd, 1995; Hendrickson & Latta, 1996).

Taylor & Todd (1995) surveyed 430 experienced and 356 inexperienced potential users of an Information Technology (IT) system in an attempt to examine the role of prior experience in IT usage based in the theoretical framework of TAM. The researchers collected usage measures for these subjects over a 12-week period. They found that their model provided an adequate fit for their collected data, which specifically indicated that the perceived usefulness of the IT, the ease of use of the IT, and user attitudes, along with

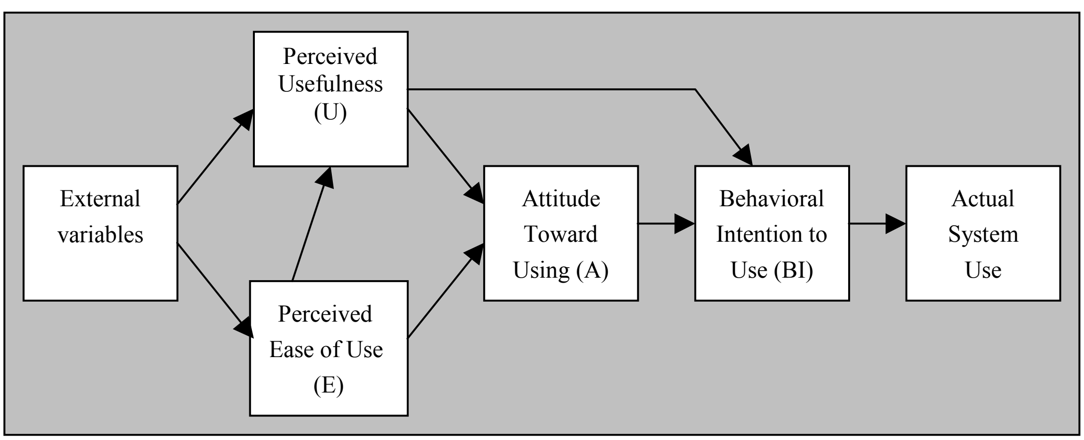


Figure 5: Davis' Technology Acceptance Model (TAM)

several other variables provided for a determination of IT usage. Predictive validity for the Perceived Usefulness and Perceived Ease of Use constructs within the TAM model has also been demonstrated (Szanja, 1994).

The roots of the perceived usefulness construct predate the TAM model. The theoretical grounds for the construct can be found in expectancy theory. This theory "asserts that the perceived relative attractiveness of various options is related to people's beliefs about the consequences to which each option will lead and their beliefs about the desirability of these consequences (Chau, 1996, p.189)." Larcker and Lessig (1981) examined constructs proposed in the literature related to the idea of perceived usefulness. They identified two primary dimensions of perceived usefulness which they termed "perceived useableness" and "perceived importance." Perceived useableness reflects whether the information format is "unambiguous, clear, or readable." The formal definition applied to this dimension would "refer to the information quality that allows a decision maker to utilize the set as an input for problem solution." Whether information is "relevant, informative, meaningful, important, helpful, or significant" reflects the perceived importance dimension. Formally stated, "perceived importance will refer to the quality that causes a particular item set to acquire relevance to the decision maker (p. 123)." Adams, Nelson and Todd (1992) later set these two dimensions within the larger context of the TAM.

Chin and Todd (1995) reviewed Adams, Nelson and Todd's (1992) analysis of the TAM and the question of bi-dimensional components of the perceived usefulness construct. Chin and Todd found no empirical support for the separation of usefulness into two dimensions, and criticized the analysis of Adams, et al. based on inappropriate cross validation, item and construct confounds, the likelihood of capitalization of chance (due to a small sample), and a lack of substantive theoretical rationale.

Recently another utilization model has been proposed in the literature. Goodhue and Thompson (1995) proposed a model called the Technology-to-Performance Chain (TPC) which asserts that "for an information technology to have a positive impact on individual performance, the technology must be utilized, and the technology must be a good fit with the tasks it supports (p. 213)." They developed their model by integrating the previously disparate streams of research focusing on technology utilization and task-technology fit (TTF). The utilization-focused research emphasizes "user attitudes and beliefs to predict the utilization of information systems (p.214)." The task-technology fit research has explored the performance impacts that result "when a technology provides features and support that 'fit' the requirements of a task (p.214)."

Central to Goodhue and Thompson's proposals are the limitations they attribute to pure utilization measures in isolation from other significant factors affecting performance of the system and the user. They noted that "to the extent that utilization is not voluntary, performance impacts will depend increasingly upon task-technology fit rather than utilization (p. 216)." In regard to performance impacts, Goodhue and Thompson also observed that

> . . .there is little explicit recognition that more utilization of a system will not necessarily lead to higher performance. Utilization of a poor system (i.e. one with low TTF) will not improve performance, and poor systems may be utilized extensively due to social factors, habit, ignorance, availability, etc., even when utilization is voluntary.

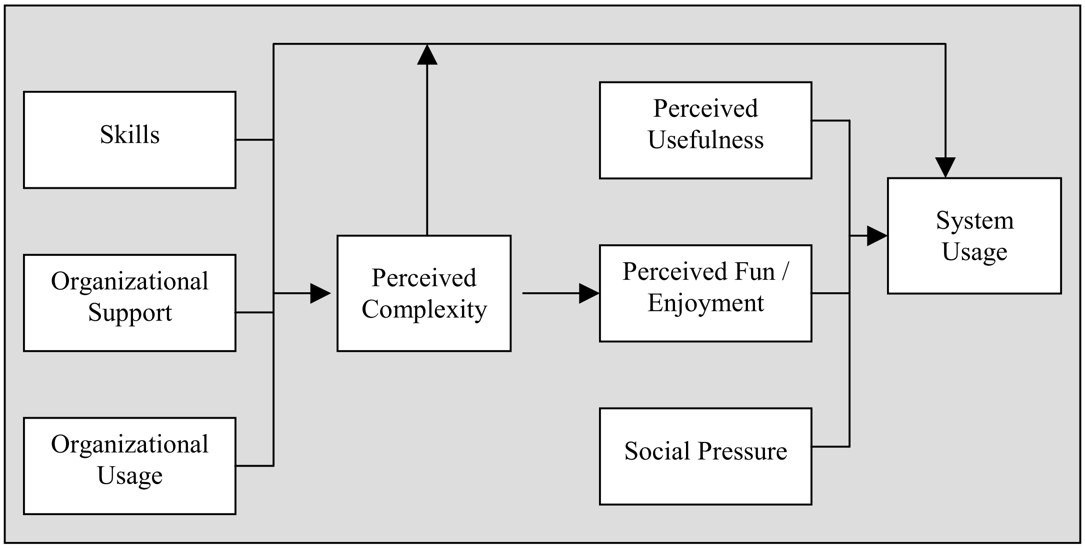
Baroudi, Olson and Ives (1986) actually incorporated the idea of TTF into their measures of system usage in the decade prior to Goodhue and Thompson's efforts. In their own words:

> A set of activities typically performed or supervised by production managers was identified from production management textbooks and handbooks. The list of activities was reviewed by two experts in production management who suggested minor modifications. A set of questions was then formulated regarding a manager's past use of information systems to support the identified activities (p.234-5)

An effort has been made to integrate the TAM and TTF models since the theories underlying both models have specific elements in common. These elements are derived from the proposition that a persons engages in a behavior "because he or she has evaluated the benefits of engaging in that behavior and expects a certain result (Dishaw & Strong, 1997)." With high TTF, expected benefits should be more likely. Dishaw and Strong (1997) demonstrated that while TAM and TTF both directly affect utilization, TTF also "indirectly determines Perceived Usefulness through the mediation of Perceived Ease of Use."

Igbaria, Parasuraman and Baroudi (1996) proposed a motivational model of microcomputer usage which consolidated theoretical frameworks from much of the previous utilization literature. Their model, presented in Figure 6, shows the effects of concepts drawn from the TRA and TAM models along with other social and antecedent variables. The model variables in this study accounted for 28 percent of the variance on usage. The researchers suggested other variables which might help account for more

Figure 6: Igbaria, Parasuraman and Baroudi's (1996) Motivational Model of Computer Usage



variance; however, the trend seen in this and other studies is that at the level of attribute measurement which has prevailed in the utilization research, the pool of predictive variables is so large that measurement of all potential predictors quickly becomes untenable.

Each of these theories focuses on utilization as the dependent variable and often equates utilization with system success. However, equating utilization with success has some potential difficulties. Szajna (1993) criticized the application of utilization measures as a single measure of system success. Her criticisms were based on the following observations:

- Many factors are related to usage that are not necessarily related to success; these factors include: accessibility of the IS, political and social pressure, users' prior computer experience, amount of training received, amount of computer anxiety, and other individual user characteristics.

- Levels of usage are difficult to measure in terms of ideal or sufficient use. Different systems or users may experience "successful" use with different levels of use.
- The level of "voluntariness" can affect use of a system: "if no alternative information source is available, or political/social influences exist, then the decision to utilize the system may not be truly at the user's command (p. 148)."
- The relevance of the information system and its output to the decision-making task can have a bearing upon the success of the system: "with some usage measures an increase in usage can increase the time spent in decision making and decrease the efficiency of the process (p. 149)."

Szajna's criticisms are repeated in other studies and provide a caution to all research which attempts to model utilization as a dependent variable without first recognizing the precursors which affect both utilization and success.

Research in Information Technology Satisfaction

Research focusing on information technology satisfaction addresses as a primary issue the definition of satisfaction itself. After a significant review of the pertinent literature, a much cited study by Bailey and Pearson (1983) defined satisfaction as: "in a given situation . . . the sum of one's feelings or attitudes toward a variety of factors affecting that situation (p. 531)." Bailey and Pearson also identified 36 distinct factors in 22 studies from the human-computer interaction literature which affect user satisfaction. From these factors, they developed a semantic differential instrument which included three additional factors for a total of 39 factors. This instrument represents an early attempt at formalization of a measure for user satisfaction. However, the more significant contribution of this study was the attempt to incorporate the concepts used in this instrument into a formal definition of satisfaction, namely " the weighted sum of a user's positive or negative reaction to a set of 39 factors (p. 538)" or

$$S_i = \sum_{j=1}^{n} R_{ij} W_{ij}$$

Where R_{ij} = The reaction to factor j by individual i and W_{ij} = The importance of factor j to individual i.

In a 1988 study, Doll and Torkzadeh piloted a 40-item questionnaire to assess end-user computing satisfaction (EUCS). After multiple administrations and analysis of the pilot form, a final instrument consisting of twelve items was derived. The components contributing to this final satisfaction measure were identified under five categories: content, accuracy, format, ease of use, and timeliness. Doll and Torkzadeh's EUCS instrument has demonstrated continued reliability and validity in subsequent studies (Torkzadeh & Doll, 1991; Hendrickson, Glorfeld & Cronan, 1994). In 1994, Torkzadeh and Dwyer expanded on this satisfaction research to provide a path analytic study of determinants of information system usage (see Figure 7). This usage study examined factors of user involvement, user training, user satisfaction, user confidence, and system use. Many of these factors, particularly the reciprocal relationship between user satisfaction and system usage, provided useful input to the utilization prediction model proposed in this study.

Other studies have proposed and tested satisfaction instruments. The most significant of these studies have based their instruments on theoretical models which

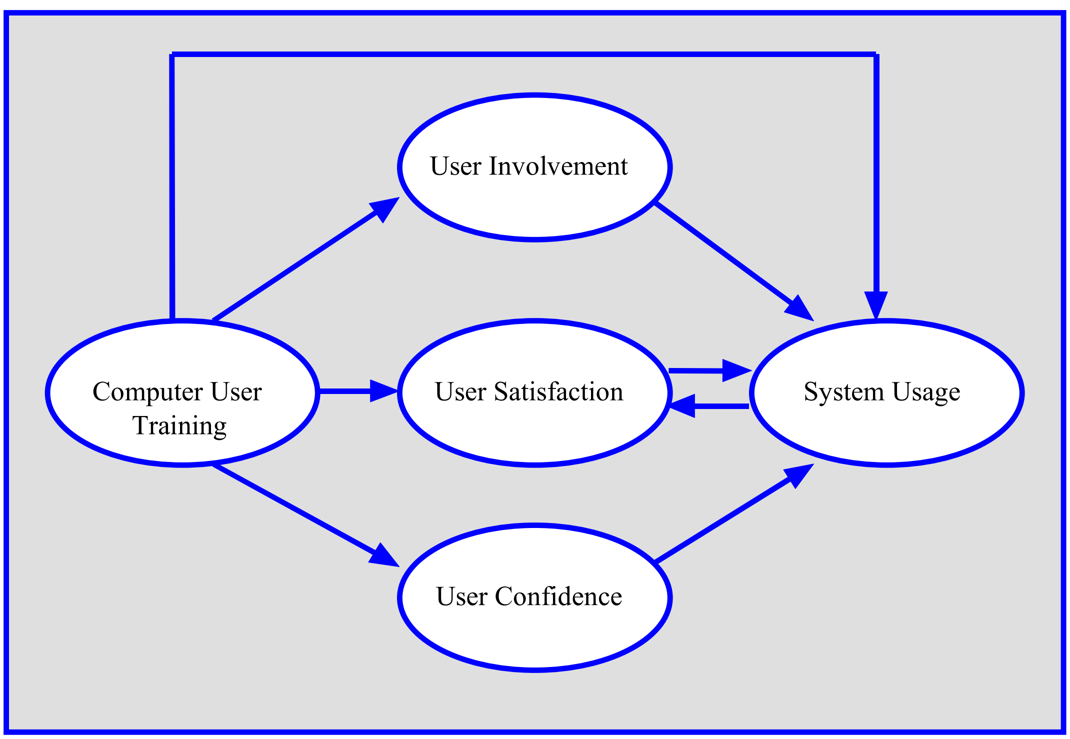


Figure 7: Torkzadeh and Dwyer's 1994 Utilization Relationship Model

incorporate specific antecedents of user satisfaction. Models from these studies contributed to the construction of the utilization prediction model proposed in this research. Generally, two types of satisfaction instruments have emerged. Ives, Olson and Baroudi (1983) noted that of these two types:

> The first focuses on the information systems product. With such diverse names as "system acceptance," "output quality," and "MIS appreciation," these scales focus on the content of the information system (e.g. accuracy, relevance) and the manner in which the information is presented (e.g. format, mode). The second type . . . includes the organizational support for developing and maintaining the system as well as the system product itself. This type of instrument contains items concerned with training, documentation, development procedures, systems maintenance, etc., as well as items related to system content. Thus it provides an indicator of the overall quality of information services provided by an information services function.

An example of the second type of instrument is provided by Baroudi and Orlikowski (1988) who examined user information satisfaction through the development and application of an instrument to measure "User Satisfaction with the Information Services Function" (USISF). According to the authors, "The measurement of how satisfied a user is with his or her information system (user information satisfaction or UIS) has become a pervasive measure of the success or effectiveness of an information system. This is true for both management information systems (MIS) practitioners and researchers (p. 44-45)."

Kettinger and Lee (1994) also provide examples of the second type of satisfaction instrument in their examination of the constructs of perceived service quality and user satisfaction with the IS function. They compared SERVQUAL (an instrument from the marketing literature measuring customer perceived service quality) and Baroudi and Orlikowski's 1988 USISF instrument. Their findings suggest that SERVQUAL may provide more comprehensive measures of IS service quality. Kettinger and Lee also discussed several important issues in regard to the measurement of service quality and related constructs. However, both conceptual and empirical issues have been raised with these service quality measures (Van Dyke, Kappelman, & Prybutok, 1999).

The expanding dependencies relating to user satisfaction were further explored in another study by Igbaria and Nachman (1990). They examined correlates of satisfaction and IT use in six different industries and found significant relationships between IT satisfaction and the leadership styles of users, the availability/accessibility of IT, and the computer anxiety of users. Lee, Kim, & Lee (1995) added to the pool of satisfaction related variables by proposing a model that described relationships between the acceptance, effectiveness and training components of information system implementation. This model identified strong relationships between IS acceptance, IS satisfaction, end-user ability and system utilization. The emphasis of the study was on the need for training of end-users; however, the information concerning system utilization provides insight into some potentially key causal factors.

In 1996 Kappelman expanded on earlier work focused on training as a determinant of satisfaction. Kappelman posited that the psychological dimension of "User System Involvement" is the actual precursor of satisfaction (and thus success) and that user training represented only one factor contributing to the involvement construct. The user involvement construct was also expanded and amended by McKeen, Guimareas and Wetherbe (1994) to include other types of involvement and to reflect the influence of mediating variables. Figure 8 shows the relationships found in McKeen et al.'s results. The influence of task and system characteristics has been added as mediating variables and organizational attributes are inherent in the user participation, communication and influence variables. Kim, Suh and Lee (1998) focused primarily upon the task uncertainty characteristic in the development of a model predicting both user satisfaction and utilization. In this, as in many recent studies, the relationships between task, user and system continue to come to the forefront of model development and research.

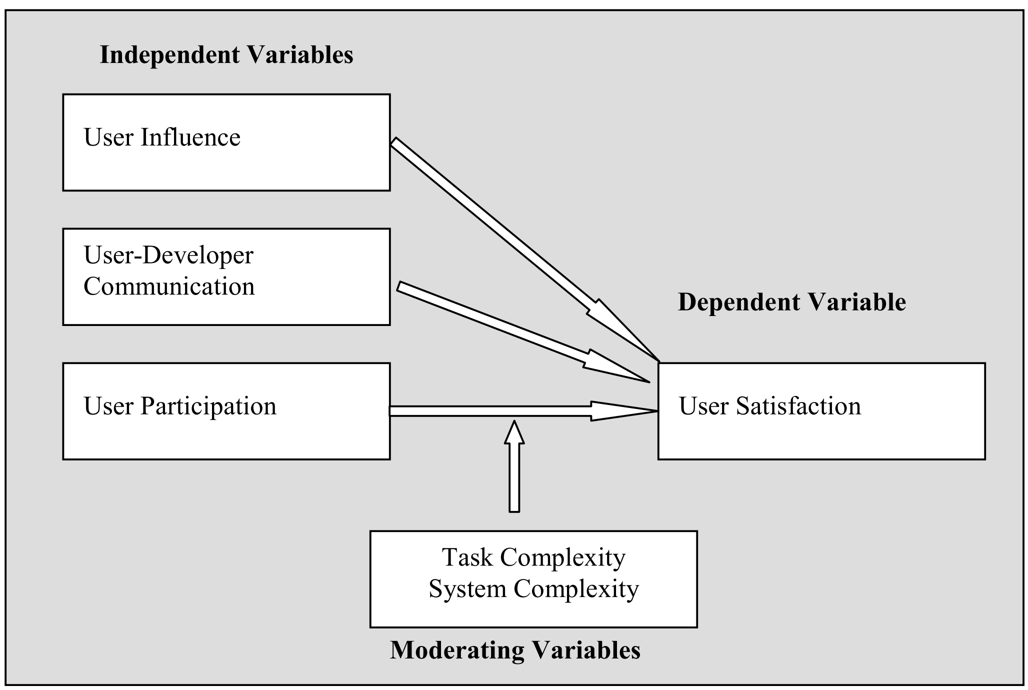


Figure 8: McKeen, Guimareas and Wetherbe's (1994) Relationships Found among Research Variables

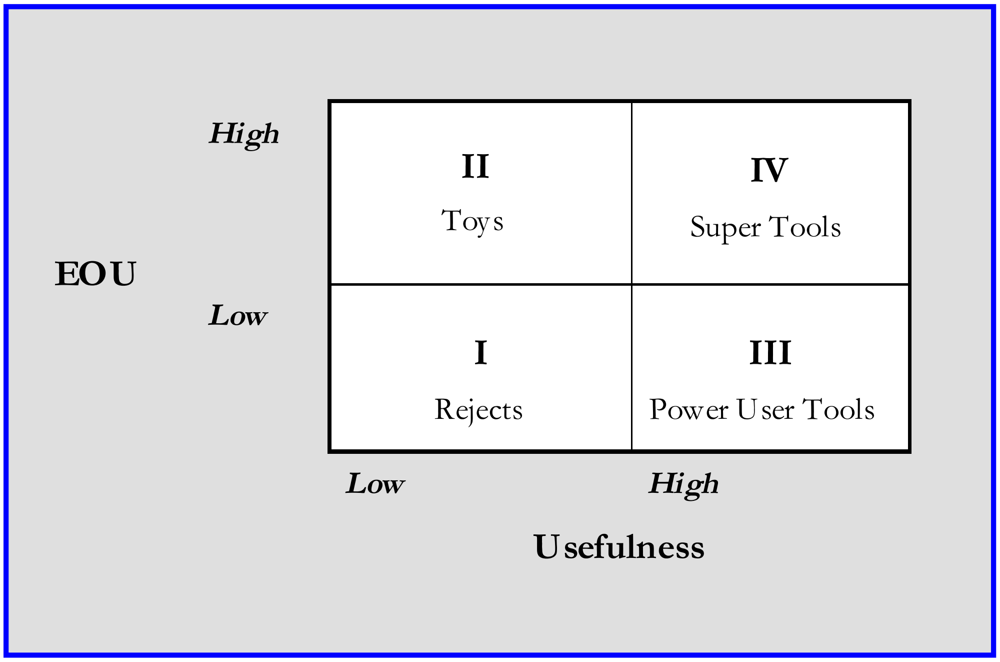
Research in Adoption & Diffusion of Innovation

Rogers' diffusion process models have provided a significant theoretical foundation for many studies since their proposal. Hightower and Brightman (1994) reviewed five innovation attributes identified by Rogers that help explain adoption decisions (p. 12):

1. *Relative advantage* is the degree to which an innovation is perceived as being better than the idea it supersedes.
2. *Compatibility* is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters.
3. *Complexity* is the degree to which an innovation is perceived as relatively difficult to understand and use.
4. *Trialability* is the degree to which an innovation may be experimented with on a limited basis.
5. *Observability* is the degree to which the results of an innovation are visible to others.

Keil, Beranek and Konsynski (1995) examined the usefulness and ease of use (EOU) constructs in relation to utilization through the diffusion of innovation literature. Specifically, they state that "in diffusion of innovation terms, usefulness can be mapped to the concept of 'relative advantage,' or the degree to which the innovation is perceived as better than existing practice (p. 77)." They also observe that EOU "can be viewed as inversely related to the concept of 'complexity' (p. 77)." Relating these constructs to utilization, they call upon Davis, Bagozzi and Warshaw (1989) who suggested that "the

Figure 9: Usefulness/EOU Grid



primary impact of EOU on use is expressed indirectly through its effect on usefulness (p. 79)." Chin and Gopal (1995) reinforced the salience of this construct in a study about adoption of group support systems (GSS) by finding that "relative advantage appears to be the most important criterion for an individual when determining which GSS among several is the best for that individual (p. 59)."

Keil et al. also present a framework for understanding the relationship of EOU and usefulness to adoption which they called the "Usefulness/EOU Grid" (see Figure 9). While crediting McLean for the basic framework, they describe "a 2x2 grid where each quadrant represents a different combination of the two attributes." They also point out that "in the context of software development and implementation, the usefulness/EOU grid provides a mechanism for discussing the current mix of usefulness and EOU and for plotting a future course if a different mix is desired (p. 78-79).” The quadrant that is characterized by the highest degree of utilization is quadrant IV. Systems in this quadrant possess both a high degree of EOU and usefulness. Thus, they are more likely to attract initial use, and because of their applicability and benefit, likely to result in continued use.

Other studies have focused more on organizational aspects of adoption than user characteristics. Iacovou, Benbasat, and Dexter (1995) examined three major factors that influence IT adoption practices among small organizations. These factors were organizational readiness, external pressures to adopt, and perceived benefits. The most salient reason for adoption among these organizations was external pressures, especially from trading partners. However, the benefits from adoption due to these external pressures were found to be limited without an accompanying willingness and ability to integrate the new technology into operational procedures.

Williams et al. (1997) introduced their research on organizational adoption of electronic commerce with a review of organizational and inter-organizational factors significant to adoption of technology in general. Factors mentioned include:

- Organizational structure: “a centralized decision-making structure may facilitate . . . adoption”
- The degree to which “an innovation is perceived as being better than the idea it supercedes”
- Consistency with current systems
- Support by top management and a management champion
- Adoption by similar firms or channel partners
- Endorsement of the technology by formal industry structures

- Dependence of trading partners
- The transaction climate

Premkumar and Ramamurthy (1995) mention other relative advantage concepts including "the ability of the innovation to cut costs in operations, provide clerical efficiency, provide timely and accurate decision making information, and aid in service differentiation."

Externalities can also play a significant role in the adoption of technologies. Besley and Case (1993) reviewed various empirical approaches to the analysis of technology adoption. In this review they also cited three sources of external influence on adoption choices (p. 399):

i. *Network Externalities*.—Adopters care about how many other individuals adopt because there is some public-good element to the technology.

ii. *Market Power Externalities*.—Adopters with market power will care about adoption by others if adopting early implies some advantage in market power.

iii. *Learning Externalities*.—[Adopters] may care about others' adoption decisions if early adopters teach late adopters something.

The technology adoption and diffusion of innovation literature is quite broad and meta-analysis of results from studies in this area can result in contradictory findings; however, by segmenting this literature into logical categories, meta-analytical studies become more consistent. Prescott and Conger (1995) illustrate this principle in their summary of the diffusion of innovation (DOI) literature published between 1984 and early 1995. They review 70 representative information technology-related DOI studies and propose that the seemingly contradictory results obtained from DOI research can be understood more clearly through the use of a classification scheme. In this scheme they "distinguish between innovations according to their locus of impact (information system [IS] unit, intra- or inter-organizational) and between studies according to their research approach (factor or stage) (p. 21)." Primary comparisons were drawn within locus of impact and research approach classifications; however, the authors also compared across classifications. According to Prescott and Conger, the "classification scheme reveals that the diffusion process for each type of innovation may be sensitive to different environmental, managerial, technological or functional contingencies (p. 33)." Again, the significance of these primary forces on IT outcomes is demonstrated and reinforces the user, organizational, system and task constructs from yet another theoretical perspective.

CHAPTER 3

METHODOLOGY

Research Design

An efficient examination of the utilization prediction model involves the following steps:

1. Use of the model to predict utilization for the impending technology change.
2. Post-implementation measures of utilization for the new information technology.
3. Comparison of predicted utilization with actual post-implementation measures.

Two methodological needs are evident in examining this model. First, a method of measuring technology use is required. Absolute utilization reflects actual time spent using a system as reflected by both frequency and duration patterns. This type of utilization can be determined by a combination of direct monitoring (through audit file analysis) and user self-report.

The second methodological need is for a method of measurement of the interactions enumerated in the utilization prediction model. The most practical approach to measurement is through surveys since the majority of the variables can only be elicited through direct user response. Each of the variables in the model has been previously measured as independent construct through various survey tools. A combination of these tools which have demonstrated sufficient reliability and validity will be applied in this study to describe the interactions in the proposed model.

The testing of this model can be best accomplished in an environment where the utilization index values are most likely to be extremely high or low. The health care field offers such an environment. Health care organizations tend to lag behind other business entities in their adoption of new organization-wide information technology; however, within each organization enclaves of early adopters will exist. This polarization along the lines of information technology adoption makes extremes of utilization behavior more likely. Also, health care organizations are eager to test new methodologies for predicting information technology viability due to extreme competition present in the current marketplace.

An attempt was made to first apply this methodology within a specialized tertiary care facility, a private, not-for-profit pediatric hospital. All information systems scheduled for implementation at the hospital which served as the study environment were examined to determine suitability for inclusion in this research according to the following criteria:

- The system should have a sufficiently large user population from which to draw significant statistics.
- The system should provide for logging of user activities through generation of automated audit files.
- The system should be scheduled for implementation within six calendar months.

Only two systems met the specified criteria. The first of these systems is an enterprise-wide system which serves as both an employee scheduling system and an employee information system. No system previously provided this type of functionality access across the hospital. The second information system selected for inclusion provides access to education materials designed to be distributed to patients and their families by care providers. It was implemented within the context of the hospital's newly created Intranet. Previously this information was accessed through an internally designed system that provided for limited printing of information. A comparison for both systems is included in Table 2. This table summarizes the previous method of performing tasks, user population, time-frame for the study, training on each system, system accessibility and use requirements.

Table 2: A Comparison of Implementation Characteristics of the Staff Scheduling System and the Patient Information System

	Staff Scheduling System	Patient Information System
Previous Method of Performing Task	Variety of methods: 1. DOS-based system used primarily by patient care areas. 2. Windows based spreadsheet solutions. 3. Paper and pencil solutions.	Two methods used: 1. On-line Windows word-processor based solution. 2. Paper file based solutions.
	Staff Scheduling System	**Patient Information System**
User Population	250-300 users including managers, clerical, and professional staff	Primarily 500-700 patient care staff and their clerical support staff
Time-frame	First-Second quarter, 1998	Second quarter, 1999 (originally scheduled for First-Second quarter, 1998)
Training	1. Two required overview classes for managers for a total of four classroom hours of system training with optional attendance at other training classes. 2. Four different four hour training classes for users focusing on the core functions of the system. Users are required to attend classes specific to their work area. 3. Distribution to all users of both quick reference and exhaustive reference materials.	1. Minimal on the job training available for staff. 2. Distribution of “quick-reference” guides describing system use.
Accessibility	Accessible only through individual request and limited to those who have successfully completed structured training programs.	Accessible through all hospital computers and available with unlimited access.
Use Requirements	Hospital policy details specific use which must be made by every department. Some functions and reports are optional use only.	Hospital policy specifies that patients and their families should receive educational support, but does not dictate use of this system.

Model Specifications

The proposed model in this study (Figure 10) overviews the interactions that determine specific levels of information system utilization. As illustrated in this diagram, the direct antecedents of utilization are system satisfaction and system support. Also, a feedback mechanism exists in this model wherein the degree of system utilization directly affects system satisfaction. Specifically, this feedback mechanism acts to intensify the degree of system satisfaction resulting in a cascade effect. For example, in the presence of negative system satisfaction (dissatisfaction), utilization of the system tends to increase the degree of dissatisfaction. In the presence of positive satisfaction, utilization will tend

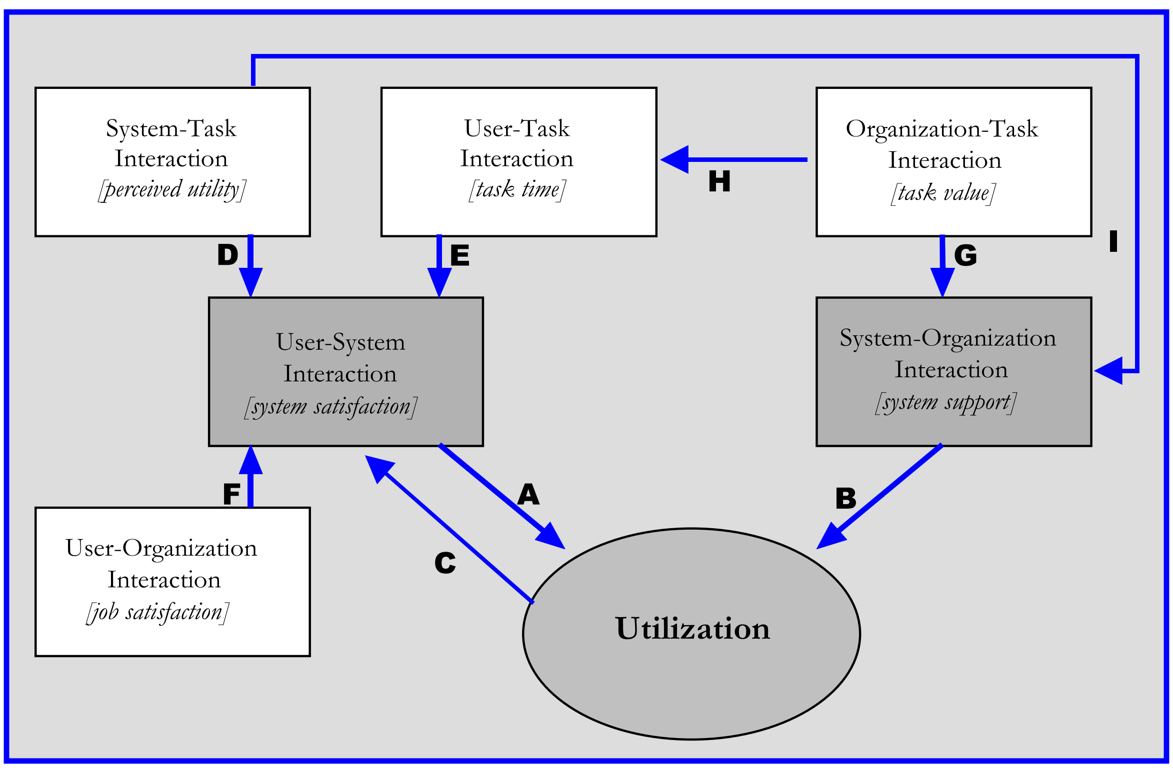


Figure 10: Utilization Prediction Model

to increase satisfaction even more. However, these tendencies present in the feedback mechanism can be overwhelmed by extreme values of other factors in the model.

The inclusion of satisfaction in this type of feedback chain has been observed in previous research. William Doll (1991) observed that “end-user computing satisfaction is potentially both a dependent variable (when the domain of one’s research interest is upstream activities or factors that cause end-user satisfaction) or an independent variable (when the domain of one’s research interest is downstream behaviors affected by end-user satisfaction) (p. 6).” Doll’s “System to Value Chain” is shown in Figure 11. In explaining the formulation of his instrument for measuring end-user satisfaction, Doll points out that his orientation was toward the upstream domain of research; although he admits that the instrument may also be useful in predicting behavior as well. He adds that efforts to link satisfaction to behavior are unlikely without “correspondence in target, action, and behavioral entities. (p. 6).” The model described in the current research meets this challenge by recognition and integration of the primary forces driving utilization behavior and their interactions.

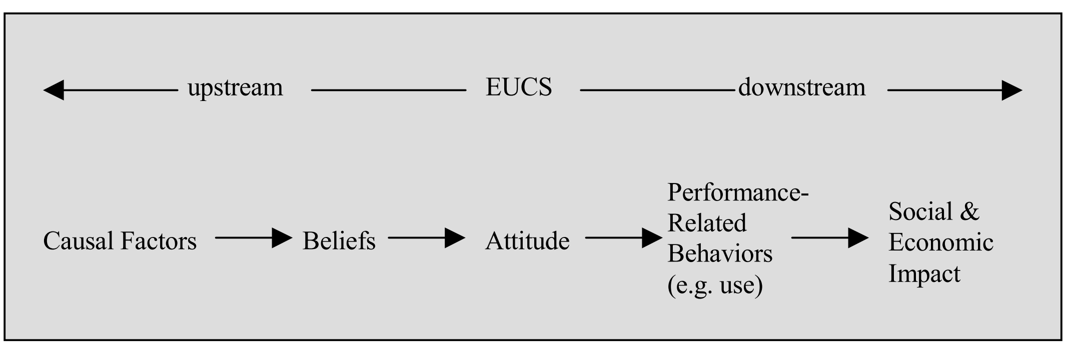


Figure 11: Doll’s (1991) System to Value Chain

Hypotheses

Several hypotheses were used to address the research questions in this study. The following hypotheses have been listed under the research question that they are designed to address.

Question 1: *Does the magnitude of utilization of an information system change predictably according to changes in primary force interactions*?

Hypothesis 1: Regarding the antecedents of utilization.

1.1 As user satisfaction [User-System interaction] and organizational support [Organization-System interaction] increase, utilization will increase. Stated as a hypothesis, this effect would be:

$H1.1_0$: $\rho \bullet 0$; $H1.1_a$: $\rho > 0$

1.2 As user satisfaction [User-System interaction] increases, utilization will increase. Stated as a hypothesis, this effect would be:

$H1.2_0$: $\rho \bullet 0$; $H1.2_a$: $\rho > 0$

1.3 As organizational support [Organization-System interaction] increases, utilization will increase. Stated as a hypothesis, this effect would be:

$H1.3_0$: $\rho \bullet 0$; $H1.3_a$: $\rho > 0$

1.4 In the presence of negative user satisfaction [User-System interaction], utilization will decrease.

$H1.4_0$: $\rho \bullet 0 \mid \text{user satisfaction} < 0$

$H1.4_a$: $\rho > 0 \mid \text{user satisfaction} < 0$

1.5 In the presence of negative organizational support [Organization-System interaction], utilization will decrease.

$H1.5_0$: $\rho \bullet 0$ | organizational support < 0

$H1.5_a$: $\rho > 0$ | organizational support < 0

<u>Hypothesis 2: Regarding the antecedents of user satisfaction.</u>

2.1 As task time [User-Task interaction] and perceived utility [System-Task interaction] increase, user satisfaction [User-System interaction] will increase.

$H2.1_0$: $\rho \bullet 0$; $H2.1_a$: $\rho > 0$

2.2 As task time [User-Task interaction] increases, user satisfaction [User-System interaction] will increase.

$H2.2_0$: $\rho \bullet 0$; $H2.2_a$: $\rho > 0$

2.3 As perceived utility [System-Task interaction] increases, user satisfaction [User-System interaction] will increase.

$H2.3_0$: $\rho \bullet 0$; $H2.3_a$: $\rho > 0$

2.4 In the presence of negative task time [User-Task interaction], user satisfaction [User-System interaction] will decrease.

$H2.4_0$: $\rho \bullet 0$ | task time < 0

$H2.4_a$: $\rho > 0$ | task time < 0

2.5 In the presence of negative perceived utility [System-Task interaction], user satisfaction [User-System interaction] will decrease.

$H2.5_0$: $\rho \bullet 0$ | perceived utility< 0

$H2.5_a$: $\rho > 0$ | perceived utility< 0

2.6 Negative job satisfaction will reduce user satisfaction [User-System interaction].

$H2.6_0$: $\rho \bullet 0$ | Job-Satisfaction < 0

$H2.6_a$: $\rho > 0$ | Job-Satisfaction < 0

Hypothesis 3: Regarding the antecedents of organizational support.

3.1 As organizational value [Task-Organization interaction] and perceived utility [System-Task interaction] increase, organizational support [Organization-System interaction] will increase.

$H3.1_0$: $\rho \bullet 0$; $H3.1_a$: $\rho > 0$

3.2 As organizational value [Task-Organization] interaction increases, organizational support [Organization-System interaction] will increase.

$H3.2_0$: $\rho \bullet 0$; $H3.2_a$: $\rho > 0$

3.3 As perceived utility [System-Task interaction] increases, organizational support [Organization-System interaction] will increase.

$H3.3_0$: $\rho \bullet 0$; $H3.3_a$: $\rho > 0$

3.4 In the presence of negative organizational value [Task-Organization interaction], organizational support [Organization-System interaction] will decrease.

$H3.4_0$: $\rho \bullet 0$ | organizational value < 0

$H3.4_a$: $\rho > 0$ | organizational value < 0

3.5 In the presence of negative perceived utility [System-Task interaction], organizational support [Organization-System interaction] will decrease.

$H3.5_0$: $\rho \bullet 0$ | perceived utility< 0

$H3.5_a$: $\rho > 0$ | perceived utility< 0

Hypothesis 4: Regarding the antecedents of task time.

4 As organizational value [Task-Organization interaction] increases, task time [User-Task interaction] will increase.

$H4_0$: $\rho \bullet 0$; $H4_a$: $\rho > 0$

Question 2: *Can self-reported utilization measures act as a proxy for actual utilization monitoring?*

Hypothesis 5: Regarding self report of utilization versus actual use.

5 Self-report is correlated with actual use of a system.

$H6_0$: $\rho = 0$; $H6_a$: $\rho \neq 0$

Hypothesis 6: Regarding comparison of self report across systems.

6 Correlations between self-reported utilization and actual utilization will be higher for non–required use systems than for required use systems.

$H7_0$: $\rho 1 \bullet \rho 2$; $H7_a$: $\rho 1 > \rho 2$

Discussion of Hypotheses

Each of the hypotheses in this research reflects interactions within the causal model described in Figure 10 (p. 40). The model itself was tested to determine its viability; however, the research hypotheses themselves provide additional non-causal insights into the nature of the constructs involved within the model. To assist in understanding the relationship of each hypothesis to the proposed causal model, the following discussion will include the capitalized letters from Figure 10 (labeled A through I, see p. 40) which directly concern each hypothesis.

Hypothesis 1.1 concerns the two primary force interactions which have the most direct influence on utilization: user satisfaction (effect A) and organizational support (effect B). This hypothesis states that positive values of these elements result in increased utilization. Hypotheses 1.2-1.3 address the individual effects A and B, while hypothesis 1.4-1.5 state that negative effects from either A or B result in decreased utilization.

Hypothesis 2.1 predicts that user satisfaction increases as task time (effect E) and perceived utility (effect D) increase. The individual effects (E and D) are described in hypotheses 2.2-2.3. These effects are reversed in hypotheses 2.4-5 with the presence of either negative task time (effect E) or negative perceived utility (effect D). Negative job satisfaction (effect F) also can influence user satisfaction as described in hypothesis 2.6.

In this model, organizational support increases as Organizational Task Value (effect G) and perceived utility (effect I) increase. This relationship is stated in hypothesis 3.1-3.3 and expanded in hypotheses 3.4-3.5 which predict that negative Organizational Task Value (effect G) or negative perceived utility (effect I) cause organizational support to decrease.

Additional effects in this model include Organizational Task Value (effect H) which can act to increase task time as seen in Hypothesis 4.

The measures in this study include both self-report and audit log measures. The final two hypotheses concern the relationship between these two types of measures. Hypothesis 5 posits that a significant relation exists between the self-report measures and the audit log data. Hypothesis 6 further explores this relationship by asserting that higher correlations exist between the self-report measures and the audit log data for non-required systems that for required systems. In this study, the staff scheduling system is a required-use system and the patient education system is a non-required-use system.

Subject Selection

All users of the two systems included in this study were involved as subjects. Access to the scheduling system is only granted to employees who have been through specific training for the system and who have a need to access the system. All managerial staff in the hospital were trained to use the system. Also, each department within the hospital is required to have support staff trained to maintain the system.

The second system included in this study, the patient education system, did not have an initially well-defined user population. Access to this system was provided through the hospital's Intranet to all employees in the hospital who use computers. No special training or "need to access" is required for patient education system users.

Due to the level of organizational support within the hospital for both of these systems, all employees who access these systems were targeted for inclusion in this study. There was minimal overlap between user populations due to the intended use of each system.

Data Gathering

Three approaches to data gathering were pursued. Automated system audit files were analyzed to determine utilization information for the systems in this study. These files contain the following information:

1. User
2. Date and time of use
3. Activity performed

The second approach to data gathering was through user surveys. These surveys were applied to corroborate audit file statistics, measure antecedent variables and test the viability of this study's predictive utilization model. The third approach to data gathering involved mining data from current information systems to retrieve demographic data for each of the subjects in this study. This indirect approach to demographic data collection facilitated shorter survey administration in other phases of this study.

A total of three different surveys were used. Each of these surveys had overlapping items as well as unique items due to the timing of survey administration. Surveys were administered to gather the information specified in Table 3. Scales used in the final phase of data analysis are in boldface type.

Users of the staffing system attended formal training where they completed a pre-training survey at the beginning of class and a post-training survey at the end of class. Patient education system users did not attend formal training and therefore completed only the "Pre-Training" survey upon their initial use of the patient education system. Users of

Table 3: Survey Administration Information

Variable	Pre-Training/ Pre-system use: *for both target systems*	Post-training: *for staffing system only*	Post-system use: *for both target systems*
User-System	Computer Anxiety (General)	**System Satisfaction (New)** Perceived Ease of Use (New)	Computer Anxiety (General) System Satisfaction (New) Perceived Ease of Use (New)
User-Task:	**Task-Time Measures (Current)**		Task-Time Measures (New)
User-Organization	**Job Satisfaction**		Job Satisfaction
System-Task	Success Measures (Current)	Success Measures (New) **Perceived Utility (New)** Task Technology Fit: Selected Scales (New)	Success Measures (New) Perceived Utility (New) Task Technology Fit: Selected Scales (New)
System-Organization	Organizational Support for Computers (General) **Organizational Support for System (New)**	Organizational Support for Computers (New)	Organizational Support for Computers (General) Organizational Support for System (New)
Task-Organization:	**Task Value Measures**		Task Value Measures
Utilization	Use of Computers (General)		Use of Computers (General) **Use of System (New)**

both systems were sent a post-system use survey six weeks after their respective system was “live.”

Surveys were initially designed to be administered electronically since all members of the targeted user populations had demonstrated proficiency in the use of computer applications including Microsoft Windows™, electronic mail and Netscape Navigator™. For users of the scheduling system, the survey was delivered in class through a custom designed Microsoft Access™ program which presented one question at a time while preventing subjects from skipping questions or returning to previously answered questions. For surveys administered outside of the classroom, the initial survey for the patient education system and the follow-up survey for the scheduling system, this same mechanism was used with one change. To deliver the survey tool to the users, a compressed Microsoft Access™ database was delivered to the users via email. This compressed database actually stored user responses in a linked master survey database on the hospital’s computer network.

The follow-up survey for the patient education system users presented some difficulties. The hospital was in the process of upgrading all Microsoft software when the survey administration dates arrived. In order to reach all users with the follow-up survey, the survey had to be distributed by interdepartmental mail. This unfortunately resulted in a significantly smaller response set for the patient education system follow-up survey. Items from each of the surveys are included in the Appendix along with relevant response scales. Survey questions were derived from already existent instruments. Validity and reliability of the included measurement scales were assumed based upon previous development and testing of each instrument in the literature. Where feasible, responses were gathered based on a 7-point Likert scale. For items whose original design required an alternate response scale, original instrument response scale construction was used.

Each survey item was tested in a pilot administration using two groups of ten reviewers. The first pilot group reviewed item phrasing, construction, and face validity of the staffing system user surveys. The second pilot group provided the same type of analysis for the patient education system surveys. There was no membership overlap between pilot groups. Also, pilot group members were not included in the primary study. Results from the pilot study were collected and analyzed for feedback. Based upon the pilot, one question from the "Success" scale was omitted due to lack of clarity and item relevance. This scale was also omitted from the analysis phase of this research. Also, some clarifications were added where such changes would not substantially change the content of a question.

Utilization measures were taken from instruments designed by Igbaria and Iivari (1995) and Torkzadeh and Dwyer (1994). These instruments were selected due to their repeated use in the literature and their scope in measurement of the utilization construct. They focus on two types of utilization: general use of computers and use of a specific application. In the initial survey, only general use of computers was measured. In the four-week follow-up survey, both general use of computers and use of the specific application involved in this study were examined.

The user-system interaction was addressed through the use of three different scales. Kernan and Howard's Computer Anxiety scale (Montazemi, Cameron & Gupta, 1996) was used to determine the user's attitude toward computers in general both before and after use of the application of concern. The remaining two scales were used to measure user attitudes and perceptions specific to the systems included in this study. System satisfaction was measured through the use of Doll and Torkzadeh's (1988) 12-item scale which has been examined repeatedly for both reliability and validity. Finally, Davis' Perceived Ease of Use measure as formulated by Montazemi, Cameron and Gupta (1996) and Keil, Beranek and Konsynski (1995) was included.

The user-task interaction represented by information requirement was addressed through task time measures adapted from Igbaria & Iivari (1995). These measures are task specific and require the subject to estimate the frequency and duration of tasks. Time estimates concerning tasks were made before and after introduction of new technology. These estimates reflect time to accomplish a task using methods current at the time of evaluation.

Job satisfaction, the user-organization interaction proxy, was measured using Hackman and Oldham's 1975 five-item Job Diagnostic Survey, General Job Satisfaction scale. This scale was selected due to its recognized reliability and validity in the literature. Also, normative data for this scale is available for health care workers.

The system-task interaction was described using scales which measure task technology fit, general system success and perceived utility. Selected scales from Goodhue and Thompson's (1995) Task-Technology Fit measure were included as well as Conrath and Sharma's (1993) success measures. The success measures are oriented around users' perceptions of effectiveness, value and the overall satisfaction in relation to specific tasks accomplished by the system. Davis' perceived utility measure as formulated by Montazemi, Cameron and Gupta (1996); Keil, Beranek and Konsynski

(1995); and Igbaria and Iivari (1995) provided the final scale included to measure the system-task interaction.

Management support of the system, the measure of system-organization interaction, was elicited through a 4-item scale developed by Igbaria and Iivari (1995) and a 4-item scale developed by Thompson, Higgins and Howell (1994). These scales were adopted to measure perceived organizational support of computers in general and of the specific systems included in this study.

Finally, the value of a task or information was measured using adaptations of Conrath and Sharma's (1993) success measures. The expectations and value items from these measures were adapted by omitting references to specific systems, thereby retaining a focus on the value of specific tasks.

Data Analysis

Several different analysis methods were used to examine the data gathered in this study. The majority of the analysis was performed in SAS for Windows™, version 8.0. Data coding, scatterplots, and other graphical analysis were performed in Microsoft Excel™, version 97. Initially, descriptive statistics were compiled to facilitate a general description of both the subjects and the data. Following this initial analysis, a correlational matrix of all independent variables was constructed to assist in further interpretation of the data. Subsequent to these initial data descriptive attempts, n size for both system subject groups was finalized. To be included in succeeding analysis, subjects were required to meet the following criteria:

1. Demonstrate at least one access of specified system during the 100 day data gathering period. This criteria insured that subjects who completed surveys, but never had opportunity to access the system were not included in the analysis.
2. Complete all survey questions comprising scales used in final analysis. The statistical methods used in this research require no missing variables among subjects.

After identification of final subject groups, consideration was given as to the feasibility of combination versus comparison of subject groups. N size of approximately 100 subjects is recommend as a minimum for path analysis. If each group of users included sufficient subjects to provide for a comparative analysis wherein model testing between these groups could occur, a more robust analysis would be possible. However, patient education subject group size was of concern, therefore the following steps were performed to determine the possibility of pooling subjects for a path analytic approach:

1. Demographic comparisons across subject groups,
2. Exploratory factor analysis to determine if subject groups' variables loaded on the same factors.

Exploratory Factor Analysis

Exploratory factor analysis served two purposes. The first purpose, as mentioned previously, allowed testing for similarity across subject groups. A second purpose was to provide insight into the congruence of meaningful dimensions of the observed data and theorized constructs. The primary forces should be evident in loadings across dimensions where the combinations of forces represent meaningful demonstrations of the prediction model's elements. Extraction of factors was performed using the principal axis method. Factors were rotated first to an orthogonal then to an oblique solution to assist in factor interpretation. Each observed variable in this analysis was expected to have a factorial complexity of one, indicating that each variable would have a significant loading on only one factor.

Structured Equation Modeling

The use of structural equation modeling (SEM) to test causal relationships in research models has increased during the last decade. While this technique can provide powerful insights into specific models, it also requires careful use and justification. Chin and Todd (1995) caution that these techniques "may lead to inappropriate conclusions if statistical criteria are permitted to drive analysis and override substantive understanding of a problem (p. 237)."

Since the model discussed in this proposal is causal in nature and has sound theoretical grounds, SEM is an appropriate form of analysis. To facilitate testing of the structural equation model, the software program SAS/CALIS was used to first assess and "fix" the measurement model. Following Segars and Grover's (1993) recommendations in order to avoid "possible interaction between measurement and structural models (p. 519),"

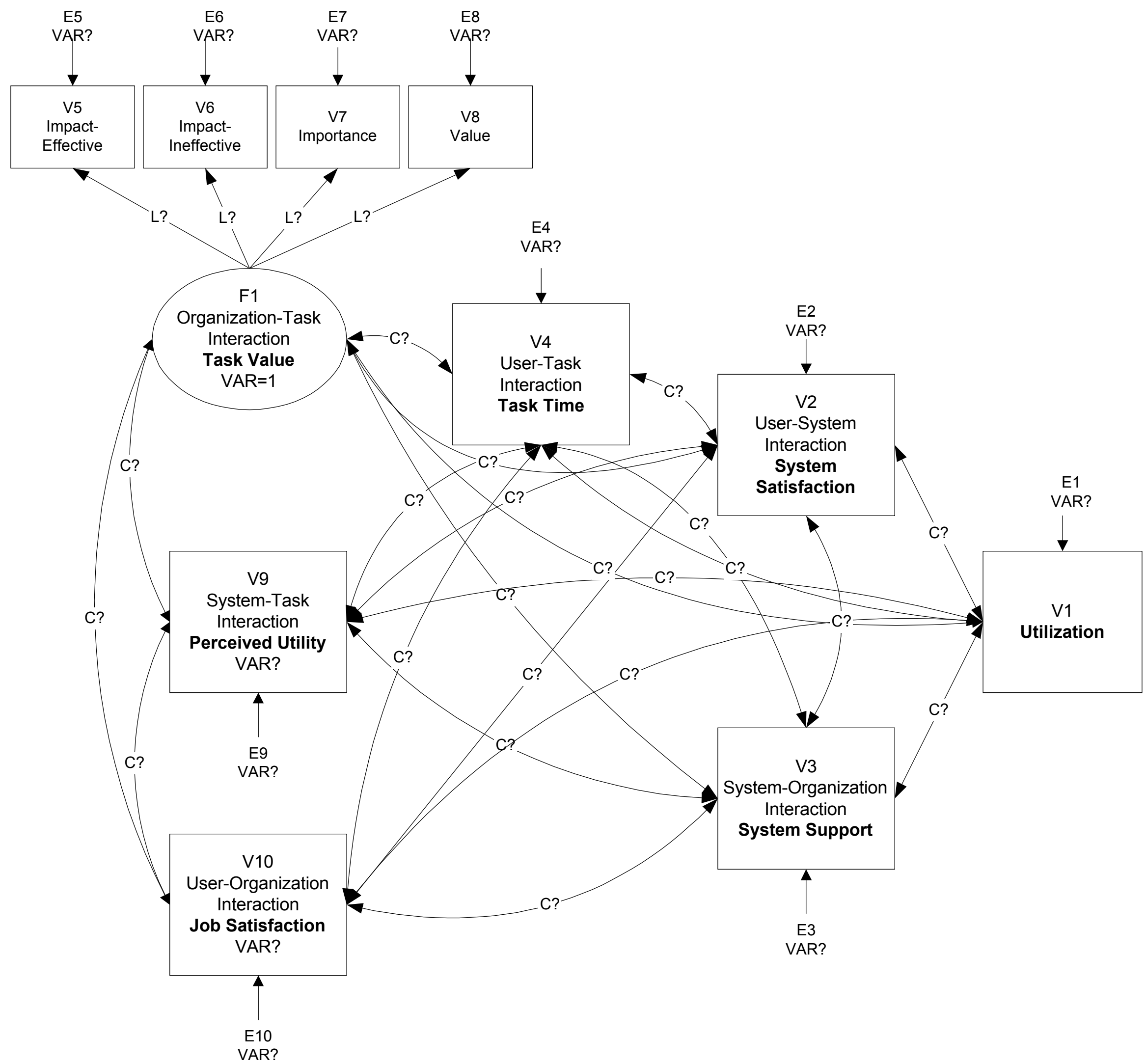


Figure 12: The Initial Measurement Model, after Identifying all Parameters to be Estimated (Completed Program for Confirmatory Factor Analysis)

the assessment sequence consisted of fitting the utilization prediction model to sample data and an iterative evaluation of the solution in terms of parameter estimates and goodness of fit followed by modification of the model to improve its fit to the data. The initial measurement model shown in Figure 12 actually comprises a confirmatory factor analysis as all variable are allowed to freely covary. Bentler's (1989) nomenclature conventions were followed in identification of model variables and graphical construction. The letter "F" (for Factor) is used to label the latent variable in the model, while the letter "V" (for Variable) is used to identify the manifest variables in the model.

According to Hatcher (1994, p. 345), "a measurement model is a factor-analytic model in which you will identify the latent constructs of interest and indicate which observed variables will be used to measure each latent construct." In Figure 12, one latent variable is identified (F1: Task Value), while all other variables are included as manifest. Manifest variables are directly measured while latent variables are inferred from their influence on manifest variables. Each of the manifest variables in this model are actually constructs represented by single multi-item scales. The Task Value latent variable is estimated as the result of a combination of single item predictors. Although multi-item scales are preferred to single-item predictors of latent variables, practical considerations about survey length precluded this approach. Each latent variable should minimally have three predictors and the obvious implications for survey size are evident.

In Figure 12, covariances between variables are indicated with curved, double-headed arrows. Residual or error terms are indicated for all endogenous variables (those causally affected by other variables). The variance of the latent variable has been fixed at one to address the scale indeterminancy problem, while manifest variable variances are allowed to be estimated as free parameters. The model itself is non-standard (including both latent and manifest variables) and is recursive (no feedback loops specified). After this measurement model was fully assessed, the structural model was tested and compared with the theoretical model shown in Figure 13.

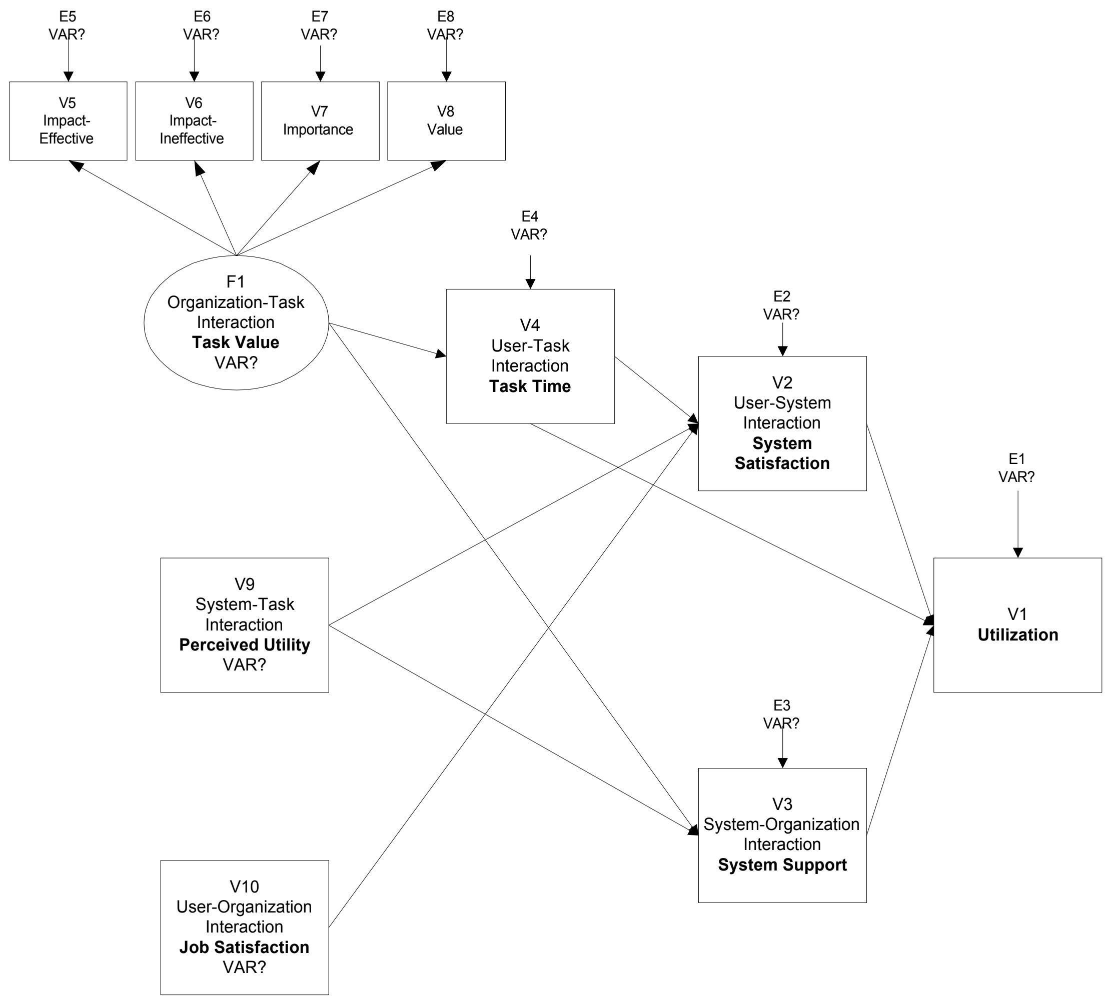


Figure 13: Initial Theoretical Model

Necessary Conditions for Path Analysis

The use of path analysis requires that certain perquisites are met regarding both the data used and the model being tested. The following assumptions are required (Hatcher, 1994, p. 148-9):

- Interval- or ratio-level measurement
- Minimal number of values (able to assume a minimum of four values)
- Normally distributed data (removal of outliers should be considered if data are markedly non-normal)
- Linear and additive relationships (not curvilinear or interactive relationships between independent and dependent variables)
- Absence of multicollinearity (where strong intercorrelations exist between variables)
- Absence of measurement error (antecedent variables as perfectly reliable indicators of underlying concepts)
- Inclusion of all nontrivial cases (if met, this indicates self-containment and non-correlated residuals)
- Overidentified model (model includes more equations than unknowns, simple recursive models are always overidentified)
- Minimal number of observations (large sample procedures with approximately 100 subjects or 5 subjects for each parameter to be estimated)
- At least three indicator variables per latent factor (four were initially identified for F1: Task Value)

- A maximum of 20-30 indicator variables.

Characteristics of an Ideal Fit

Hatcher (1994, p. 393) also identifies some widely accepted characteristics of an ideal fit for a structural equation model. The following characteristics from Hatcher were used in the present study to test fit of the developed models:

- The p value for the model chi-square test should be nonsignificant (should be greater than .05); the closer to 1.00, the better.
- The chi-square/df ratio should be less than 2.
- The CFI and the NNFI should both exceed .9; the closer to 1.00, the better.
- The absolute value of the t statistics for each factor loading and path coefficient should exceed 1.96, and the standardized factor loading should be nontrivial in size (i.e. absolute values should exceed .05).
- The R2 values for the latent endogenous variables should be symmetrical and centered on zero, and relatively few (or no) normalized residuals should exceed 2.0 in absolute value.
- The combined model should demonstrate relatively high levels of parsimony and fit, as evidenced by the PR and PNFI.
- The structural portions of the model should demonstrate relatively high levels of parsimony and fit as evidenced by the RNFI, the RPR and the RPFI.
- A chi-square difference test should reveal no significant difference between the theoretical model and the measurement model.

CHAPTER 4

FINDINGS

System Subject Comparisons

Sample Demographics

Demographic data availability for each system's subject groups is included in Table 4. Demographic data in this table is segmented not only by system, but also according to users who were in included or omitted from the final analysis. Users not included in the analysis included those who never utilized the systems and those who did not complete required surveys The nature of the statistical methods employed in this

Table 4: Demographic Data Availability for Subjects by System

	Demographic Data:	*Users in analysis*	*Users not in analysis*	*Total Users*
System 1: Staffing System	Demographics Available	83 (38.4%) (92.2%)	133 (61.6%) (91.7%)	216 (91.9%)
	Demographics Not available	7 (36.8%) (7.8%)	12 (63.2%) (8.3%)	19 (8.1%)
	Total Users	90 (38.3%)	145 (61.7%)	235
System 2: Patient Education System	Demographics Available	18 (11.3%) (85.6%)	141 (88.7%) (65.3%)	159 (67.1%)
	Demographics Not available	3 (3.8%) (14.3%)	75 (96.2%) (34.7%)	78 (32.9%)
	Total Users	21 (8.5%)	216 (91.5%)	237

**Percentages in parentheses to the right of statistic is percent of row total; percentages in parentheses below statistic is percent of column total.*

research does not allow for missing variables, therefore only complete survey data was able to be included. Demographic data was not available for all system users; however, as the demographic analysis included in Table 4 and Table 5 shows, users included in the analysis for the staffing system were very similar to users not included in the analysis.

Table 5: Demographic Information for Users by System

		System 1: Staffing System			**System 2: Patient Education System**		
		Users in analysis	Users not in analysis	Total Users	Users in analysis	Users not in analysis	Total Users
Gender	Female	71	92	163	17	123	140
	Male	8	35	43	0	10	10
	Unknown	11	18	29	4	83	87
	Total Users	90	145	235	21	216	237
Marital Status	Married	47	70	117	9	65	74
	Divorced	5	4	9	0	8	8
	Single	26	51	77	8	55	63
	Unknown	12	20	32	4	88	92
	Total Users	90	145	235	21	216	237
Age Distribution (*data not available for all subjects*)	20-29	7	20	27	3	35	38
	30-39	24	48	72	8	65	73
	40-49	31	44	75	3	26	29
	50-59	14	14	28	3	7	10
	60-69	3	1	4	0	0	0
	Total Users	79	127	206	17	133	150
Avg. Wage Rate ***(standard dev.)***		\$19.88 *(\$7.82)*	\$20.82 *(\$8.95)*		\$19.85 *(\$4.30)*	\$18.30 *(\$6.20)*	

As shown in Table 5, the distribution of gender, marital status, age and wage rates in the subject sample were comparable to the general population of system users. However, the population generalizability of patient education system subjects included in the analysis was questionable. For this reason and because of the small n size for this group of subject, it was determined that patient education system subjects could not be independently included in the path analysis.

Audit File Statistics

Audit files were examined for both of the systems in this study to determine utilization statistics for each subject as well as for high level analysis for pattern detection purposes. The utilization statistic chosen for this study was number of days in which the system was accessed (out of the 100 day audit period). Descriptive statistics for this variable are listed in Table 6.

Table 6: Descriptive Statistics for System Utilization

Statistic: Days of Use (out of 100)	***System 1: Scheduling System***	***System 2: Patient Education System***
Mean	14.2	2.9
Standard Error	1.6	0.5
Median	9.0	2.0
Mode	4.0	1.0
Standard Deviation	14.9	2.4
Sample Variance	220.8	5.7
Kurtosis	1.7	2.8
Skewness	1.6	1.6
Range	63.0	9.0
Minimum	1.0	1.0
Maximum	64.0	10.0

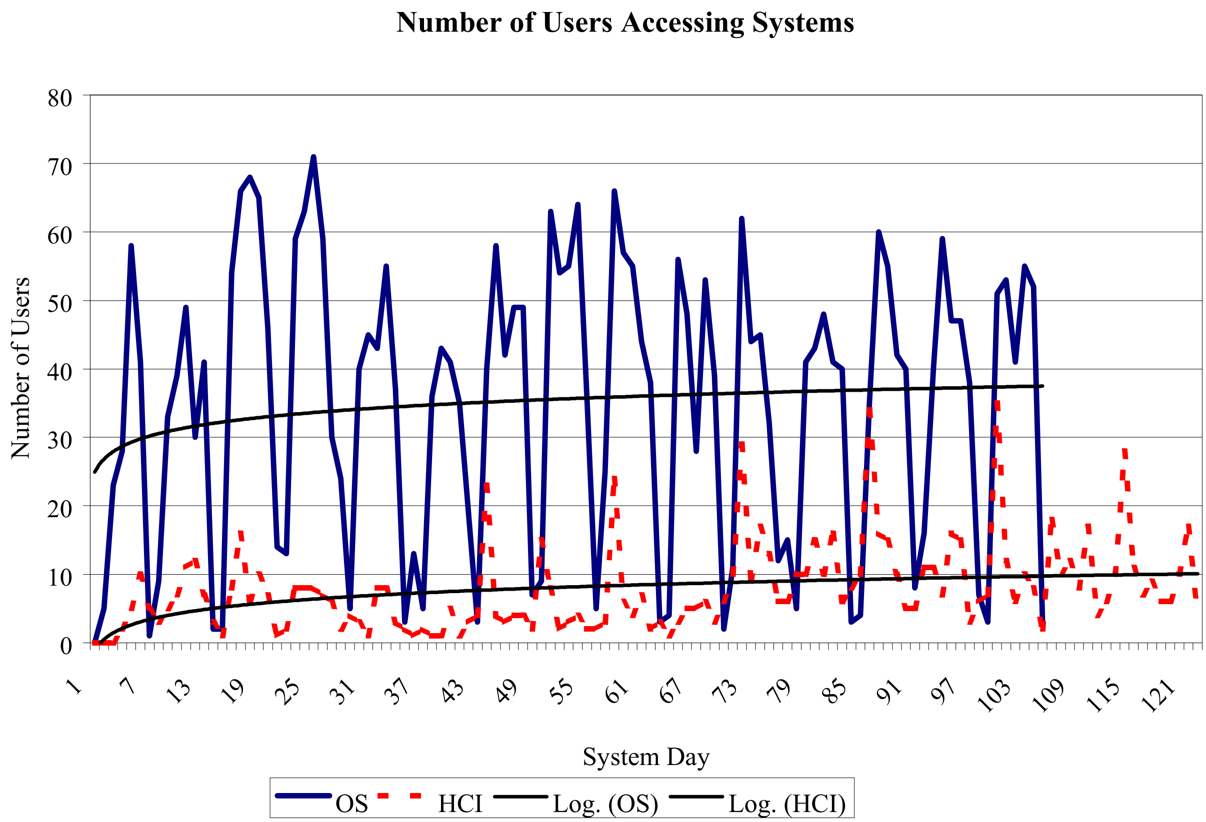
Two other utilization statistics were derived for comparison purposes from the audit files: "system hits" and "utilization hours." The system hits variable incremented each time a user accessed a different part of the system. In the case of the scheduling system, this would include each report or information screen access. For the patient education system, it would reflect each document accessed for printing or viewing. The utilization hours simply reflected the sum of the range of access times across each day. For example, if a user accessed the system first at 10:00 am and for a final time at 4:00 pm, the user would be credited with six hours. This measure simply reflects a range of access times, not total utilization times. All of these various measures were highly correlated as seen in Table 7. In the case of the scheduling system utilization measures, the lowest correlation was 0.8823.

As seen in Figure 14, a trend toward increased utilization occurred across time for both systems. Also, use of both systems was heavily loaded toward Monday through Fridays. The spikes in the patient education system use was correlated with training dates for new employees (while no formal training was offered during implementation of this system, a training module was included in the new employee clinical systems course).

Table 7: Correlations between Utilization Measures

	System 1: Scheduling System		***System 2: Patient Education System***	
	Days	**Hits**	**Days**	**Hits**
Hits	0.8823		0.9386	
Hours	0.9066	0.8945	0.6761	0.8303

Figure 14: Graphical Representation of System Use as Indicated by Audit File Analysis (trendlines are included for each system; OS=scheduling system; HCI=education system)



Exploratory Factor Analysis

Similarity across subject groups was addressed through exploratory factor analysis. The results of this analysis are detailed in Table 8. The top three loading variables for Factor 1 matched between systems; however, two additional dissimilar variables significantly loaded on this factor for each system as well. In interpreting the patterns, an item loading was considered significant when its value was .40 or greater. For Factor 2, the top two loading variables were the same on both systems; however, an

Table 8: Results of Exploratory Factor Analysis; Comparison of Factor Loadings for Relevant System

Factor 1									
System 1: Scheduling System					**System 2: Patient Education System**				
Variable		Initial Principal Factors Extraction	Varimax: Orthogonal Extraction	Promax: Oblique Extraction	Variable		Initial Principal Factors Extraction	Varimax: Orthogonal Extraction	Promax: Oblique Extraction
V5	IMPEFF	0.862	0.895	0.866	V5	IMPEFF	0.836	0.856	0.870
V7	IMPORT	0.843	0.897	0.922	V7	IMPORT	0.834	0.900	0.883
V6	IMPINEFF	0.827	0.877	0.921	V6	IMPINEFF	0.773	0.731	0.671
V8	VALUE	0.693	0.655	0.628					
V9	PCVUTL	0.459	0.158	0.044					
					V4	TSKTIME	0.562	0.450	0.230
					V2	SATISF	0.466	0.126	-0.036
Factor 2									
Variable		Initial Principal Factors Extraction	Varimax: Orthogonal Extraction	Promax: Oblique Extraction	Variable		Initial Principal Factors Extraction	Varimax: Orthogonal Extraction	Promax: Oblique Extraction
V9	PCVUTL	0.593	0.731	0.735	V9	PCVUTL	0.827	0.854	0.783
V2	SATISF	0.592	0.694	0.705	V2	SATISF	0.724	0.901	0.968
V3	ORGSPT	0.571	0.636	0.641					
					V10	JOBSAT	0.588	0.493	0.464

IMPEFF: Impact of Effective *task name*
IMPORT: Importance of *task name*
IMPINEFF: Impact of Ineffective *task name*
VALUE: Value of *task name*
PCVUTIL: Perceived Utility
TSKTIME: Task Time
SATISF: System Satisfaction
ORGSPT: Organizational Support for System
JOBSAT: Job Satisfaction

additional dissimilar variable significantly loaded for each system as well. The total number of factors extracted for each system also differed. Based on the results of this factor analysis, it was clear that while definite similarities existed between the two systems, enough significant differences were also present so that pooling data from the two groups might prove a somewhat haphazard endeavor.

The magnitude of factor loadings was extremely consistent for the antecedents of the latent variable in the path model, Task Value. Variables 5-8 clearly provided insight into the same contract when examined through this exploratory analysis. Factor loadings were of much lower magnitude for other antecedent variables indicating a lower level of similarity across primary forces. This result is consistent with the proposition that each primary force is unique in its contribution to the predictive model. As expected, each observed variable had a factorial complexity of one in the rotated factor pattern (promax/oblique).

Model Analysis

Confirmatory Factor Analysis

Due to the small n size of the patient education system subject group and the inability to pool subjects as noted by the exploratory factor analysis, only the scheduling system subjects were included in subsequent model development and analysis in the structural equation modeling portions of this research.

The fit of the initial measurement model was first tested with confirmatory factor analysis in order to "fix" the theoretical model. The test for significance of covariance values in this model is the *t* test. The tested confirmatory model with *t* values entered is displayed in Figure 15. Significant covariations are indicated with dark double-headed arrows. Maximum-likelihood parameter estimation was applied once multivariate normality and observation independence were established since this method is scale invariant and recognized as most appropriate for small sample sizes (Saris & Stronkhorst, 1984, p.173).

In the initial analysis, four subjects demonstrated significant kurtosis due to their characteristics as multivariate outliers. No significant commonalities were found between these subjects, either in utilization statistics, survey responses or demographics. They were identified initially as extreme contributors to kurtosis, driving the overall kurtosis index to over 30, through the PROC CALIS module in SAS. A procedure to identify potential weighting of the outliers calculated all weights as one except for the four outliers who would require significantly diminished weightings. A decision was made to omit the subjects based on the extreme nature of the multivariate outlier problem and a lack of subject commonality. As a result, Mardia's Multivariate Kurtosis index was reduced to 2.4254 (Normalized Multivariate Kurtosis was 0.7259).

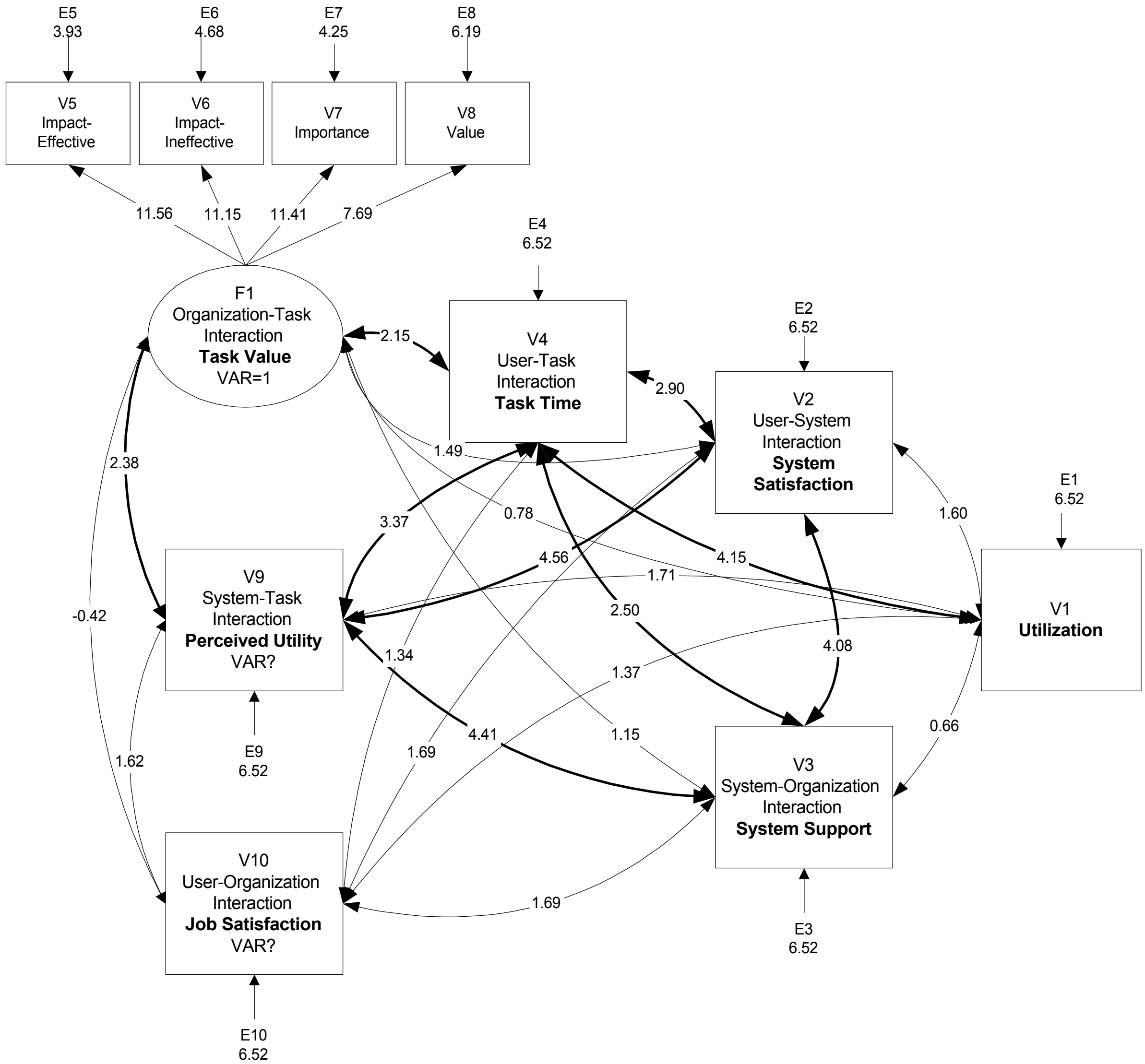


Figure 15: The Initial Measurement Model (Completed Program for Confirmatory Factor Analysis with significance of covariance values indicated by *t* test values)

The overall fit for the initial model was acceptable; however, unacceptable residuals along with a number of nonsignificant covariances indicated the need for a more refined measurement model. Actual fit statistics are included in Table 9. Of this initial measurement model the relationships which demonstrated significance included:

- Utilization:Task-Time (V1:V4)
- System-Satisfaction:System-Support (V2:V3)
- System-Satisfaction:Task-Time (V2:V4)
- System-Satisfaction:Perceived-Utility (V2:V9)
- System-Support:Task-Time (V3:V4)

Table 9: Confirmatory Factor Analysis Model Fit for Initial Measurement Model

Fit Statistic	**Value**
Fit Function	0.4586
Goodness of Fit Index (GFI)	0.9273
GFI Adjusted for Degrees of Freedom (AGFI)	0.8001
Parsimonious GFI (Mulaik, 1989)	0.4121
Chi-Square	38.9841
Pr > Chi-Square, *df* = 20	0.0067
Independence Model Chi-Square	491.34
Independence Model Chi-Square DF	45
Bentler's Comparative Fit Index	0.9575
Bentler & Bonett's (1980) Non-normed Index	0.9043
Bentler & Bonett's (1980) NFI	0.9207
James, Mulaik, & Brett (1982) Parsimonious NFI	0.4092
Bollen (1986) Normed Index Rho1	0.8215
Bollen (1988) Non-normed Index Delta2	0.9597

- System-Support:Perceived-Utility (V3:V9)
- Task-Time:Perceived-Utility (V4:V9)
- Task-Time:Task-Value (V4:F1)

The first significant modification to the initial model was the removal of one antecedent of the latent variable Task-Value (F1). This variable is labeled "V8: Value" in the

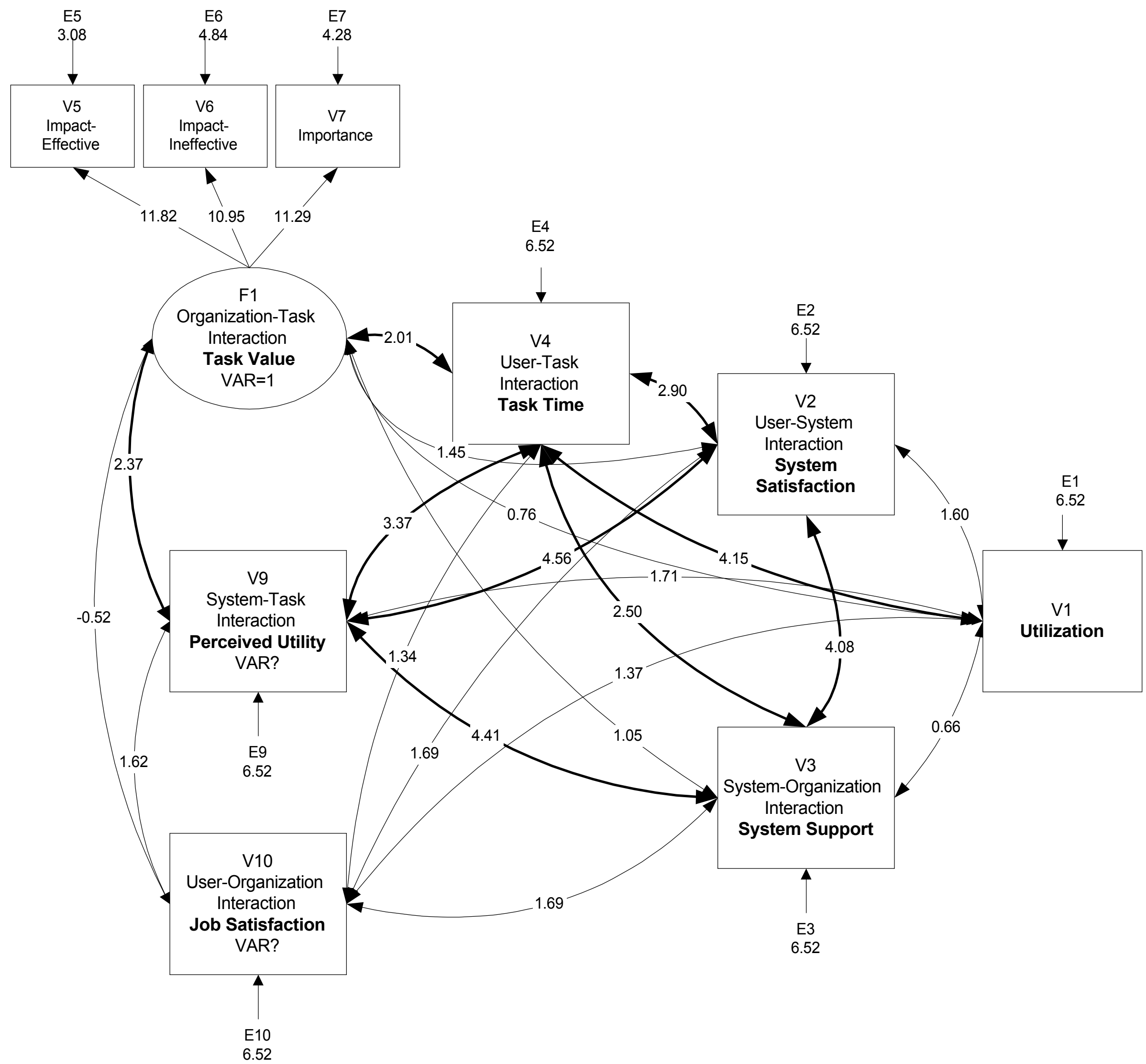


Figure 16: The Final Measurement Model (with significance of covariance values indicated by *t* test values)

preceding path diagrams. This variable held the lowest correlation with other antecedents of task value and was the variable contributing the most to unacceptable residual values. Dropping this variable is consistent with accepted treatment of latent variable antecedents and validates the recommendation for starting out with more than three predictors variables for each latent variable. The removal of V8 resulted in the final measurement model displayed in Figure 16.

Table 10: Confirmatory Factor Analysis Model Fit for Final Measurement Model

Fit Statistic	**Value**
Fit Function	0.2474
Goodness of Fit Index (GFI)	0.9512
GFI Adjusted for Degrees of Freedom (AGFI)	0.8172
Parsimonious GFI (Mulaik, 1989)	0.3171
Chi-Square	21.0308
Pr > Chi-Square, df=12	0.0499
Independence Model Chi-Square	414.53
Independence Model Chi-Square DF	36
Bentler's Comparative Fit Index	0.9761
Bentler & Bonett's (1980) Non-normed Index	0.9284
Bentler & Bonett's (1980) NFI	0.9493
James, Mulaik, & Brett (1982) Parsimonious NFI	0.3164
Bollen (1986) Normed Index Rho1	0.8478
Bollen (1988) Non-normed Index Delta2	0.9776

The final measurement model includes a number of covariances whose values do not rise to the level of significance. These covariance were addressed through further model modification with the goal of improving fit and approaching theoretical model specifications. Fit statistics resulting from the production of the final measurement model through confirmatory factor analysis are included in Table 10.

Model Modification

The tested theoretical model is included in Figure 17. Initial revisions to this model were pursued based upon the results of the confirmatory factor analysis. Iterative improvements were then identified using fit statistics in combination with normalized residuals as indicators of improvement. In altering the revised path models, actual and predicted covariance matrices were examined along with the results of both the Wald Test (to determine potential paths to eliminate) and the Lagrange Multiplier Test (to determine potential paths to add). Improvement of model fit was advanced by fixing parameters at zero for nonsignificant covariances in the model. Only one parameter was fixed at a time based upon the amount of predicted reduction in chi-square according to the stepwise multivariate Wald test. Those covariances whose elimination would cause the least chi-square change were eliminated first. After each change, the model was recalculated to determine the impact of the change upon model fit and covariance magnitudes. Summaries for four revised models which demonstrate this iterative improvement process are included in Table 11 along with significance values for each causal path.

Some paths were retained which did not demonstrate significant covariances but which were theoretically significant to the structural integrity of the model. While structural equation modeling can certainly identify relationship which might deserve consideration for removal, the fact that these statistically nonsignificant covariances were theoretically significant demanded powerful evidence to justify removal. Also, problems can be associated with model modifications when sample size is small (around 100 subjects), when many modifications are made, and when modifications are not justified

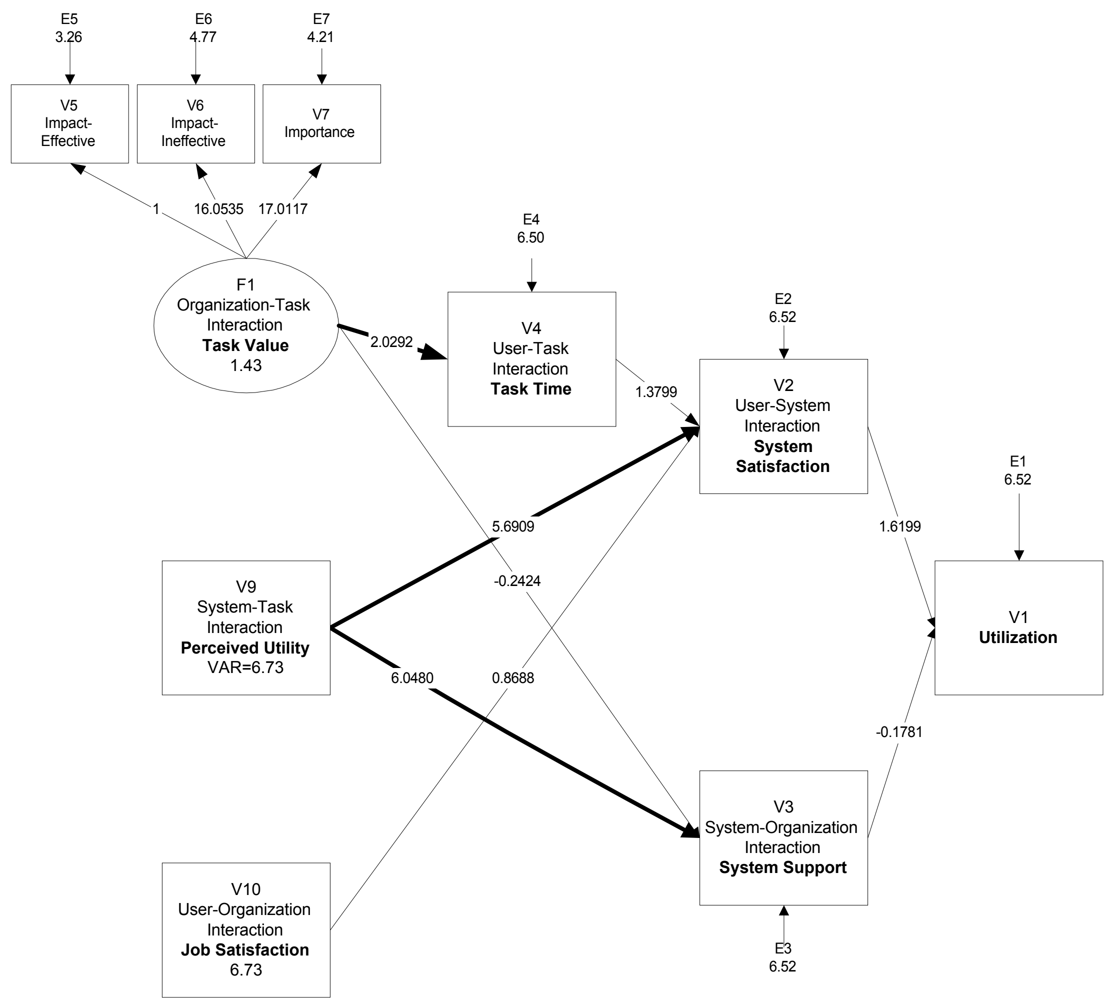


Figure 17: Initial Theoretical Model (with significance of covariance values indicated by *t* test values)

according to theory or prior research (Hatcher, 1994, p. 199). Therefore, modifications were kept to a minimum and only modifications that reflected "good" theory were made.

The revised models developed in this analysis met each of the prerequisite conditions for path analysis. Interval level of measurement was present with most variables able to assume up to seven values. Outliers were identified and removed in a few justified instances to maintain a relatively normal distribution of data.
Further analysis demonstrated linear additive relationships between independent and dependent variables. Strong intercorrelations only existed between antecedents of the single latent variable, which is actually a desirable characteristic for demonstration of scale reliability. The single latent variable had sufficient number of indicators and the model had an appropriate number of indicators overall as well. The model is desirably overidentified since it is a simple recursive model. All nontrivial cases were included due to the design of the study; elimination of subjects was only due to incomplete survey data and trivial outliers. Finally the theoretical foundations of the scales used in the developed models contributes to the minimization of measurement error.

Figure 18 illustrates the significance of the causal relationships in the fourth revised model. The largest asymptotically standardized residual for this model retained a value of 1.85267, below the maximum recommended of 2.0. R-square values for each endogenous manifest variable in the model are listed in Table 11. Of particular note are the R-square values for utilization (V1), system satisfaction (V2) and organizational support (V3). A comparison between the relationships in the fourth revised model and the relationships in the initial theoretical model shows that the following combinations

Table 11: Significance Test Summaries for Revised Models 1-4

Variables in Causal Relationships		**Significance of covariance *t* test values**			
Predicted Variable	**Antecedent**	**Revised Model 1**	**Revised Model 2**	**Revised Model 3**	**Revised Model 4**
V1	V2	0.4948	0.4927	0.5025	0.5025
	V3	-0.9254	-0.9347	-0.9263	-0.9263
	V4	5.1668	5.2334	5.3500	5.3488
	R^2	**0.2625**	**0.2671**	**0.2633**	**0.2632**
V2	V3	2.4002	2.4698	2.5525	2.5525
	V4	1.1149	1.1663		
	V9	3.5947	3.6216	4.1174	4.1776
	R^2	**0.3848**	**0.3811**	**0.3735**	**0.3736**
V3	V4	0.8597			
	V9	5.1813	6.0012	6.0012	6.0016
	F1	-0.3682			
	R^2	**0.3041**	**0.2976**	**0.2976**	**0.2976**
V4	V9	3.5055	3.5057	3.5057	3.9430
	F1	1.2052	1.2063	1.2063	
	R^2	**0.1703**	**0.1703**	**0.1703**	**0.1546**
V9	V10	1.8756	1.8743	1.8743	1.8780
	F1	2.5485	2.5457	2.5457	2.5524
	R^2	**0.1088**	**0.1086**	**0.1086**	**0.1091**
Bentler's Comparative Fit Index		0.9871	0.9918	0.9909	0.9897
Bentler & Bonett's (1980) Non-normed Index		0.9755	0.9866	0.9857	0.9846
James, Mulaik, & Brett (1982) Parsimonious NFI		0.4974	0.5741	0.5981	0.6218
Pr > Chi-Square		0.2003	0.2919	0.2802	0.2645

were retained due their statistical significance:

- System-Satisfaction:Perceived-Utility (V2:V9)
- System-Support:Perceived-Utility (V3:V9)

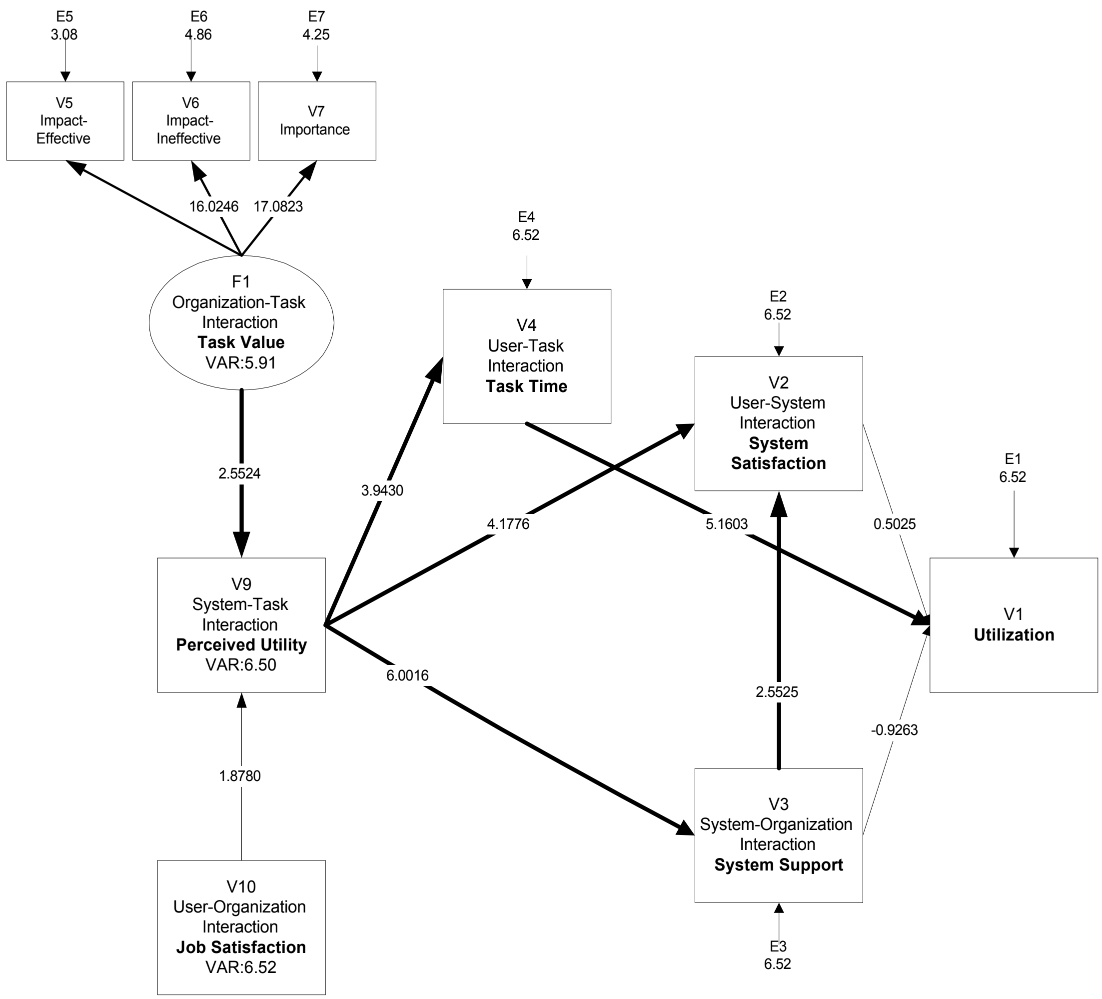


Figure 18: Fourth Revised Model (significant causal paths are bolded)

Paths that fell out from the initial theoretical model were:

- System-Satisfaction:Task-Time (V2:V4)
- System-Satisfaction:Job-Satisfaction (V2:V10)
- Task-Value:System-Support (F1:V3)
- Task-Value:Task-Time (F1:V4)

Paths that were retained due to their theoretical significance, but which did not demonstrate significance in this analyses were:

- Utilization:System-Satisfaction (V1:V2)
- Utilization:System-Support (V1:V3)

Paths that were added in model modification which were not in the original theoretical model were:

- Utilization:Task-Time (V1:V4)
- System-Satisfaction:System-Support (V2:V3)
- Task-Time:Perceived-Utility (V4:V9)
- Task-Value:Perceived-Utility (F1:V9)
- Job-Satisfaction: Perceived-Utility (V10:V9)

In total four paths were dropped from the original theoretical model and five paths were added. The overall fit for the initial model was excellent.

The characteristics of an ideal fit as listed by Hatcher (1994, p. 393) were matched quite well by the revised model. The p value for the model chi-square test ranged from 0.2003 for revised model 1 to 0.2919 for revised model 2. All models met the characteristic of Chi-square nonsignificance and all chi-square/df ratio were less than

2 (highest was 1.257). The CFI and the NNFI both exceeded .9 for all revised models, the lowest CFI was 0.9871 and NNFI was 0.9755.

The absolute value of the *t* statistics for most factor loadings and path coefficients exceeded 1.96. The exceptions were those causal relationships which were deemed to be theoretically significant but not statistically significant as noted earlier in these results. All relationships with nontrivial standardized factor loadings were removed subsequent to revised model 1 (absolute values exceeded .05). No latent endogenous variables were included in these models; therefore the symmetry characteristics of such variables were not relevant for this study. No normalized residuals exceeded 2.0 in absolute value (highest was 1.85267).

Controlling for the complexity of models through parsimony indices is routinely recommended by most researchers (Marsh, Balla & Hau, 1996, p.324). The fourth revised combined model demonstrated the highest levels of parsimony and fit compared to other models as demonstrated by the parsimony ratio (PR) and the parsimonious normed-fit index (PNFI) with PR=0.6667 and PNFI=0.6218. The structural portions of all revised models demonstrated high levels of parsimony and fit as well, evidenced by the relative normed-fit index (RNFI) with all values exceeding 1.0000. Relative parsimony ratios (RPR) and relative parsimonious fit indexes (RPFI) could not be calculated because of the nonstandard nature of the model. Table 12 contains summaries of these statistics for all models.

Chi-square difference tests were performed for each model with results for each test included in Table 13. The chi-square difference tests were performed by comparing each model of interest to the final measurement model. As expected, significant differences exist with the null model and the uncorrelated model. The initial theoretical model also demonstrated significant differences from the measurement model ($p<0.001$). This difference indicates weakness in the original specification of the theoretical model; however, the revised models derived from the combination of the confirmatory factor analysis and the theoretical model showed no significant difference from the measurement model.

Table 12: Parsimony and Fit Characteristics of Combined and Structural Models

	Combined Model							Structural Model
Model	χ^2	**df**	**NFI**	**NNFI**	**CFI**	**PR**	**PNFI**	**RNFI**
$\mathbf{M_0}$ Null model	414.53	36	0.000	----	----	----	----	----
$\mathbf{M_u}$ Uncorrelated factors	146.437	18	0.6467	0.3214	0.6607	0.5000	0.3234	0.0000
$\mathbf{M_t}$ Initial Theoretical model	71.185	24	0.8283	0.8130	0.8753	0.6667	0.5522	0.6636
$\mathbf{M_{r1}}$ Revised model 1	23.892	19	0.9424	0.9755	0.9871	0.5278	0.4974	1.0350
$\mathbf{M_{r2}}$ Revised model 2	25.109	22	0.9394	0.9866	0.9918	0.6111	0.5741	1.0513
$\mathbf{M_{r3}}$ Revised model 3	26.449	23	0.9362	0.9857	0.9909	0.6389	0.5981	1.0488
$\mathbf{M_{r4}}$ Revised model 4	27.895	24	0.9327	0.9846	0.9897	0.6667	0.6218	1.0453
$\mathbf{M_{mI}}$ Initial Measurement model	38.984	20	0.9207	0.9043	0.9575	0.5556	0.4092	0.9152
$\mathbf{M_{mF}}$ Final Measurement model	21.031	12	0.9493	0.9284	0.9761	0.3333	0.3164	1.0000

Note: N = 86. NFI = normed-fit index; NNFI = non-normed-fit index; CFI = comparative fit index; PR = parsimony ratio; PNFI = parsimonious normed-fit index; RNFI = relative normed-fit index.

Table 13: Comparisons to M_{mF} Final Measurement Model, χ^2=21.031 (df=12)

Model		**χ^2**	***df***	**χ^2 diff**	***df* diff**	**χ^2 crit, *p*<.001**	**Significant difference?**
M_0	Null model	414.53	36	393.499	24	51.179	*p*<.001
M_u	Uncorrelated factors	146.437	18	125.406	6	22.458	*p*<.001
M_t	Initial Theoretical model	71.185	24	50.154	12	32.909	*p*<.001
M_{r1}	Revised model 1	23.892	19	2.861	7	24.322	No
M_{r2}	Revised model 2	25.109	22	4.078	10	29.588	No
M_{r3}	Revised model 3	26.449	23	5.418	11	31.264	No
M_{r4}	Revised model 4	27.895	24	6.864	12	32.909	No

Hypotheses Testing

Several hypotheses were used to address the research questions in this study. The first research question of interest was whether the magnitude of utilization of an information system change predictably according to changes in primary force interactions. The results of each set of hypotheses tested are summarized in Table 14.

Table 14: Research Questions and Associated Hypotheses with Study Findings

Research Questions	**Hypotheses**	**Finding**
Question 1: *Does the magnitude of utilization of an information system change predictably according to changes in primary force interactions*?	Hypothesis 1: Regarding the antecedents of utilization.	
	1.1 As user satisfaction [User-System interaction] and organizational support [Organization-System interaction] increase, utilization will increase.	Cannot reject H_0
	1.2 As user satisfaction [User-System interaction] increases, utilization will increase.	Cannot reject H_0
	1.3 As organizational support [Organization-System interaction] increases, utilization will increase.	Cannot reject H_0
	1.4 In the presence of negative user satisfaction [User-System interaction], utilization will decrease.	Cannot reject H_0 due to lack of a testable negative response set
	1.5 In the presence of negative organizational support [Organization-System interaction], utilization will decrease.	Cannot reject H_0 due to lack of a testable negative response set

Table 14 (continued): Research Questions and Associated Hypotheses with Study Findings

Research Questions	**Hypotheses**		**Finding**
Question 1: *Does the magnitude of utilization of an information system change predictably according to changes in primary force interactions*?	Hypothesis 2:	Regarding the antecedents of user satisfaction.	
	2.1	As task time [User-Task interaction] and perceived utility [System-Task interaction] increase, user satisfaction [User-System interaction] will increase.	Cannot reject H_0
	2.2	As task time [User-Task interaction] increases, user satisfaction [User-System interaction] will increase.	Cannot reject H_0
	2.3	As perceived utility [System-Task interaction] increases, user satisfaction [User-System interaction] will increase.	Reject H_0
	2.4	In the presence of negative task time [User-Task interaction], user satisfaction [User-System interaction] will decrease.	Reject H_0
	2.5	In the presence of negative perceived utility [System-Task interaction], user satisfaction [User-System interaction] will decrease.	Cannot reject H_0 due to lack of a testable negative response set
	2.6	Negative job satisfaction will reduce user satisfaction [User-System interaction].	Cannot reject H_0 due to lack of a testable negative response set
	Hypothesis 3:	Regarding the antecedents of organizational support.	
	3.1	As organizational value [Task-Organization interaction] and perceived utility [System-Task interaction] increase, organizational support [Organization-System interaction] will increase.	Cannot reject H_0

Table 14 (continued): Research Questions and Associated Hypotheses with Study Findings

Research Questions	**Hypotheses**		**Finding**
Question 1: *Does the magnitude of utilization of an information system change predictably according to changes in primary force interactions*	3.2	As organizational value [Task-Organization] interaction increases, organizational support [Organization-System interaction] will increase.	Cannot reject H_0
	3.3	As perceived utility [System-Task interaction] increases, organizational support [Organization-System interaction] will increase.	Reject H_0
	3.4	In the presence of negative organizational value [Task-Organization interaction], organizational support [Organization-System interaction] will decrease.	Cannot reject H_0 due to lack of a testable negative response set
	3.5	In the presence of negative perceived utility [System-Task interaction], organizational support [Organization-System interaction] will decrease.	Cannot reject H_0 due to lack of a testable negative response set
	Hypothesis 4:	Regarding the antecedents of task time.	
	4	As organizational value [Task-Organization interaction] increases, task time [User-Task interaction] will increase.	Cannot reject H_0
Question 2: *Can self-reported utilization measures act as a proxy for actual utilization monitoring?*	Hypothesis 5:	Regarding self report of utilization versus actual use.	
	5	Self-report is correlated with actual use of a system.	Reject H_0
	Hypothesis 6:	Regarding comparison of self report across systems.	
	6	Correlations between self-reported utilization and actual utilization will be higher for non–required use systems than for required use systems.	Cannot reject H_0 due to lack of a testable response set

Hypothesis 1: Regarding the antecedents of utilization.

Non-causal insights into the nature of the constructs involved within the developed models were gathered through the examination of each of the hypothesis proposed earlier in this study. Hypotheses 1.1-5 concern the two primary force interactions which have the most direct influence on utilization: user satisfaction and organizational support. These hypotheses state that positive values of these elements result in increased utilization, while negative effects from either element result in decreased utilization. The path coefficients significance *t* test values were 0.5025 for user satisfaction and -0.9263 for organizational support.

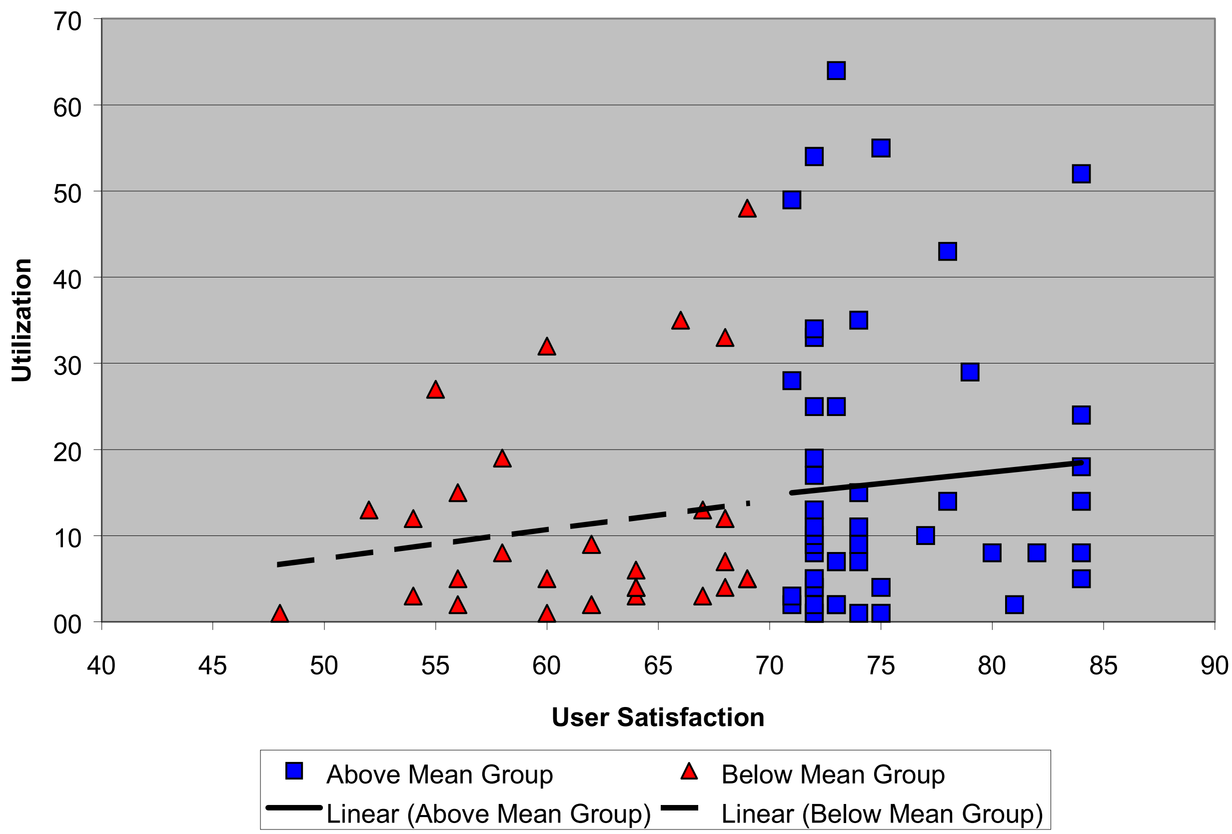


Figure 19: Utilization by User-satisfaction Split Response Set

Based upon the path coefficients, the null hypotheses could not be rejected for Hypotheses 1.1-3. The remaining hypotheses regarding the direct antecedents of utilization involve negative user-satisfaction and organizational support. In examining the response sets for this analysis, only two subjects indicated negative user-satisfaction or negative organizational support. While this fact precluded formal analysis of negative response sets, the response sets were divided across the mean and regression lines were calculated for each "split" response set. A scatterplot showing the user-satisfaction split response set is included in Figure 19. There were no apparent differences between split sets for this variable. A scatterplot showing the organizational support split response set

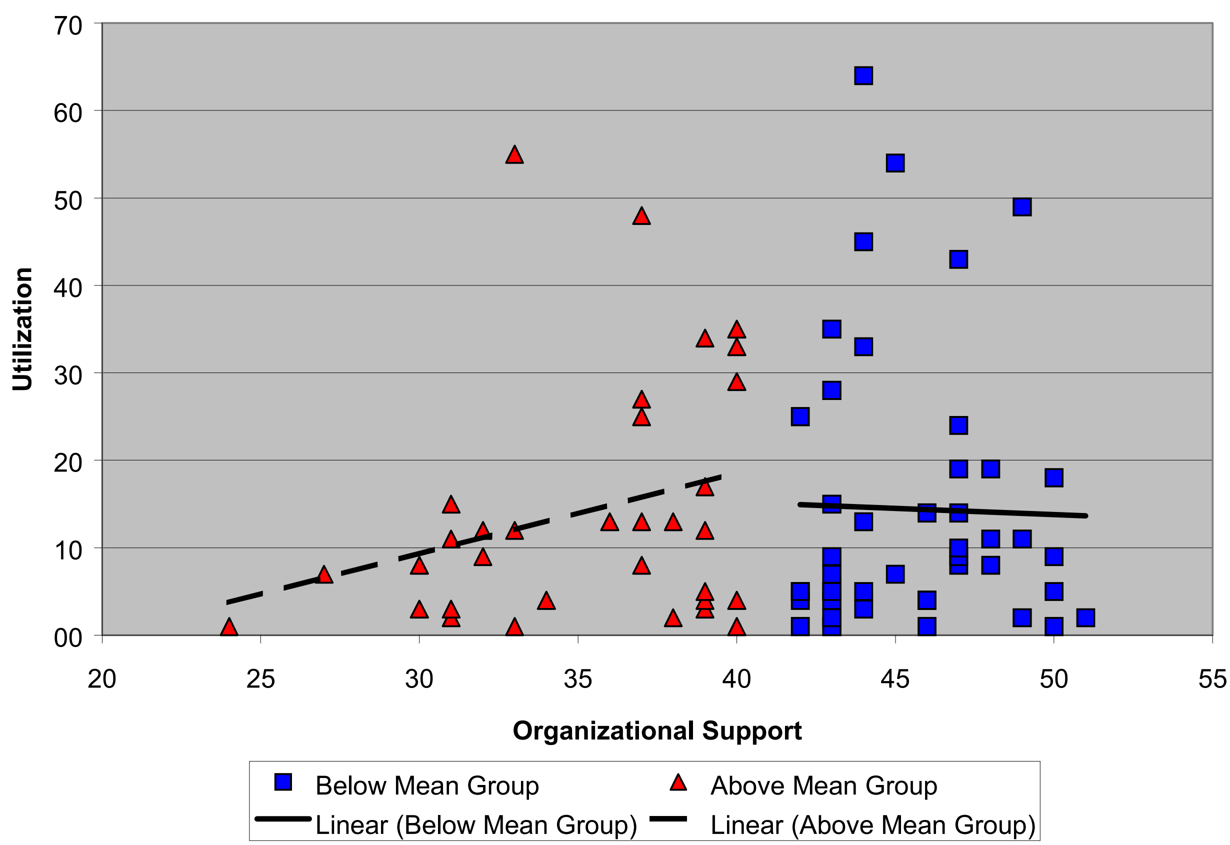


Figure 20: Utilization by Organizational Support Split Response Set

is included in Figure 20. There was an apparent difference between the regression lines shown for this variable. Due to the lack of a testable negative response set, the null hypotheses for Hypotheses 1.4-5 could not be rejected; however, the apparent difference between split response sets for organizational support suggests a negative effect may be likely.

<u>Hypothesis 2: Regarding the antecedents of user satisfaction.</u>

Hypotheses 2.1-6 involve the predictors of user satisfaction. Increasing Task-Time and Perceived-Utility are identified as effecting increases in user-satisfaction.

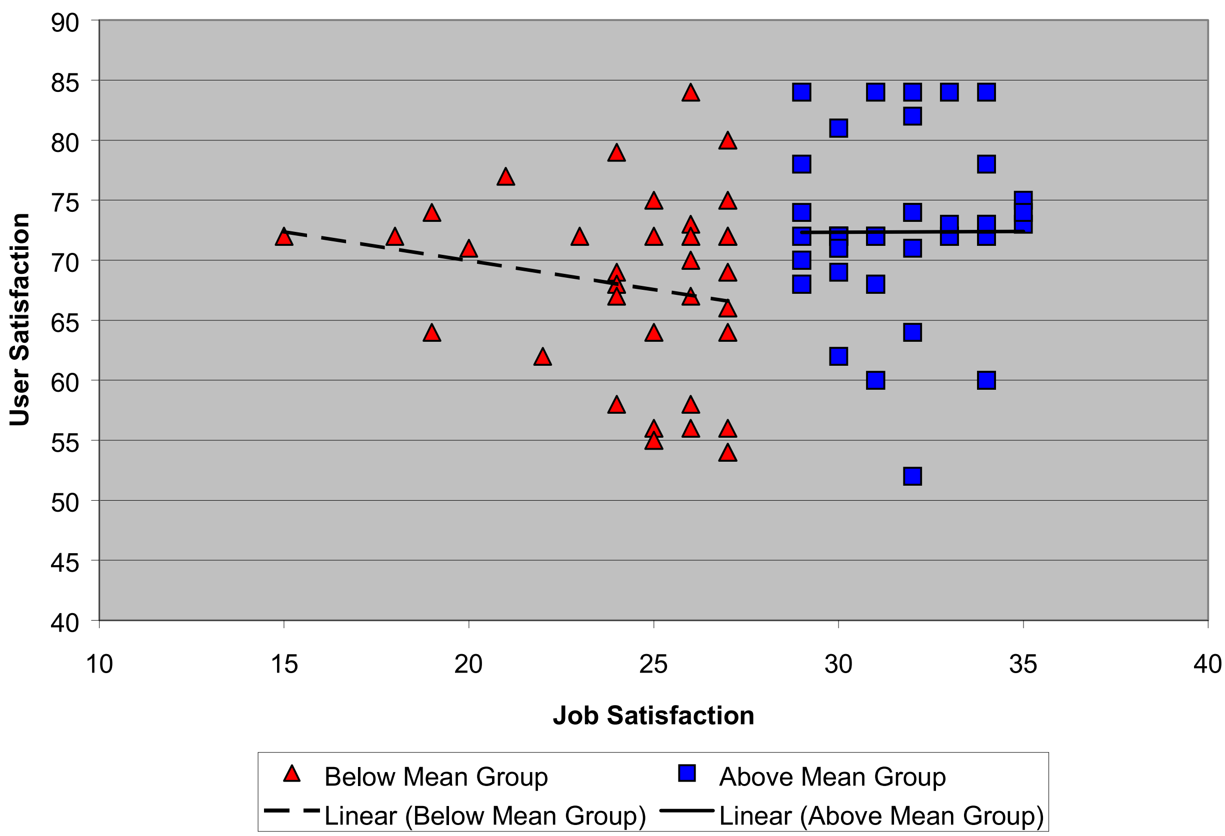


Figure 21: User Satisfaction by Job Satisfaction Split Response Set

Decreasing values of either task time, perceived utility or job satisfaction are seen as causing decreasing user satisfaction. Path coefficients significance *t* test values were 1.1663 for task time and 4.1776 for perceived utility. Based upon the path coefficients, the null hypotheses could not be rejected for Hypotheses 2.1-2. The null hypothesis was rejected for Hypothesis 2.3 since according to significance tests, as perceived utility increases, user satisfaction increases.

Hypotheses 2.4-6 involve the effects of negative task-time, perceived-utility and job-satisfaction. In the response sets for these variables only one subject reported

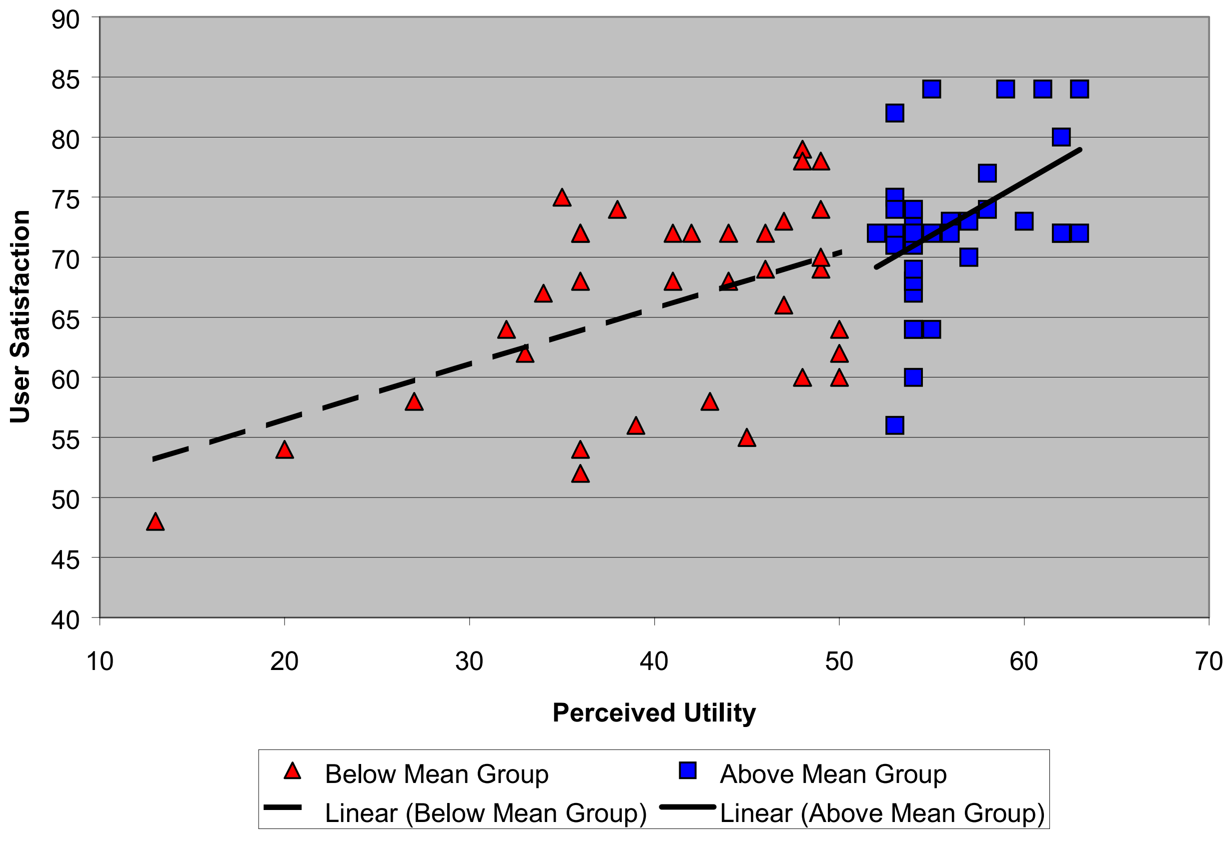


Figure 22: User Satisfaction by Perceived Utility Split Response Set

negative job satisfaction and only three subjects reported negative perceived utility. Formal analysis of negative response sets for these two variable was therefore not feasible; however, in a secondary analysis the response sets were divided across the mean and regression lines were calculated for each "split" response set. A scatterplot showing the job-satisfaction split response set is included in Figure 21. There were no apparent differences between split sets for this variable. The perceived utility split response set scatterplot showing is included in Figure 22; however, there was no apparent difference

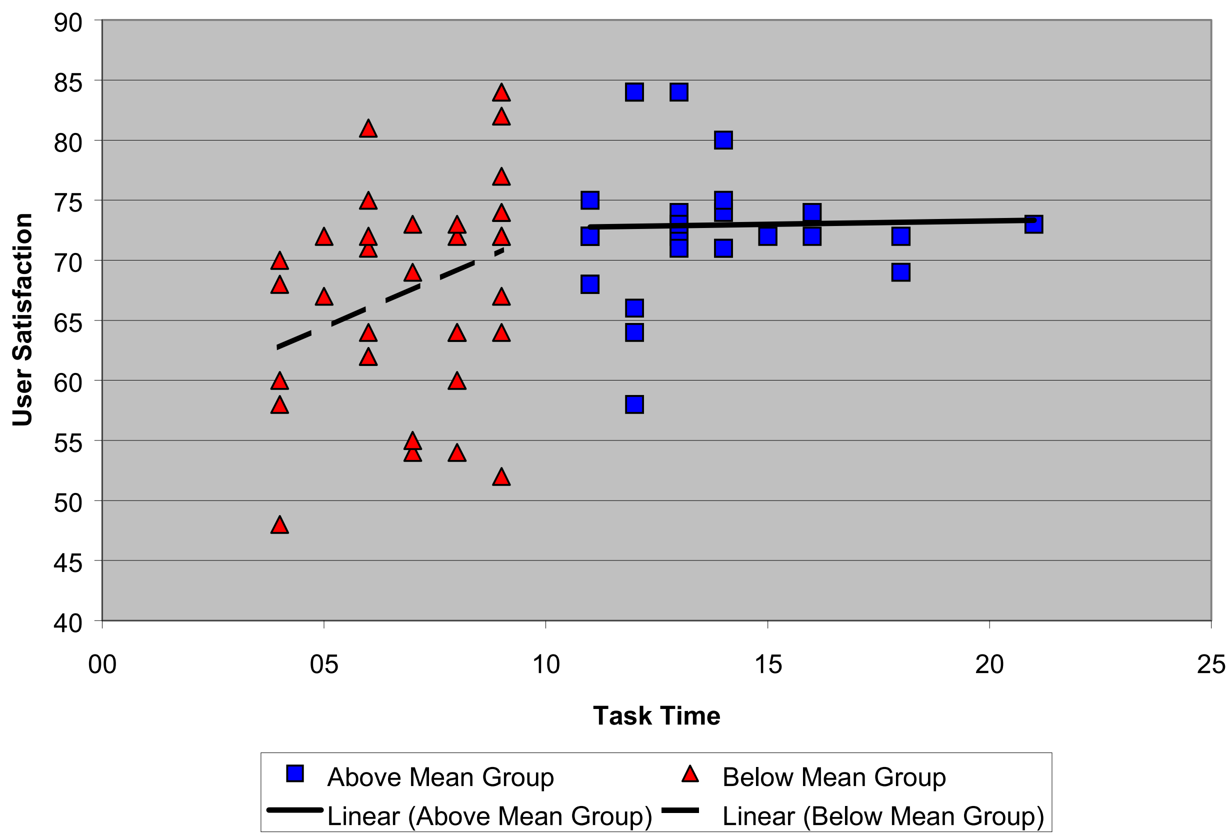


Figure 23: User Satisfaction by Task Time Split Response Set

between the regression lines shown for this variable either. Due to the lack of a testable negative response set, the null hypotheses for Hypotheses 2.5-6 could not be rejected.

Hypothesis 2.3-4 and the task time variable provided results of greater interest. This variable did show a show a significant causal effect on user satisfaction as well as significant differences between "positive" and "negative" task time groups. Due to these results the null hypotheses for both 2.3 and 2.4 were rejected. Figure 23 shows the regression lines plotted against task time for user response sets split across the mean. Similar regression lines were obtained when this split was shifted to the scale's midpoint for splitting of "positive" and "negative" response groups.

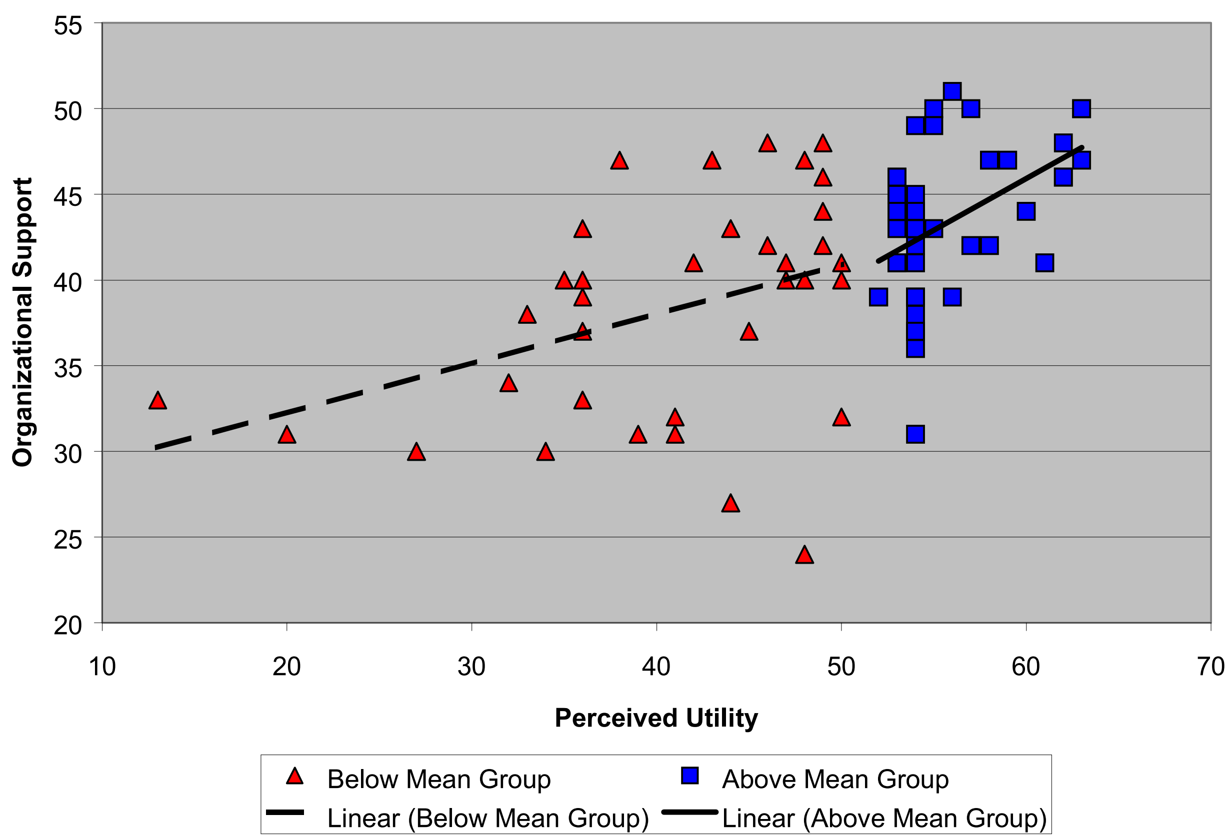
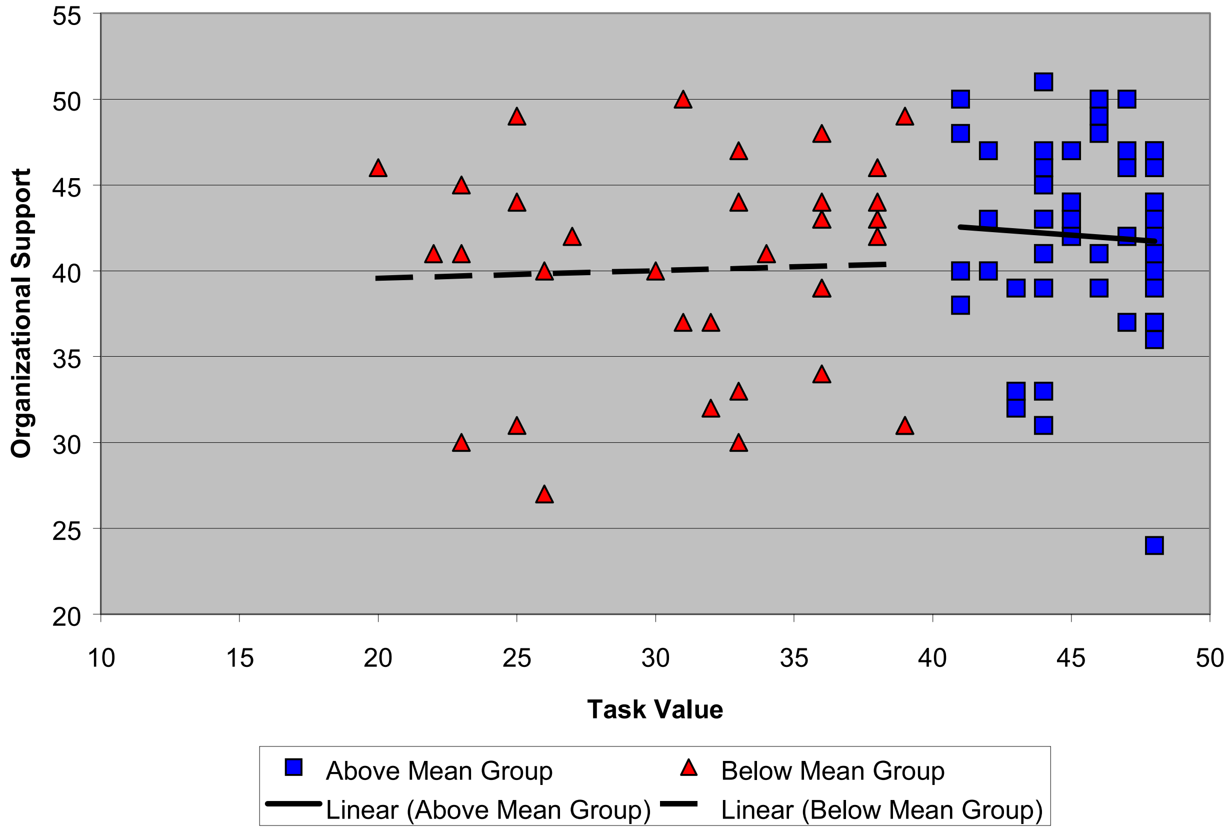


Figure 24: Organizational Support by Task Value Split Response Set

Figure 25: Organizational Support by Perceived Utility Split Response Set



<u>Hypothesis 3: Regarding the antecedents of organizational support.</u>

The final multi-variable hypotheses in this study are included under Hypotheses 3.1-5. These hypotheses involve the antecedents of organizational support. Specifically, in hypothesis 3.1-3 organizational support increases as organizational value and perceived utility increase. This relationship is stated in the negative in hypotheses 3.4-3.5 which predict that negative organizational task value or negative perceived utility cause organizational support to decrease. Path coefficients significance *t* test values were -0.3682 for task value and 6.0016 for perceived utility. The null hypotheses could not be rejected for Hypotheses 3.1-2 based upon the path coefficients. However, the null hypothesis was rejected for Hypothesis 3.3 since the significance value of t=6.0016 indicated a definite increase in perceived utility as user satisfaction increases. Figure 24 shows regression lines plotted against organizational support for user response sets split across the task value mean, while Figure 25 shows the perceived utility split response set. Insufficient number of negative responses of were received to accurately judge the effects of negative task value and of negative perceived utility of organizational support; therefore, the null hypotheses for Hypotheses 3.4-5 could not be rejected.

Hypothesis 4: Regarding the antecedents of task time

Hypothesis 4 addresses the effects of increasing organizational value on task time. Organizational value's effect on task time dropped out in the first revised model due to nonsignificant causal effects. As a result the null hypothesis could not be rejected in the case of Hypothesis 4.

Hypothesis 5: Regarding self report of utilization versus actual use and

Hypothesis 6: Regarding comparison of self report across systems

A combination of audit file and survey data were gathered to address Hypothesis 5 and 6. Table 15 shows the correlations and associated probabilities between utilization and the survey questions that were asked. For Hypotheses 5 the null hypothesis was easily rejected. The final hypotheses predicted differences between reported utilization and actual utilization for subjects in the staff scheduling system group and subjects in the patient education system group. This prediction was based upon the requirements for use of each system. Use of the scheduling system was mandated by the hospital, while use of the education system was less required. Unfortunately the subject size of the education system group resulted in an untestable situation for Hypothesis 6.

Table 15: Correlations and Associated Probabilities Between Utilization Audit File Statistics and Survey Items

Days of Use (out of 100)		Survey Item
Correlation	***p***	
0.58837	<.0001	How frequently do you use One Staff?
0.59433	<.0001	How much time do you spend on One Staff each day?
0.59469	<.0001	To what extent do you have personal or direct interaction with One Staff?
0.48937	<.0001	To what extent do you have personal or direct interaction with One Staff to produce reports for your management?
0.37944	0.0026	To what extent do you have personal or direct interaction with One Staff to produce reports for persons other than yourself or your management?

CHAPTER 5

CONCLUSIONS AND SUMMARY

Performance of Utilization Model

The magnitude of utilization of an information system does change predictably according to changes in primary force interactions as described in this analysis. Based upon the findings of this study, the following conclusions were derived:

- The utilization prediction model described in this study provided a good theoretical and quantitative fit.
- The most significant direct predictor of utilization was task-time.
- The most significant indirect predictor of utilization was perceived utility.
- User satisfaction was predicted by organizational support and perceived utility.
- Perceived utility also predicted task time and organizational support.
- Task value predicted perceived utility.
- Self report and actual utilization were significantly correlated.

The challenge in retaining opportunities for practical application of this model like many models is in restraining the number of measures required without impairing the predictive ability . Often, through the use of simplified heuristics, results such as those found in this study can be projected into easier use. Some possible heuristics generated from this study's conclusions include:

- When a system is perceived as useful in accomplishing a task that a person normally performs, the person will use the system.
- The more time a person spends on a given task, the greater the likelihood that the person will use an automated solution which helps with that task when one is available.
- The more an organization supports a system and the system is seen as useful, the greater the likelihood that employees will be satisfied with the system.
- The more perceived value a task has, the more likely a person is to perceive as useful an information system designed to facilitate that task

Each of these conclusions and proposed heuristics were derived from a model which accounted for 26.7 percent of the variance in utilization. This percentage exceeds that accounted for by most studies. And although the sample size in this study bordered on being minimally acceptable, the strong theoretical foundations of the model and the amount of variance in the response sets allowed for an effective analysis.

Considerations for Future Research

Continued efforts to improve upon existing utilization prediction models are inevitable since abundant resources are necessary for the implementation of any information technology. The current study has contributed a model which builds upon past theory while proposing a practical approach to measurement of predictive variables. Future research testing this model and its component interactions could assess the robustness of the model as well as providing greater insight into the relative significance of each causal factor. Longitudinal studies examining the performance of the utilization prediction model across the information system life cycle could also offer further understanding of this model. Future research involving larger and diverse subject pools could also add to generalizability of the model. Further structural development of the model could involve the following foci:

- Incorporation of feedback mechanisms within the model developed in this study would likely provide a more satisfactory model fit were a large enough sample size available.
- Replacement of manifest variables, particularly the user satisfaction and organizational support variables, with latent variables measuring the same constructs could contribute added strength to the model's predictive power.

Any further research examining the model within this study will contribute to the understanding of the ability of the interaction approach to develop useful theory. In the current study, the examination of pairs of variables formed the basis for the utilization prediction model. This type of interaction approach can also be seen in the underlying mechanisms of principal components analysis as well as other factor analytic methods. The study of variable interactions, as opposed to the study of isolated variables, provides for the inclusion of fewer constructs within a model as well as reflecting more accurately the operation of these variables in the "real world." As is evident from the overview of primary forces in this study, the confluence of increasing numbers of variable interactions offers insight into many predictive model challenges. Future research which examines this utilization model can further demonstrate the robustness of the approach and the utilization model across divergent groups of users, organizations, systems and tasks.

APPENDIX A

USER SURVEYS

PROGRAM FILE FROM EFA RUN OF SYSTEM 1 DATA

USER SURVEYS

Survey questions have been phrased for use with staffing system users. For patient education system users, questions were appropriately modified.

Pre-Training Survey Items

Scoring Scale for items in this Survey unless otherwise noted**:**

1	2	3	4	5	6	7
Strongly Disagree	***Disagree***	***Slightly Disagree***	***Neither Agree nor Disagree***	***Slightly Agree***	***Agree***	***Strongly Agree***

SECTION I		
Item		***Construct and Source***
1.	I feel apprehensive about using a computer.	*COMPUTER ANXIETY* *Montazemi, Cameron and Gupta, 1996*
2.	I am unsure of my ability to interpret a computer printout.	
3.	I am not confident that I could learn computer skills.	
4.	There's a computer revolution going on, and I don't feel like I'm part of it.	
5.	I feel like a technological outcast because I don't use computers very much, if at all.	
6.	I am unsure of my ability to learn a computer programming language.	

Item	Construct and Source
7. I hesitate to use a computer for fear of making mistakes that I cannot correct.	
8. I have avoided computers because they are unfamiliar to me.	
9. Computers are kind of strange and frightening.	
10. Computer terminology sounds like confusing jargon to me.	
11. Computers intimidate and threaten me.	
12. Other people are learning about and using computers, and I'm being left out of that group.	
13. I have difficulty understanding most technological matters.	
14. Even though computers are valuable and necessary, I still have a fear of them.	

SECTION II

Item	Construct and Source
1. How frequently do you use a computer? *Scoring scale:* 1 ------ 2 ---------3--------- 4 ---------5--------- 6 *Less than once a month* / *Once a month* / *A few times a month* / *A few times a week* / *About once a day* / *Several times a day*	*USE* *Igbaria & Iivari, 1995*
2. How much time do you spend on a computer each day? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5--------- 6 *Almost Never* / *Less than half hour* / *½ to 1 hour* / *1 – 2 hours* / *2 – 3 hours* / *More than 3 hours*	
3. The extent of personal/direct interaction with computers? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5 *not at all* / *a little* / *moderately* / *much* / *a great deal*	*Torkzadeh & Dwyer, 1994*

Item	Construct and Source
4. The extent of personal/direct interaction with computers to produce reports for your management? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5 *not at all* / *a little* / *moderately* / *much* / *a great deal*	
5. The extent of personal/direct interaction with computers to produce reports for persons other than yourself or your management? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5 *not at all* / *a little* / *moderately* / *much* / *a great deal*	

SECTION III

Item	Construct and Source
1. Management is really eager to see that we are happy with using our computers.	*ORGANIZATIONAL SUPPORT* *Igbaria & Iivari, 1995*
2. I am convinced that management is sure as to what benefits can be achieved with the use of computers.	
3. Management has provided most of the necessary help and resources to get us used to the computers quickly.	
4. I am always supported and encouraged by my boss to use the computer in my job.	

SECTION IV

Item	*Construct and Source*
1. What impact does <u>ineffective</u> employee scheduling (i.e. work schedules, vacation requests, sick days, on-call scheduling) have on your organization? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5--------- 6 *Extreme impact* / *Very much of an impact* / *Quite an impact* / *Somewhat of an impact* / *Marginal impact* / *No impact at all*	*TASK VALUE* *Adapted from Conrath & Sharma, 1993*
2. How important do you consider employee scheduling (i.e. work schedules, vacation requests, sick days, on-call scheduling) to be to your organization? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5--------- 6 *Extremely important* / *Very important* / *Quite important* / *Somewhat important* / *Marginally important* / *Not at all important*	
3. What impact does <u>effective</u> employee information maintenance (i.e. phone number changes, payroll notes, address changes, etc.) have on your organization? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5--------- 6 *Extreme impact* / *Very much of an impact* / *Quite an impact* / *Somewhat of an impact* / *Marginal impact* / *No impact at all*	
4. How valuable do you consider employee information maintenance (i.e. phone number changes, payroll notes, address changes, etc.) to be to your organization? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5--------- 6 *Extremely valuable* / *Very valuable* / *Quite valuable* / *Somewhat valuable* / *Marginally valuable* / *Not at all valuable*	

SECTION V		
Item		***Construct and Source***
1.	Generally speaking, I am very satisfied with this job.	*JOB SATISFACTION* *Hackman & Oldham, 1975*
2.	I frequently think of quitting this job.	
3.	I am generally satisfied with the kind of work I do in this job.	
4.	Most people on this job are very satisfied with the job.	
5.	People on this job often think of quitting.	

SECTION VI		
Item		***Construct and Source***
1.	How much total time do you spend on employee scheduling (i.e. work schedules, vacation requests, sick days, on-call scheduling) each month? *Scoring scale:* 1 ------- 2 --------3 --------4 --------5 --------6 --------7 *No time* — *less than – 3 hours* — *3 – 6 hours* — *6 – 12 hours* — *12 – 24 hours* — *24 – 40 hours* — *More than 40 hours*	*USE* *Adapted from Igbaria & Iivari, 1995*
2.	How frequently do you deal with employee scheduling (i.e. work schedules, vacation requests, sick days, on-call scheduling)? *Scoring scale:* 1 --------- 2 ---------3 --------- 4 ---------5 --------- 6 *Less than once a month* — *Once a month* — *A few times a month* — *A few times a week* — *About once a day* — *Several times a day*	
3.	How effective do you consider the way in which you currently do employee scheduling (i.e. work schedules, vacation requests, sick days, on-call scheduling) to be in meeting your organization's needs? *Scoring scale:* 1 --------- 2 ---------3 --------- 4 ---------5 --------- 6 *Extremely valuable* — *Very valuable* — *Quite valuable* — *Somewhat valuable* — *Marginally valuable* — *Not at all valuable*	*SUCCESS* *Conrath & Sharma, 1993*

Item	***Construct and Source***
4. If you had to assign a value to the way in which you currently do employee scheduling (i.e. work schedules, vacation requests, sick days, on-call scheduling) by comparing all of its costs and benefits (tangible and intangible), do you perceive that benefits . . . . *Scoring scale:* 1 ------- 2 --------3 --------4 --------5 --------6 --------7 *greatly exceed costs* / *clearly exceed costs* / *marginally exceed costs* / *roughly equal costs* / *marginally less than costs* / *clearly less than costs* / *greatly less than costs*	
5. In relation to your expectations, how satisfied are you with the way in which you currently do employee scheduling (i.e. work schedules, vacation requests, sick days, on-call scheduling)? *Scoring scale:* 1 --------- 2 ---------3 --------- 4 ---------5 *Completely satisfied* / *Highly satisfied* / *Partially satisfied (about average)* / *Minimally satisfied* / *Not at all deal*	
6. How much total time do you spend maintaining employee information (i.e. phone number changes, payroll notes, address changes, etc.) each month? *Scoring scale:* 1 ------- 2 --------3 --------4 --------5 --------6 --------7 *No time* / *less than – 3 hours* / *3 – 6 hours* / *6 – 12 hours* / *12 – 24 hours* / *24 – 40 hours* / *More than 40 hours*	*TASK-TIME* *Adapted from Igbaria & Iivari, 1995*
7. How frequently do you maintain employee information (i.e. phone number changes, payroll notes, address changes, etc.)? *Scoring scale:* 1 --------- 2 ---------3 --------- 4 ---------5--------- 6 *Less than once a month* / *Once a month* / *A few times a month* / *A few times a week* / *About once a day* / *Several times a day*	

Item	Construct and Source
8. How effective do you consider the way you currently do employee information maintenance (i.e. phone number changes, payroll notes, address changes, etc.) to be in meeting your organization's needs? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5--------- 6 *Extremely effective* / *Very effective* / *Quite effective* / *Somewhat effective* / *Marginally effective* / *Not at all effective*	*SUCCESS* *Conrath & Sharma, 1993*
9. If you had to assign a value to the way in which you currently do employee scheduling (i.e. work schedules, vacation requests, sick days, on-call scheduling) by comparing all of its costs and benefits (tangible and intangible), do you perceive that benefits . . . . *Scoring scale:* 1 ------- 2 --------3 --------4 --------5 --------6 --------7 *greatly exceed costs* / *clearly exceed costs* / *marginally exceed costs* / *roughly equal costs* / *marginally less than costs* / *clearly less than costs* / *greatly less than costs*	
10. In relation to your expectations, how satisfied are you with the way you currently do employee information maintenance (i.e. phone number changes, payroll notes, address changes, etc.)? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5 *Completely satisfied* / *Highly satisfied* / *Partially satisfied (about average)* / *Minimally satisfied* / *Not at all deal*	

Item		Construct and Source
11.	What impact does effective employee scheduling (i.e. work schedules, vacation requests, sick days, on-call scheduling) have on your organization? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5--------- 6 *Extreme impact / Very much of an impact / Quite an impact / Somewhat of an impact / Marginal impact / No impact at all*	*TASK VALUE* *Adapted from Conrath & Sharma, 1993*
12.	How valuable do you consider employee scheduling (i.e. work schedules, vacation requests, sick days, on-call scheduling) to be to your organization? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5--------- 6 *Extremely valuable / Very valuable / Quite valuable / Somewhat valuable / Marginally valuable / Not at all valuable*	
13.	What impact does ineffective employee information maintenance (i.e. phone number changes, payroll notes, address changes, etc.) have on your organization? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5--------- 6 *Extreme impact / Very much of an impact / Quite an impact / Somewhat of an impact / Marginal impact / No impact at all*	
14.	How important do you consider employee information maintenance (i.e. phone number changes, payroll notes, address changes, etc.) to be to your organization? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5--------- 6 *Extremely important / Very important / Quite important / Somewhat important / Marginally important / Not at all important*	

Post-Training Survey Items (Staff Scheduling System Only)

Scoring Scale for items in this Survey unless otherwise noted**:**

1	2	3	4	5	6	7
Strongly Disagree	***Disagree***	***Slightly Disagree***	***Neither Agree nor Disagree***	***Slightly Agree***	***Agree***	***Strongly Agree***

SECTION I	
Item	***Construct and Source***
1. Management is really eager to see that we are happy with using One Staff.	*ORGANIZATIONAL SUPPORT Igbaria & Iivari, 1995*
2. I am convinced that management is sure as to what benefits can be achieved with the use of One Staff.	
3. Management has provided most of the necessary help and resources to get us used to One Staff quickly.	
4. I am always supported and encouraged by my boss to use One Staff in my job.	
5. In general, the organization has supported the introduction of One Staff.	*Thompson, Higgins And Howell, 1994*
6. The senior management of the hospital have been helpful in introducing One Staff.	
7. My boss is very supportive of One Staff use for my job.	
8. The proportion of departmental coworkers who use One Staff. *Scoring scale:* 1 --------- 2 ---------3--------- 4 *less than ¼* / *more than ¼, but less than half* / *more than half, but less than ¾* / *more than ¾*	

SECTION II		
Item		***Construct and Source***
1.	Using One Staff in my job will enable me to accomplish tasks more quickly.	*PERCEIVED UTILITY* *Montazemi, Cameron and Gupta, 1996*
2.	Using One Staff will improve my job performance.	
3.	Using One Staff in my job will increase my productivity.	
4.	Using One Staff will enhance my effectiveness on the job.	
5.	Using One Staff will make it easier to do my job.	
6.	I will find One Staff useful in my job.	*Montazemi, Cameron and Gupta, 1996*
7.	Using One Staff will improve the quality of work I do.	*Keil, Beranek & Konsynski, 1995*
8.	Overall, using One Staff will be advantageous in my job.	
9.	One Staff will provide me with information that will lead to better decisions.	*Igbaria & Iivari, 1995*

SECTION III		
Item		***Construct and Source***
1.	Learning to operate One Staff will be easy for me.	*PERCEIVED EASE OF USE* *Montazemi, Cameron and Gupta, 1996; Keil, Beranek & Konsynski, 1995*
2.	I will find it easy to get One Staff to do what I want it to do.	
3.	Overall, I will find One Staff easy to use.	
4.	My interaction with One Staff will be clear and understandable.	
5.	It will be easy for me to become skillful at using One Staff.	*Montazemi, Cameron and Gupta, 1996*
6.	I will find One Staff to be flexible to interact with.	
7.	I believe that One Staff will be cumbersome to use.	*Keil, Beranek & Konsynski, 1995*
8.	Using One Staff will often be frustrating.	
9.	Using One Staff will require a lot of mental effort.	

SECTION IV	
Item	***Construct and Source***
1. In relation to your expectations, how satisfied will you be with One Staff? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5 *Completely satisfied* · *Highly satisfied* · *Partially satisfied (about average)* · *Minimally satisfied* · *Not at all deal*	*GENERAL SUCCESS* *Conrath & Sharma, 1993*
2. How effective do you consider One Staff will be in meeting your organization's needs? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5--------- 6 *Extremely effective* · *Very effective* · *Quite effective* · *Somewhat effective* · *Marginally effective* · *Not at all effective*	
3. If you had to assign a value to One Staff by comparing all of its costs and benefits (tangible and intangible), do you perceive that benefits . . . . *Scoring scale:* 1 ------- 2 --------3 --------4 --------5 --------6 --------7 *greatly exceed costs* · *clearly exceed costs* · *marginally exceed costs* · *roughly equal costs* · *marginally less than costs* · *clearly less than costs* · *greatly less than costs*	

SECTION V	
Scoring Scale for items in this Section: 1 -------------- 2 -------------- 3 -------------- 4 -------------- 5 -------------- 6 -------------- 7 ***Extremely Likely*** — ***Quite Likely*** — ***Slightly Likely*** — ***Neither*** — ***Slightly Unlikely*** — ***Quite Unlikely*** — ***Extremely Unlikely***	
Item	***Construct and Source***
1. Will you be satisfied with the accuracy of One Staff? 2. Will you get the information you need in time? 3. Will you think the output is presented in a useful format? 4. Will the information content meet your needs? 5. Will One Staff provide reports that seem to be just about exactly what you need? 6. Will One Staff provide sufficient information? 7. Will One Staff provide the precise information you need? 8. Will One Staff provide up-to-date information? 9. Is the information from One Staff clear? 10. Will One Staff be accurate? 11. Will One Staff be easy to use? 12. Is One Staff user friendly?	*SATISFACTION* *Doll & Torkzadeh, 1988*

SECTION VI	
Item	***Construct and Source*** *TASK-TECHNOLOGY FIT* *Goodhue & Thompson, 1995*
1. I frequently deal with ill-defined business problems in my job. 2. I am getting the training I need to be able to use the One Staff system and data effectively. 3. I frequently deal with ad-hoc, non routine problems in my job.	*Task Equivocality & Training*

Item		Construct and Source
4.	There is not enough training for me or my staff on how to find, understand, access or use information in the One Staff system.	
5.	Frequently the problems I work in my job involve answering questions that have never been asked in quite that form before.	

Follow-Up Survey Items

Scoring Scale for items in this Survey unless otherwise noted**:**

1	2	3	4	5	6	7
Strongly Disagree	***Disagree***	***Slightly Disagree***	***Neither Agree nor Disagree***	***Slightly Agree***	***Agree***	***Strongly Agree***

SECTION I		
Item		***Construct and Source***
1.	I feel apprehensive about using a computer.	*COMPUTER ANXIETY Montazemi, Cameron and Gupta, 1996*
2.	I am unsure of my ability to interpret a computer printout.	
3.	I am not confident that I could learn computer skills.	
4.	There's a computer revolution going on, and I don't feel like I'm part of it.	
5.	I feel like a technological outcast because I don't use computers very much, if at all.	
6.	I am unsure of my ability to learn a computer programming language.	
7.	I hesitate to use a computer for fear of making mistakes that I cannot correct.	
8.	I have avoided computers because they are unfamiliar to me.	
9.	Computers are kind of strange and frightening.	
10.	Computer terminology sounds like confusing jargon to me.	
11.	Computers intimidate and threaten me.	
12.	Other people are learning about and using computers, and I'm being left out of that group.	
Item		***Construct and Source***

Item	Construct and Source
13. I have difficulty understanding most technological matters.	
14. Even though computers are valuable and necessary, I still have a fear of them.	

SECTION II

Item	*Construct and Source*
1. How frequently do you use a computer? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5--------- 6 1 = *Less than once a month*; 2 = *Once a month*; 3 = *A few times a month*; 4 = *A few times a week*; 5 = *About once a day*; 6 = *Several times a day*	*USE* *Igbaria & Iivari, 1995*
2. How much time do you spend on a computer each day? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5--------- 6 1 = *Almost Never*; 2 = *Less than half hour*; 3 = *½ to 1 hour*; 4 = *1 – 2 hours*; 5 = *2 – 3 hours*; 6 = *More than 3 hours*	
3. The extent of personal/direct interaction with computers? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5 1 = *not at all*; 2 = *a little*; 3 = *moderately*; 4 = *much*; 5 = *a great deal*	*USE* *Torkzadeh & Dwyer, 1994*
4. The extent of personal/direct interaction with computers to produce reports for your management? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5 1 = *not at all*; 2 = *a little*; 3 = *moderately*; 4 = *much*; 5 = *a great deal*	

Item	Construct and Source
5. The extent of personal/direct interaction with computers to produce reports for persons other than yourself or your management? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5 *not at all* / *a little* / *moderately* / *much* / *a great deal*	

SECTION III

Item	Construct and Source
1. Management is really eager to see that we are happy with using our computers.	*ORGANIZATIONAL SUPPORT* *Igbaria & Iivari, 1995*
2. I am convinced that management is sure as to what benefits can be achieved with the use of computers.	
3. Management has provided most of the necessary help and resources to get us used to the computers quickly.	
4. I am always supported and encouraged by my boss to use the computer in my job.	

SECTION IV

Item	Construct and Source
1. Generally speaking, I am very satisfied with this job.	*JOB SATISFACTION* *Hackman & Oldham, 1975*
2. I frequently think of quitting this job.	
3. I am generally satisfied with the kind of work I do in this job.	
4. Most people on this job are very satisfied with the job.	
5. People on this job often think of quitting.	

SECTION V		
Item		***Construct and Source***
1.	How much total time do you spend on employee scheduling (i.e. work schedules, vacation requests, sick days, on-call scheduling) each month? *Scoring scale:* 1 ------- 2 --------3 --------4 --------5 --------6 --------7 *No time* / *less than – 3 hours* / *3 – 6 hours* / *6 – 12 hours* / *12 – 24 hours* / *24 – 40 hours* / *More than 40 hours*	*TASK TIME* *Igbaria & Iivari, 1995*
2.	How frequently do you deal with employee scheduling (i.e. work schedules, vacation requests, sick days, on-call scheduling)? *Scoring scale:* 1 --------- 2 ---------3 --------- 4 ---------5 --------- 6 *Less than once a month* / *Once a month* / *A few times a month* / *A few times a week* / *About once a day* / *Several times a day*	
3.	How effective do you consider the way in which you currently do employee scheduling (i.e. work schedules, vacation requests, sick days, on-call scheduling) to be in meeting your organization's needs? *Scoring scale:* 1 --------- 2 ---------3 --------- 4 ---------5 --------- 6 *Extremely effective* / *Very effective* / *Quite effective* / *Somewhat effective* / *Marginally effective* / *Not at all effective*	*SUCCESS* *Conrath & Sharma, 1993*
4.	If you had to assign a value to the way in which you currently do employee scheduling (i.e. work schedules, vacation requests, sick days, on-call scheduling) by comparing all of its costs and benefits (tangible and intangible), do you perceive that benefits . . . . *Scoring scale:* 1 ------- 2 --------3 --------4 --------5 --------6 --------7 *greatly exceed costs* / *clearly exceed costs* / *marginally exceed costs* / *roughly equal costs* / *marginally less than costs* / *clearly less than costs* / *greatly less than costs*	

Item	Construct and Source
5. In relation to your expectations, how satisfied are you with the way in which you currently do employee scheduling (i.e. work schedules, vacation requests, sick days, on-call scheduling)? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5 *Completely satisfied* / *Highly satisfied* / *Partially satisfied (about average)* / *Minimally satisfied* / *Not at all deal*	
6. How much total time do you spend maintaining employee information (i.e. phone number changes, payroll notes, address changes, etc.) each month? *Scoring scale:* 1 ------- 2 --------3 --------4--------5--------6--------7 *No time* / *less than – 3 hours* / *3 – 6 hours* / *6 – 12 hours* / *12 – 24 hours* / *24 – 40 hours* / *More than 40 hours*	*TASK TIME* *Igbaria & Iivari, 1995*
7. How frequently do you maintain employee information (I.e. phone number changes, payroll notes, address changes, etc.)? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5--------- 6 *Less than once a month* / *Once a month* / *A few times a month* / *A few times a week* / *About once a day* / *Several times a day*	
8. How effective do you consider the way you currently do employee information maintenance (i.e. phone number changes, payroll notes, address changes, etc.) to be in meeting your organization's needs? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5--------- 6 *Extremely effective* / *Very effective* / *Quite effective* / *Somewhat effective* / *Marginally effective* / *Not at all effective*	*SUCCESS* *Conrath & Sharma, 1993*

Item		***Construct and Source***
9.	If you had to assign a value to the way in which you currently do employee scheduling (i.e. work schedules, vacation requests, sick days, on-call scheduling) by comparing all of its costs and benefits (tangible and intangible), do you perceive that benefits . . . . *Scoring scale:* 1 ------- 2 --------3 --------4 --------5 --------6 --------7 *greatly exceed costs* / *clearly exceed costs* / *marginally exceed costs* / *roughly equal costs* / *marginally less than costs* / *clearly less than costs* / *greatly less than costs*	
10.	In relation to your expectations, how satisfied are you with the way you currently do employee information maintenance (i.e. phone number changes, payroll notes, address changes, etc.)? *Scoring scale:* 1 --------- 2 ---------3 --------- 4 ---------5 *Completely satisfied* / *Highly satisfied* / *Partially satisfied (about average)* / *Minimally satisfied* / *Not at all deal*	
11.	How frequently do you use One Staff? *Scoring scale:* 1 --------- 2 ---------3 --------- 4 ---------5--------- 6 *Less than once a month* / *Once a month* / *A few times a month* / *A few times a week* / *About once a day* / *Several times a day*	
12.	How much time do you spend on One Staff each day? *Scoring scale:* 1 --------- 2 ---------3 --------- 4 ---------5--------- 6 *Almost Never* / *Less than half hour* / *½ to 1 hour* / *1 – 2 hours* / *2 – 3 hours* / *More than 3 hours*	

Item	Construct and Source
13. To what extent do you have personal or direct interaction with One Staff? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5 *not at all — a little — moderately — much — a great deal*	
14. To what extent do you have personal or direct interaction with One Staff to produce reports for your management? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5 *not at all — a little — moderately — much — a great deal*	
15. To what extent do you have personal or direct interaction with One Staff to produce reports for persons other than yourself or your management? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5 *not at all — a little — moderately — much — a great deal*	

SECTION VI

Item	Construct and Source
1. Management is really eager to see that we are happy with using One Staff.	*ORGANIZATIONAL SUPPORT Igbaria & Iivari, 1995*
2. I am convinced that management is sure as to what benefits can be achieved with the use of One Staff.	
3. Management has provided most of the necessary help and resources to get us used One Staff quickly.	
4. I am always supported and encouraged by my boss to use One Staff in my job.	
5. In general, the organization has supported the introduction of One Staff.	*Thompson, Higgins and Howell, 1994*

Item		Construct and Source
6.	The senior management of the hospital have been helpful in introducing One Staff.	
7.	My boss is very supportive of One Staff use for my job.	
8.	The proportion of departmental coworkers who use One Staff. *Scoring scale:* 1 --------- 2 ---------3--------- 4 *less than ¼ · more than ¼, but less than half · more than half, but less than ¾ · more than ¾*	

SECTION VII

Item		Construct and Source
1.	Using One Staff in my job enables me to accomplish tasks more quickly.	*PERCEIVED UTILITY* *Montazemi, Cameron and Gupta, 1996; Keil, Beranek & Konsynski, 1995*
2.	Using One Staff improves my job performance.	
3.	Using One Staff in my job increases my productivity.	
4.	Using One Staff enhances my effectiveness on the job.	
5.	Using One Staff makes it easier to do my job.	
6.	I find One Staff useful in my job.	*Montazemi, Cameron and Gupta, 1996*
7.	Using One Staff improves the quality of work I do.	*Keil, Beranek & Konsynski, 1995*
8.	Overall, using One Staff is advantageous in my job.	
9.	One Staff provides me with information that leads to better decisions.	*Igbaria & Iivari, 1995*

SECTION VIII		
Item		***Construct and Source***
1.	Learning to operate One Staff was easy for me.	*PERCEIVED EASE OF USE Montazemi, Cameron and Gupta, 1996; Keil, Beranek & Konsynski, 1995*
2.	I find it easy to get One Staff to do what I want it to do.	
3.	Overall, I find One Staff easy to use.	
4.	My interaction with One Staff is clear and understandable.	
5.	It was easy for me to become skillful at using One Staff.	*Montazemi, Cameron and Gupta, 1996*
6.	I find One Staff to be flexible to interact with.	
7.	I believe that One Staff is cumbersome to use.	*Keil, Beranek & Konsynski, 1995*
8.	Using One Staff is often frustrating.	
9.	Using One Staff requires a lot of mental effort.	

SECTION IX		
Item		***Construct and Source***
1.	In relation to your expectations, how satisfied are you with One Staff? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5 *Completely satisfied / Highly satisfied / Partially satisfied (about average) / Minimally satisfied / Not at all deal*	*GENERAL SUCCESS Conrath & Sharma, 1993*
2.	How effective do you consider One Staff is in meeting your organization's needs? *Scoring scale:* 1 --------- 2 ---------3--------- 4 ---------5--------- 6 *Extremely effective / Very effective / Quite effective / Somewhat effective / Marginally effective / Not at all effective*	

Item	Construct and Source
3. If you had to assign a value to One Staff by comparing all of its costs and benefits (tangible and intangible), do you perceive that benefits . . . . *Scoring scale:* 1 ------- 2 --------3 --------4 --------5 --------6 --------7 *greatly exceed costs* / *clearly exceed costs* / *marginally exceed costs* / *roughly equal costs* / *marginally less than costs* / *clearly less than costs* / *greatly less than costs*	

SECTION X

Scoring Scale for items in this Section:

1	2	3	4	5	6	7
Extremely Likely	***Quite Likely***	***Slightly Likely***	***Neither***	***Slightly Unlikely***	***Quite Unlikely***	***Extremely Unlikely***

Item	Construct and Source
1. Are you satisfied with the accuracy of One Staff?	*SATISFACTION* *Doll & Torkzadeh, 1988*
2. Do you get the information you need in time?	
3. Do you think the output is presented in a useful format?	
4. Does the information content meet your needs?	
5. Does One Staff provide reports that seem to be just about exactly what you need?	
6. Does One Staff provide sufficient information?	
7. Does One Staff provide the precise information you need?	
8. Does One Staff provide up-to-date information?	
9. Is the information from One Staff clear?	
10. Is One Staff be accurate?	
11. Is One Staff be easy to use?	
12. Is One Staff user friendly?	

SECTION XI		
Item		***Construct and Source*** *TASK-TECHNOLOGY FIT* *Goodhue & Thompson, 1995*
1.	One Staff is subject to unexpected or inconvenient down times which make it harder to do my work.	System Reliability
2.	One Staff is an important and valuable aid to me in the performance of my job.	Individual Performance Impact
3.	I frequently deal with ill-defined business problems in my job.	Task Equivocality
4.	I am getting the help I need in accessing and understanding One Staff.	Support
5.	One Staff data is up-to-date enough for my purposes.	Currency
6.	I am getting the training I need to be able to use the One Staff system and data effectively.	Training
7.	There is not enough training for me or my staff on how to find, understand, access or use information in the One Staff system.	Training
8.	The data maintained in One Staff is pretty much what I need to carry out my tasks.	Right Data
9.	Data that would be useful to me in One Staff is unavailable because I don't have the right authorization.	Authorization
10.	One Staff has a large, positive impact on my effectiveness and productivity in my job.	Individual Performance Impact
11.	I know who to call when I'm having trouble with the One-Staff system or data.	Support
12.	The problems I deal with in my job frequently involve more than one business function.	Task Interdependence
13.	One Staff is missing critical data that would be very useful to me in my job.	Right Data
14.	It is easy to find out what data the hospital maintains in One Staff on a given subject.	Locatability
15.	I can count on One Staff to be “up" and available when I need it.	System Reliability

Item		Construct and Source
16.	The problems I deal with in my job frequently involve more than one business function.	Task Interdependence
17.	How dependent are you on One Staff in your job?	Dependence
18.	Sufficiently detailed data is maintained by the hospital in One Staff.	Right Level of Detail
19.	It is easy to get assistance when I have questions or problems finding or using data in One Staff.	Support
20.	On the One Staff system and reports I deal with, the exact meaning of the data elements is either obvious, or easy to find out.	Meaning
21.	One Staff is subject to frequent problems and crashes.	System Reliability
22.	I frequently deal with ad-hoc, non-routine problems in my job.	Task Equivocality
23.	Frequently the problems I work with in my job involve answering questions that have never been asked in quite that form before.	Task Equivocality
24.	The exact definition of One Staff data relating to my tasks is easy to find out.	Meaning
25.	It is easy to locate hospital or departmental data in One Staff on a particular issue, even if I haven't used that data before.	Locatability
26.	I can't get data that is current enough to meet my job needs from One Staff.	Currency
27.	One Staff maintains data at an appropriate level of detail for my department's tasks.	Right Level of Detail
28.	Getting authorization to access data in One Staff that would be useful in my job is time consuming and difficult.	Authorization

APPENDIX B

SAS PROGRAM FILES AND OUTPUT

PROGRAM FILE FROM EFA RUN OF SYSTEM 1 DATA

```
options ls=132;
title 'OS ANALYSIS EFA';
DATA OS;
INFILE 'OS10.TXT';
INPUT
@1  (V1)  (2.)
@3  (V2)  (2.)
@5  (V3)  (2.)
@7  (V4)  (2.)
@9  (V5)  (2.)
@11 (V6)  (2.)
@13 (V7)  (2.)
@15 (V8)  (2.)
@17 (V9)  (2.)
@19 (V10) (2.);
LABEL
V1 ='UDAYS'
V2 ='SATISF'
V3 ='ORGSPT'
V4 ='TSKTIME'
V5 ='IMPEFF'
V6 ='IMPINEFF'
V7 ='IMPORT'
V8 ='VALUE'
V9 ='PCVUTL'
V10='JOBSAT';
PROC CORR DATA=OS RANK ;
    VAR V1-V10;
    RUN;
PROC FACTOR     DATA=OS
                SIMPLE
                METHOD=PRIN
                PRIORS=SMC
                NFACT=10
                SCREE
                ROTATE=PROMAX;
            VAR V1-V10;
    RUN;
```

PROGRAM FILE FROM EFA RUN OF SYSTEM 2 DATA

```
options ls=132;
title 'HCI ANALYSIS EFA';
DATA HCI;
INFILE 'HCI10.TXT';
INPUT
@1  (V1)  (2.)
@3  (V2)  (2.)
@5  (V3)  (2.)
@7  (V4)  (2.)
@9  (V5)  (2.)
@11 (V6)  (2.)
@13 (V7)  (2.)
@15 (V8)  (2.)
@17 (V9)  (2.)
@19 (V10) (2.);
LABEL
V1 ='UDAYS'
V2 ='SATISF'
V3 ='ORGSPT'
V4 ='TSKTIME'
V5 ='IMPEFF'
V6 ='IMPINEFF'
V7 ='IMPORT'
V8 ='VALUE'
V9 ='PCVUTL'
V10='JOBSAT';
PROC CORR DATA=HCI RANK ;
    VAR V1-V10;
    RUN;
PROC FACTOR     DATA=HCI
                SIMPLE
                METHOD=PRIN
                PRIORS=SMC
                NFACT=10
                SCREE
                ROTATE=PROMAX;
            VAR V1-V10;
    RUN;
```

PROGRAM FILE FROM FINAL MEASUREMENT MODEL RUN

```
options ls=80;
title 'OS MEASUREMENT FINAL;
DATA OS;
INFILE 'OSPRIME.TXT';
INPUT
.
.   {input statements here}
.
;
LABEL
V1 ='UDAYS'
V2 ='SATISF'
V3 ='ORGSPT'
V4 ='TSKTIME'
V5 ='IMPEFF'
V6 ='IMPINEFF'
V7 ='IMPORT'
V8 ='VALUE'
V9 ='PCVUTL'
V10='JOBSAT';
PROC CALIS COVARIANCE CORR RESIDUAL MODIFICATION KURTOSIS;
    LINEQS
        V5 = LV5F1 F1 + E5,
        V6 = LV6F1 F1 + E6,
        V7 = LV7F1 F1 + E7;
    STD
        V1-V4 = VARV1-VARV4,
        V9-V10 = VARV9-VARV10,
        E5-E7 = VARE5-VARE7,
        F1 = 1;
    COV
V1 V2 = CV1V2,
V1 V3 = CV1V3,
V1 V4 = CV1V4,
V1 F1 = CV1F1,
V1 V9 = CV1V9,
V1 V10= CV1V10,
V2 V3 = CV2V3,
V2 V4 = CV2V4,
V2 F1 = CV2F1,
V2 V9 = CV2V9,
V2 V10= CV2V10,
```

```
V3 V4 = CV3V4,
V3 F1 = CV3F1,
V3 V9 = CV3V9,
V3 V10= CV3V10,
V4 F1 = CV4F1,
V4 V9 = CV4V9,
V4 V10= CV4V10,
F1 V9 = CF1V9,
F1 V10= CVF1V10,
V9 V10= CV9V10;
VAR V1-V7 V9 V10;
    RUN;
```

PROGRAM FILE FROM INITIAL THEORETICAL MODEL RUN

```
options ls=80;
title 'OS THEORY';
DATA OS;
INFILE 'OSPRIME.TXT';
INPUT
.
.   {input statements here}
.
;
LABEL
V1 ='UDAYS'
V2 ='SATISF'
V3 ='ORGSPT'
V4 ='TSKTIME'
V5 ='IMPEFF'
V6 ='IMPINEFF'
V7 ='IMPORT'
V8 ='VALUE'
V9 ='PCVUTL'
V10='JOBSAT';
PROC CALIS COVARIANCE CORR RESIDUAL MODIFICATION KURTOSIS;
    LINEQS
        V1 = PV1V2 V2 + PV1V3 V3 + E1,
        V2 = PV2V4 V4 + PV2V9 V9 + PV2V10 V10 + E2,
        V3 = PV3F1 F1 + PV3V9 V9 + E3,
        V4 = PV4F1 F1 + E4,
        V5 =       F1 + E5,
        V6 = LV6F1 F1 + E6,
        V7 = LV7F1 F1 + E7;
    STD
        V9 = VARV9,
        V10= VARV10,
        E5-E7 = VARE5-VARE7,
        E1-E4 = VARE1-VARE4,
        F1 = VARF1;
    VAR V1-V7 V9-V10;
    RUN;
```

PROGRAM FILE FROM REVISED MODEL ONE RUN

```
options ls=80;
title 'OS REV1';
DATA OS;
INFILE 'OSPRIME.TXT';
INPUT
.
.   {input statements here}
.
;
LABEL
V1 ='UDAYS'
V2 ='SATISF'
V3 ='ORGSPT'
V4 ='TSKTIME'
V5 ='IMPEFF'
V6 ='IMPINEFF'
V7 ='IMPORT'
V8 ='VALUE'
V9 ='PCVUTL'
V10='JOBSAT';
PROC CALIS COVARIANCE CORR RESIDUAL MODIFICATION KURTOSIS;
    LINEQS
        V1 = PV1V2 V2 + PV1V3 V3 + PV1V4 V4 + E1,
        V2 = PV2V3 V3 + PV2V4 V4 + PV2V9 V9 + PV2V10 V10 +
E2,
        V3 = PV3F1 F1 + PV3V4 V4 + PV3V9 V9 + E3,
        V4 = PV4F1 F1 + PV4V9 V9 + E4,
        V5 =       F1 + E5,
        V6 = LV6F1 F1 + E6,
        V7 = LV7F1 F1 + E7,
        V9 = PV9F1 F1 + PV9V10 V10 + E9;
    STD
        V10= VARV10,
        E9 = VARE9,
        E5-E7 = VARE5-VARE7,
        E1-E4 = VARE1-VARE4,
        F1 = VARF1;
    VAR V1-V7 V9-V10;
    RUN;
```

OUTPUT FILE FROM REVISED MODEL ONE RUN

```
OS REV1                                       1
                                          22:45 Saturday, January 22, 2000

                            The CALIS Procedure
          Covariance Structure Analysis: Pattern and Initial Values

                          LINEQS Model Statement


                       Matrix      Rows    Columns    ------Matrix Type-------

 Term 1          1     _SEL_          9         18    SELECTION
                 2     _BETA_        18         18    EQSBETA          IMINUSINV
                 3     _GAMMA_       18         10    EQSGAMMA
                 4     _PHI_         10         10    SYMMETRIC


                        The 8 Endogenous Variables

     Manifest         V1    V2    V3    V4    V5    V6    V7    V9
     Latent


                        The 10 Exogenous Variables

     Manifest         V10
     Latent           F1
     Error            E1    E2    E3    E4    E5    E6    E7    E9
```

The CALIS Procedure
Covariance Structure Analysis: Pattern and Initial Values

Manifest Variable Equations with Initial Estimates

```
V1       =        .*V2     +       .*V3     +       .*V4     +  1.0000 E1
                   PV1V2            PV1V3            PV1V4


V2       =        .*V3     +       .*V4     +       .*V9     +       .*V10
                   PV2V3            PV2V4            PV2V9            PV2V10

                               +  1.0000 E2

V3       =        .*V4     +       .*V9     +       .*F1     +  1.0000 E3
                   PV3V4            PV3V9            PV3F1


V4       =        .*V9     +       .*F1     +  1.0000 E4
                   PV4V9            PV4F1


V5       =   1.0000 F1     +  1.0000 E5


V6       =        .*F1     +  1.0000 E6
                   LV6F1


V7       =        .*F1     +  1.0000 E7
                   LV7F1


V9       =        .*V10    +       .*F1     +  1.0000 E9
                   PV9V10           PV9F1
```

The CALIS Procedure
Covariance Structure Analysis: Pattern and Initial Values

Variances of Exogenous Variables

Variable	Parameter	Estimate
V10	VARV10	.
F1	VARF1	.
E1	VARE1	.
E2	VARE2	.
E3	VARE3	.
E4	VARE4	.
E5	VARE5	.
E6	VARE6	.
E7	VARE7	.
E9	VARE9	.

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Observations	86	Model Terms	1
Variables	9	Model Matrices	4
Informations	45	Parameters	26

Variable		Mean	Std Dev	Skewness	Kurtosis
V1	UDAYS	14.47674	15.08152	1.51204	1.51930
V2	SATISF	69.98837	7.81626	-0.53286	0.33807
V3	ORGSPT	41.22093	5.88997	-0.65846	0.03089
V4	TSKTIME	10.08140	3.36492	0.47039	0.69716
V5	IMPEFF	9.67442	2.12792	-0.73892	-0.29205
V6	IMPINEFF	9.43023	2.46166	-0.84190	-0.46066
V7	IMPORT	9.91860	2.07061	-0.93884	0.18327
V9	PCVUTL	49.38372	9.42359	-1.36856	2.44695
V10	JOBSAT	28.38372	4.25971	-0.64910	0.35317

Mardia's Multivariate Kurtosis	2.5942
Relative Multivariate Kurtosis	1.0262
Normalized Multivariate Kurtosis	0.8548
Mardia Based Kappa (Browne, 1982)	0.0262
Mean Scaled Univariate Kurtosis	0.1784
Adjusted Mean Scaled Univariate Kurtosis	0.1784

Observation Numbers with Largest Contribution to Kurtosis

2	38	47	32	28
108.8568	104.8207	97.7051	94.8770	76.8994

Covariances

		V1	V2	V3
V1	UDAYS	227.4523940	20.73502052	6.38755130
V2	SATISF	20.7350205	61.09398085	22.74377565
V3	ORGSPT	6.3875513	22.74377565	34.69179207
V4	TSKTIME	25.6195622	8.73036936	5.58180575
V5	IMPEFF	3.4982216	3.18440492	1.26101231
V6	IMPINEFF	2.9454172	2.39329685	1.59794802
V7	IMPORT	0.9451436	1.69316005	1.52407661
V9	PCVUTL	26.7678523	41.94569083	30.22010944
V10	JOBSAT	9.6266758	6.19274966	4.67893297

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Covariances

		V4	V5	V6
V1	UDAYS	25.61956224	3.498221614	2.945417237
V2	SATISF	8.73036936	3.184404925	2.393296854
V3	ORGSPT	5.58180575	1.261012312	1.597948016
V4	TSKTIME	11.32270862	1.415047880	2.211627907
V5	IMPEFF	1.41504788	4.528043776	4.577017784
V6	IMPINEFF	2.21162791	4.577017784	6.059781122
V7	IMPORT	1.19493844	3.926128591	4.364842681
V9	PCVUTL	12.43898769	5.585225718	4.797674419
V10	JOBSAT	2.10957592	-0.873597811	0.009439124

Covariances

		V7	V9	V10
V1	UDAYS	0.945143639	26.76785226	9.62667579
V2	SATISF	1.693160055	41.94569083	6.19274966
V3	ORGSPT	1.524076607	30.22010944	4.67893297
V4	TSKTIME	1.194938440	12.43898769	2.10957592
V5	IMPEFF	3.926128591	5.58522572	-0.87359781
V6	IMPINEFF	4.364842681	4.79767442	0.00943912
V7	IMPORT	4.287414501	4.16101231	-0.27428181
V9	PCVUTL	4.161012312	88.80396717	7.15690834
V10	JOBSAT	-0.274281806	7.15690834	18.14514364

Determinant 7885612656 Ln 22.788306

Set Covariances of Exogenous Manifest Variables

V10

NOTE: Some initial estimates computed by instrumental variable method.

NOTE: Some initial estimates computed by two-stage LS method.

NOTE: Some initial estimates computed by McDonald's method.

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Vector of Initial Estimates

	Parameter	Estimate	Type
1	PV1V2	0.10488	Matrix Entry: _BETA_[1:2]
2	PV1V3	-0.25598	Matrix Entry: _BETA_[1:3]
3	PV1V4	2.30800	Matrix Entry: _BETA_[1:4]
4	PV2V3	0.32420	Matrix Entry: _BETA_[2:3]
5	PV2V4	0.24039	Matrix Entry: _BETA_[2:4]
6	PV2V9	0.32000	Matrix Entry: _BETA_[2:8]
7	PV3V4	-0.06149	Matrix Entry: _BETA_[3:4]
8	PV3V9	0.22272	Matrix Entry: _BETA_[3:8]
9	PV4V9	0.28559	Matrix Entry: _BETA_[4:8]
10	PV2V10	0.10353	Matrix Entry: _GAMMA_[2:1]
11	PV3F1	0.91750	Matrix Entry: _GAMMA_[3:2]
12	PV4F1	0.08133	Matrix Entry: _GAMMA_[4:2]
13	LV6F1	1.11174	Matrix Entry: _GAMMA_[6:2]
14	LV7F1	0.95364	Matrix Entry: _GAMMA_[7:2]
15	PV9V10	0.26473	Matrix Entry: _GAMMA_[8:1]
16	PV9F1	2.91483	Matrix Entry: _GAMMA_[8:2]
17	VARV10	18.14514	Matrix Entry: _PHI_[1:1]
18	VARF1	4.11698	Matrix Entry: _PHI_[2:2]
19	VARE1	167.78295	Matrix Entry: _PHI_[3:3]
20	VARE2	37.55802	Matrix Entry: _PHI_[4:4]
21	VARE3	22.55841	Matrix Entry: _PHI_[5:5]
22	VARE4	11.43348	Matrix Entry: _PHI_[6:6]
23	VARE5	0.41107	Matrix Entry: _PHI_[7:7]
24	VARE6	0.97132	Matrix Entry: _PHI_[8:8]
25	VARE7	0.54329	Matrix Entry: _PHI_[9:9]
26	VARE9	51.30742	Matrix Entry: _PHI_[10:10]

Predetermined Elements of the Predicted Moment Matrix

		V1	V2	V3
V1	UDAYS	.	.	.
V2	SATISF	.	.	.
V3	ORGSPT	.	.	.
V4	TSKTIME	.	.	.
V5	IMPEFF	.	.	.
V6	IMPINEFF	.	.	.
V7	IMPORT	.	.	.
V9	PCVUTL	.	.	.
V10	JOBSAT	.	.	.

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Predetermined Elements of the Predicted Moment Matrix

		V4	V5	V6
V1	UDAYS	.	.	.
V2	SATISF	.	.	.
V3	ORGSPT	.	.	.
V4	TSKTIME	.	.	.
V5	IMPEFF	.	.	.
V6	IMPINEFF	.	.	.
V7	IMPORT	.	.	.
V9	PCVUTL	.	.	.
V10	JOBSAT	.	0	0

Predetermined Elements of the Predicted Moment Matrix

		V7	V9	V10
V1	UDAYS	.	.	.
V2	SATISF	.	.	.
V3	ORGSPT	.	.	.
V4	TSKTIME	.	.	.
V5	IMPEFF	.	.	0
V6	IMPINEFF	.	.	0
V7	IMPORT	.	.	0
V9	PCVUTL	.	.	.
V10	JOBSAT	0	.	.

WARNING: The predicted moment matrix has 3 constant elements whose values differ from those of the observed moment matrix. The sum of squared differences is 0.8384927418.

NOTE: Only 41 elements of the moment matrix are used in the model specification.

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Levenberg-Marquardt Optimization

Scaling Update of More (1978)

Parameter Estimates	26
Functions (Observations)	45

Optimization Start

Active Constraints	0	Objective Function	0.9879850031
Max Abs Gradient Element	2.3377867969	Radius	9.3301840171

Iter	Restarts	Func Calls	Act Con	Objective Function	Obj Fun Change	Max Abs Gradient Element	Lambda	Actual Over Pred Change
1	0	2	0	0.57447	0.4135	0.8341	0	0.375
2	0	3	0	0.31944	0.2550	0.1746	0	1.095
3	0	4	0	0.28161	0.0378	0.0195	0	1.186
4	0	5	0	0.28109	0.000521	0.000219	0	1.018
5	0	6	0	0.28109	1.003E-7	0.000012	0	1.023
6	0	7	0	0.28109	7.27E-10	4.161E-6	0	1.095

Optimization Results

Iterations	6	Function Calls	8
Jacobian Calls	7	Active Constraints	0
Objective Function	0.2810851016	Max Abs Gradient Element	4.1605339E-6
Lambda	0	Actual Over Pred Change	1.0947583549
Radius	0.0000883526		

GCONV convergence criterion satisfied.

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Predicted Model Matrix

		V1	V2	V3
V1	UDAYS	227.4912779	20.61391774	6.44131205
V2	SATISF	20.6139177	61.05455415	22.61041915
V3	ORGSPT	6.4413121	22.61041915	34.74121594
V4	TSKTIME	25.6478755	8.66489922	5.61664052
V5	IMPEFF	3.4127947	2.49370183	1.47468230
V6	IMPINEFF	3.7819415	2.76343441	1.63419210
V7	IMPORT	3.2382081	2.36613276	1.39924271
V9	PCVUTL	25.6092604	42.24378972	30.37818865
V10	JOBSAT	2.1848039	5.46013991	2.66651411

Predicted Model Matrix

		V4	V5	V6
V1	UDAYS	25.64787546	3.412794714	3.781941467
V2	SATISF	8.66489922	2.493701831	2.763434413
V3	ORGSPT	5.61664052	1.474682305	1.634192099
V4	TSKTIME	11.34181467	1.528924987	1.694301971
V5	IMPEFF	1.52892499	4.528043776	4.585695688
V6	IMPINEFF	1.69430197	4.585695688	6.059781122
V7	IMPORT	1.45071053	3.926405765	4.351107530
V9	PCVUTL	12.54557767	5.150236448	5.707314509
V10	JOBSAT	0.99425687	0.000000000	0.000000000

Predicted Model Matrix

		V7	V9	V10
V1	UDAYS	3.238208069	25.60926043	2.18480393
V2	SATISF	2.366132764	42.24378972	5.46013991
V3	ORGSPT	1.399242714	30.37818865	2.66651411
V4	TSKTIME	1.450710531	12.54557767	0.99425687
V5	IMPEFF	3.926405765	5.15023645	0.00000000
V6	IMPINEFF	4.351107530	5.70731451	0.00000000
V7	IMPORT	4.287414501	4.88676836	0.00000000
V9	PCVUTL	4.886768359	89.30529567	7.74421381
V10	JOBSAT	0.000000000	7.74421381	18.14514364

Determinant 10445016958 Ln 23.069391

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Fit Function	0.2811
Goodness of Fit Index (GFI)	0.9437
GFI Adjusted for Degrees of Freedom (AGFI)	0.8666
Root Mean Square Residual (RMR)	1.2749
Parsimonious GFI (Mulaik, 1989)	0.4980
Chi-Square	23.8922
Chi-Square DF	19
Pr > Chi-Square	0.2003
Independence Model Chi-Square	414.53
Independence Model Chi-Square DF	36
RMSEA Estimate	0.0550
RMSEA 90% Lower Confidence Limit	.
RMSEA 90% Upper Confidence Limit	0.1156
ECVI Estimate	0.9744
ECVI 90% Lower Confidence Limit	.
ECVI 90% Upper Confidence Limit	1.1807
Probability of Close Fit	0.4134
Bentler's Comparative Fit Index	0.9871
Elliptic Corrected Chi-Square	23.2822
Pr > Elliptic Corrected Chi-Square	0.2251
Normal Theory Reweighted LS Chi-Square	22.8363
Akaike's Information Criterion	-14.1078
Bozdogan's (1987) CAIC	-79.7404
Schwarz's Bayesian Criterion	-60.7404
McDonald's (1989) Centrality	0.9720
Bentler & Bonett's (1980) Non-normed Index	0.9755
Bentler & Bonett's (1980) NFI	0.9424
James, Mulaik, & Brett (1982) Parsimonious NFI	0.4974
Z-Test of Wilson & Hilferty (1931)	0.8420
Bollen (1986) Normed Index Rho1	0.8908
Bollen (1988) Non-normed Index Delta2	0.9876
Hoelter's (1983) Critical N	109

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Raw Residual Matrix

		V1	V2	V3
V1	UDAYS	-0.038883965	0.121102779	-0.053760755
V2	SATISF	0.121102779	0.039426703	0.133356501
V3	ORGSPT	-0.053760755	0.133356501	-0.049423878
V4	TSKTIME	-0.028313216	0.065470142	-0.034834778
V5	IMPEFF	0.085426900	0.690703094	-0.213669993
V6	IMPINEFF	-0.836524230	-0.370137560	-0.036244083
V7	IMPORT	-2.293064430	-0.672972709	0.124833893
V9	PCVUTL	1.158591825	-0.298098885	-0.158079215
V10	JOBSAT	7.441871862	0.732609748	2.012418861

Raw Residual Matrix

		V4	V5	V6
V1	UDAYS	-0.028313216	0.085426900	-0.836524230
V2	SATISF	0.065470142	0.690703094	-0.370137560
V3	ORGSPT	-0.034834778	-0.213669993	-0.036244083
V4	TSKTIME	-0.019106049	-0.113877108	0.517325936
V5	IMPEFF	-0.113877108	0.000000000	-0.008677904
V6	IMPINEFF	0.517325936	-0.008677904	0.000000000
V7	IMPORT	-0.255772090	-0.000277174	0.013735151
V9	PCVUTL	-0.106589982	0.434989270	-0.909640090
V10	JOBSAT	1.115319050	-0.873597811	0.009439124

Raw Residual Matrix

		V7	V9	V10
V1	UDAYS	-2.293064430	1.158591825	7.441871862
V2	SATISF	-0.672972709	-0.298098885	0.732609748
V3	ORGSPT	0.124833893	-0.158079215	2.012418861
V4	TSKTIME	-0.255772090	-0.106589982	1.115319050
V5	IMPEFF	-0.000277174	0.434989270	-0.873597811
V6	IMPINEFF	0.013735151	-0.909640090	0.009439124
V7	IMPORT	0.000000000	-0.725756047	-0.274281806
V9	PCVUTL	-0.725756047	-0.501328503	-0.587305466
V10	JOBSAT	-0.274281806	-0.587305466	0.000000000

Average Absolute Residual	0.536819
Average Off-diagonal Absolute Residual	0.653019

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Rank Order of the 10 Largest Raw Residuals

Row	Column	Residual
V10	V1	7.44187
V7	V1	-2.29306
V10	V3	2.01242
V9	V1	1.15859
V10	V4	1.11532
V9	V6	-0.90964
V10	V5	-0.87360
V6	V1	-0.83652
V10	V2	0.73261
V9	V7	-0.72576

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Asymptotically Standardized Residual Matrix

		V1	V2	V3
V1	UDAYS	-0.198332024	0.269293365	-0.351778309
V2	SATISF	0.269293365	0.105143497	0.455064271
V3	ORGSPT	-0.351778309	0.455064271	-0.513114364
V4	TSKTIME	-0.337366671	0.333821748	-0.513108275
V5	IMPEFF	0.029078801	0.492361628	-0.667700822
V6	IMPINEFF	-0.242322921	-0.222558590	-0.063428686
V7	IMPORT	-0.794663770	-0.485794960	0.296788683
V9	PCVUTL	0.117551087	-0.513134900	-0.513129762
V10	JOBSAT	1.098928033	0.736308661	0.890837397

Asymptotically Standardized Residual Matrix

		V4	V5	V6
V1	UDAYS	-0.337366671	0.029078801	-0.242322921
V2	SATISF	0.333821748	0.492361628	-0.222558590
V3	ORGSPT	-0.513108275	-0.667700822	-0.063428686
V4	TSKTIME	-0.513104492	-0.673931690	1.651265839
V5	IMPEFF	-0.673931690	0.000000000	-1.406387629
V6	IMPINEFF	1.651265839	-1.406387629	0.000000000
V7	IMPORT	-1.118528104	-0.072268232	1.343434702
V9	PCVUTL	-0.513115520	0.719662922	-0.941649650
V10	JOBSAT	0.779358202	-0.888557397	0.008299129

Asymptotically Standardized Residual Matrix

		V7	V9	V10
V1	UDAYS	-0.794663770	0.117551087	1.098928033
V2	SATISF	-0.485794960	-0.513134900	0.736308661
V3	ORGSPT	0.296788683	-0.513129762	0.890837397
V4	TSKTIME	-1.118528104	-0.513115520	0.779358202
V5	IMPEFF	-0.072268232	0.719662922	-0.888557397
V6	IMPINEFF	1.343434702	-0.941649650	0.008299129
V7	IMPORT	0.000000000	-0.994210726	-0.286700547
V9	PCVUTL	-0.994210726	-0.513142049	-0.513128538
V10	JOBSAT	-0.286700547	-0.513128538	0.000000000

Average Standardized Residual 0.515075
Average Off-diagonal Standardized Residual 0.592653

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Rank Order of the 10 Largest Asymptotically Standardized Residuals

Row	Column	Residual
V6	V4	1.65127
V6	V5	-1.40639
V7	V6	1.34343
V7	V4	-1.11853
V10	V1	1.09893
V9	V7	-0.99421
V9	V6	-0.94165
V10	V3	0.89084
V10	V5	-0.88856
V7	V1	-0.79466

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Distribution of Asymptotically Standardized Residuals

Each * Represents 1 Residuals

----------Range---------		Freq	Percent	
-1.50000	-1.25000	1	2.22	*
-1.25000	-1.00000	1	2.22	*
-1.00000	-0.75000	4	8.89	****
-0.75000	-0.50000	10	22.22	**********
-0.50000	-0.25000	4	8.89	****
-0.25000	0	5	11.11	*****
0	0.25000	8	17.78	********
0.25000	0.50000	5	11.11	*****
0.50000	0.75000	2	4.44	**
0.75000	1.00000	2	4.44	**
1.00000	1.25000	1	2.22	*
1.25000	1.50000	1	2.22	*
1.50000	1.75000	1	2.22	*

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Manifest Variable Equations with Estimates

```
V1       =   0.1049*V2       + -0.2560*V3       +  2.3080*V4
Std Err      0.2120 PV1V2       0.2766 PV1V3       0.4467 PV1V4
t Value      0.4948            -0.9254             5.1668

               +  1.0000 E1



V2       =   0.3242*V3       +  0.2404*V4       +  0.3200*V9
Std Err      0.1351 PV2V3       0.2156 PV2V4       0.0890 PV2V9
t Value      2.4002             1.1149             3.5947

               +  0.1035*V10      +  1.0000 E2
                  0.1590 PV2V10
                  0.6510

V3       =   0.1495*V4       +  0.3251*V9       + -0.1035*F1
Std Err      0.1739 PV3V4       0.0628 PV3V9       0.2812 PV3F1
t Value      0.8597             5.1813            -0.3682

               +  1.0000 E3



V4       =   0.1284*V9       +  0.2097*F1       +  1.0000 E4
Std Err      0.0366 PV4V9       0.1740 PV4F1
t Value      3.5055             1.2052




V5       =   1.0000 F1       +  1.0000 E5



V6       =   1.1082*F1       +  1.0000 E6
Std Err      0.0690 LV6F1
t Value     16.0689
```

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

```
V7      =   0.9488*F1       +  1.0000 E7
Std Err     0.0555 LV7F1
t Value    17.0831
```

```
V9      =   0.4268*V10      +  1.2446*F1       +  1.0000 E9
Std Err     0.2276 PV9V10      0.4884 PV9F1
t Value     1.8756             2.5485
```

Variances of Exogenous Variables

Variable	Parameter	Estimate	Standard Error	t Value
V10	VARV10	18.14514	2.78334	6.52
F1	VARF1	4.13810	0.70070	5.91
E1	VARE1	167.78295	25.73673	6.52
E2	VARE2	37.55802	5.76114	6.52
E3	VARE3	24.17729	3.70893	6.52
E4	VARE4	9.41053	1.44475	6.51
E5	VARE5	0.38995	0.12534	3.11
E6	VARE6	0.97807	0.20237	4.83
E7	VARE7	0.56187	0.13154	4.27
E9	VARE9	79.59019	12.25246	6.50

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Manifest Variable Equations with Standardized Estimates

```
V1       =   0.0543*V2      + -0.1000*V3      +  0.5153*V4      +  0.8588 E1
                    PV1V2             PV1V3             PV1V4


V2       =   0.2446*V3      +  0.1036*V4      +  0.3870*V9      +  0.0564*V10
                    PV2V3             PV2V4             PV2V9             PV2V10

                                +  0.7843 E2

V3       =   0.0854*V4      +  0.5213*V9      + -0.0357*F1      +  0.8342 E3
                    PV3V4             PV3V9             PV3F1


V4       =   0.3603*V9      +  0.1267*F1      +  0.9109 E4
                    PV4V9             PV4F1


V5       =   0.9560 F1      +  0.2935 E5


V6       =   0.9157*F1      +  0.4018 E6
                    LV6F1


V7       =   0.9322*F1      +  0.3620 E7
                    LV7F1


V9       =   0.1924*V10     +  0.2679*F1      +  0.9440 E9
                    PV9V10            PV9F1
```

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Squared Multiple Correlations

	Variable	Error Variance	Total Variance	R-Square
1	V1	167.78295	227.49128	0.2625
2	V2	37.55802	61.05455	0.3848
3	V3	24.17729	34.74122	0.3041
4	V4	9.41053	11.34181	0.1703
5	V5	0.38995	4.52804	0.9139
6	V6	0.97807	6.05978	0.8386
7	V7	0.56187	4.28741	0.8689
8	V9	79.59019	89.30530	0.1088

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Lagrange Multiplier and Wald Test Indices _PHI_[10:10]
Diagonal Matrix
Univariate Tests for Constant Constraints
Lagrange Multiplier or Wald Index / Probability / Approx Change of Value

	V10	F1	E1	E2	E3
V10	42.5000 . . [VARV10]	0.2633 0.6079 -0.4929	0.8086 0.3685 5.4584	. . . Sing	0.7975 0.3718 2.0707
F1	0.2633 0.6079 -0.4929	34.8767 . . [VARF1]	0.0821 0.7744 -0.8637	0.0201 0.8872 0.2062	. . . Sing
E1	0.8086 0.3685 5.4584	0.0821 0.7744 -0.8637	42.5000 . . [VARE1]	0.0922 0.7614 -6.8619	0.0286 0.8658 -2.5516
E2	. . . Sing	0.0201 0.8872 0.2062	0.0922 0.7614 -6.8619	42.5000 . . [VARE2]	0.0201 0.8872 11.6379
E3	0.7975 0.3718 2.0707	. . . Sing	0.0286 0.8658 -2.5516	0.0201 0.8872 11.6379	42.4931 . . [VARE3]
E4	0.8632 0.3529 1.3445	. . . Sing	0.0001 0.9912 -0.1383	0.0201 0.8872 -2.2366	. . . Sing
E5	3.5406 0.0599 -0.7336	. . . Sing	2.3550 0.1249 1.8168	3.3161 0.0686 1.0200	1.9555 0.1620 -0.6416
E6	1.7433 0.1867 0.6838	. . . Sing	0.8643 0.3525 -1.4633	0.4525 0.5012 -0.5009	0.1552 0.6936 0.2371

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Lagrange Multiplier and Wald Test Indices _PHI_[10:10]
Diagonal Matrix
Univariate Tests for Constant Constraints
Lagrange Multiplier or Wald Index / Probability / Approx Change of Value

	E4	E5	E6	E7	E9
V10	0.8632	3.5406	1.7433	0.3496	.
	0.3529	0.0599	0.1867	0.5544	.
	1.3445	-0.7336	0.6838	0.2418	.
					Sing
F1	.	.	.	.	.
	.	.	.	.	.
	.	.	.	.	.
	Sing	Sing	Sing	Sing	Sing
E1	0.0001	2.3550	0.8643	0.9355	0.0001
	0.9912	0.1249	0.3525	0.3334	0.9921
	-0.1383	1.8168	-1.4633	-1.2018	0.1598
E2	0.0201	3.3161	0.4525	1.7624	0.0201
	0.8872	0.0686	0.5012	0.1843	0.8872
	-2.2366	1.0200	-0.5009	-0.7805	-3.1869
E3	.	1.9555	0.1552	1.4146	0.7975
	.	0.1620	0.6936	0.2343	0.3718
	.	-0.6416	0.2371	0.5665	-21.2817
	Sing				
E4	42.4268	1.2709	4.8423	0.6050	0.8632
	.	0.2596	0.0278	0.4367	0.3529
	.	-0.3233	0.8269	-0.2315	-13.8181
	[VARE4]				
E5	1.2709	9.6791	1.9780	0.0052	3.4481
	0.2596	.	0.1596	0.9424	0.0633
	-0.3233	.	-1.0226	-0.0485	1.5585
		[VARE5]			
E6	4.8423	1.9780	23.3578	1.8046	1.1967
	0.0278	0.1596	.	0.1792	0.2740
	0.8269	-1.0226	.	0.8494	-1.1996
			[VARE6]		

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Lagrange Multiplier and Wald Test Indices _PHI_[10:10]
Diagonal Matrix
Univariate Tests for Constant Constraints
Lagrange Multiplier or Wald Index / Probability / Approx Change of Value

	V10	F1	E1	E2	E3
E7	0.3496	.	0.9355	1.7624	1.4146
	0.5544	.	0.3334	0.1843	0.2343
	0.2418	.	-1.2018	-0.7805	0.5665
		Sing			
E9	.	.	0.0001	0.0201	0.7975
	.	.	0.9921	0.8872	0.3718
	.	.	0.1598	-3.1869	-21.2817
	Sing	Sing			

Lagrange Multiplier and Wald Test Indices _PHI_[10:10]
Diagonal Matrix
Univariate Tests for Constant Constraints
Lagrange Multiplier or Wald Index / Probability / Approx Change of Value

	E4	E5	E6	E7	E9
E7	0.6050	0.0052	1.8046	18.2467	1.0118
	0.4367	0.9424	0.1792	.	0.3145
	-0.2315	-0.0485	0.8494	.	-0.8746
				[VARE7]	
E9	0.8632	3.4481	1.1967	1.0118	42.1961
	0.3529	0.0633	0.2740	0.3145	.
	-13.8181	1.5585	-1.1996	-0.8746	.
					[VARE9]

Rank Order of the 10 Largest Lagrange Multipliers in _PHI_

Row	Column	Chi-Square	Pr > ChiSq
E6	E4	4.84230	0.0278
E5	V10	3.54055	0.0599
E9	E5	3.44809	0.0633
E5	E2	3.31608	0.0686
E5	E1	2.35504	0.1249
E6	E5	1.97799	0.1596
E5	E3	1.95554	0.1620
E7	E6	1.80463	0.1792
E7	E2	1.76237	0.1843

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Rank Order of the 10 Largest Lagrange Multipliers in _PHI_

Row	Column	Chi-Square	Pr > ChiSq
E6	V10	1.74332	0.1867

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Lagrange Multiplier and Wald Test Indices _GAMMA_[8:2]
General Matrix
Univariate Tests for Constant Constraints
Lagrange Multiplier or Wald Index / Probability / Approx Change of Value

	V10	F1
V1	0.8086	0.0821
	0.3685	0.7744
	0.3008	-0.2087
V2	0.4238	0.0201
	.	0.8872
	.	0.0498
	[PV2V10]	
V3	0.7975	0.1355
	0.3718	.
	0.1141	.
		[PV3F1]
V4	0.8632	1.4525
	0.3529	.
	0.0741	.
		[PV4F1]
V5	3.5406	.
	0.0599	.
	-0.0404	.
		Sing
V6	1.7433	258.2105
	0.1867	.
	0.0377	.
		[LV6F1]
V7	0.3496	291.8334
	0.5544	.
	0.0133	.
		[LV7F1]
V9	3.5178	6.4946
	.	.
	.	.
	[PV9V10]	[PV9F1]

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Rank Order of the 5 Largest Lagrange Multipliers in _GAMMA_

Row	Column	Chi-Square	Pr > ChiSq
V5	V10	3.54055	0.0599
V6	V10	1.74332	0.1867
V4	V10	0.86315	0.3529
V1	V10	0.80863	0.3685
V3	V10	0.79750	0.3718

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Lagrange Multiplier and Wald Test Indices _BETA_[8:8]
General Matrix
Identity-Minus-Inverse Model Matrix
Univariate Tests for Constant Constraints
Lagrange Multiplier or Wald Index / Probability / Approx Change of Value

	V1	V2	V3	V4
V1	.	0.2448	0.8563	26.6954
	.	.	.	.
	.	.	.	.
	Sing	[PV1V2]	[PV1V3]	[PV1V4]
V2	0.0922	.	5.7608	1.2430
	0.7614	.	.	.
	-0.0409	.	.	.
		Sing	[PV2V3]	[PV2V4]
V3	0.0261	0.7179	.	0.7391
	0.8717	0.3968	.	.
	-0.0145	0.9105	.	.
			Sing	[PV3V4]
V4	0.0000	0.1024	.	.
	0.9966	0.7490	.	.
	-0.0003	0.1179	.	.
			Sing	Sing
V5	1.4496	2.9078	0.2524	0.3005
	0.2286	0.0882	0.6154	0.5836
	0.0074	0.0204	-0.0080	-0.0157
V6	0.0022	0.3180	0.0055	3.1459
	0.9626	0.5728	0.9411	0.0761
	0.0004	-0.0089	0.0015	0.0663
V7	2.1802	1.7889	0.2285	1.0738
	0.1398	0.1811	0.6326	0.3001
	-0.0095	-0.0167	0.0079	-0.0307
V9	0.0103	0.1672	0.9515	0.8632
	0.9191	0.6826	0.3294	0.3529
	-0.0096	-0.2386	-0.9573	-1.4684

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Lagrange Multiplier and Wald Test Indices _BETA_[8:8]
General Matrix
Identity-Minus-Inverse Model Matrix
Univariate Tests for Constant Constraints
Lagrange Multiplier or Wald Index / Probability / Approx Change of Value

	V5	V6	V7	V9
V1	0.0058	0.3519	0.3187	0.0201
	0.9394	0.5530	0.5724	0.8873
	0.0516	-0.3472	-0.3931	0.0284
V2	0.2978	0.0150	0.0879	12.9221
	0.5853	0.9024	0.7669	.
	0.1781	-0.0345	-0.0992	.
				[PV2V9]
V3	1.9555	0.1552	1.4146	26.8454
	0.1620	0.6936	0.2343	.
	-1.6453	0.2424	1.0083	.
				[PV3V9]
V4	1.2709	4.8424	0.6050	12.2887
	0.2596	0.0278	0.4367	.
	-0.8290	0.8454	-0.4119	.
				[PV4V9]
V5	.	1.9781	0.0052	2.0499
	.	0.1596	0.9423	0.1522
	.	-1.0456	-0.0862	0.0148
	Sing			
V6	1.9778	.	1.8048	0.6481
	0.1596	.	0.1791	0.4208
	-2.6225	.	1.5117	-0.0109
		Sing		
V7	0.0052	1.8047	.	0.7487
	0.9425	0.1791	.	0.3869
	-0.1243	0.8684	.	-0.0093
			Sing	
V9	3.4479	1.1968	1.0119	.
	0.0633	0.2740	0.3145	.
	3.9966	-1.2265	-1.5565	.
				Sing

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Rank Order of the 10 Largest Lagrange Multipliers in _BETA_

Row	Column	Chi-Square	Pr > ChiSq
V4	V6	4.84237	0.0278
V9	V5	3.44795	0.0633
V6	V4	3.14594	0.0761
V5	V2	2.90779	0.0882
V7	V1	2.18017	0.1398
V5	V9	2.04994	0.1522
V5	V6	1.97815	0.1596
V6	V5	1.97776	0.1596
V3	V5	1.95550	0.1620
V6	V7	1.80476	0.1791

Stepwise Multivariate Wald Test

	------Cumulative Statistics-----			--Univariate Increment--	
Parameter	Chi-Square	DF	Pr > ChiSq	Chi-Square	Pr > ChiSq
PV3F1	0.13554	1	0.7128	0.13554	0.7128
PV1V2	0.38036	2	0.8268	0.24482	0.6207
PV2V10	0.80417	3	0.8485	0.42382	0.5150
PV1V3	1.42533	4	0.8398	0.62116	0.4306
PV3V4	2.09328	5	0.8361	0.66795	0.4138
PV2V4	3.32564	6	0.7670	1.23236	0.2669
PV4F1	4.77376	7	0.6876	1.44812	0.2288
PV9V10	8.29195	8	0.4055	3.51820	0.0607

Input Data for Structural Equation Model Programs

Obs	UserID	Udays	V1	Uhits	Uhrs	R1	R2	R3	R4	R5	R6	R7	R8	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	R22	R23
1	25	6	6	31	0.009	1	1	7	1	1	1	1	1	1	1	1	1	1	1	6	6	6	6	7	6	6	6
2	26	45	45	1257	4.483	1	1	7	2	1	2	2	1	2	2	2	2	2	2	6	6	3	3	6	4	4	4
3	30	24	24	579	2.167	1	2	7	1	1	2	1	1	1	1	1	1	2	1	6	6	4	1	4	6	6	7
4	35	4	4	202	0.339	1	2	7	1	1	1	1	1	1	1	1	1	1	1	6	6	4	4	7	7	6	7
5	36	2	2	3	0.001	1	1	7	1	1	1	1	1	1	1	1	1	1	1	6	6	6	3	7	4	4	4
6	39	2	2	3	0.001	6	3	6	6	4	4	5	4	4	5	4	5	4	4	6	6	2	1	6	6	6	4
7	40	2	2	8	0.008	1	2	7	1	1	1	2	1	1	2	2	2	2	1	6	6	5	4	7	7	7	7
8	46	2	2	6	0.001	3	3	7	5	2	5	2	2	1	5	2	2	2	2	6	6	4	4	5	2	4	4
9	55	5	5	70	0.095	1	2	7	2	1	1	1	1	1	1	1	1	1	1	6	6	6	5	6	7	6	6
10	56	1	1	4	0.005	5	5	7	1	1	1	2	1	1	2	1	1	2	2	6	6	4	6	6	4	5	6
11	58	9	9	168	0.253	1	2	6	2	2	2	1	1	1	1	1	1	4	2	6	6	6	4	6	4	6	6
12	59	1	1	3	0.001	1	1	7	1	1	1	1	1	1	1	1	1	1	1	6	6	6	4	7	4	4	6
13	60	15	15	395	1.122	4	4	6	4	1	1	1	1	2	4	2	2	4	4	6	3	3	4	6	4	6	6
14	61	17	17	312	0.555	1	1	7	1	1	1	1	1	1	1	1	1	1	1	6	6	6	6	7	6	7	6
15	62	3	3	34	0.068	1	1	7	1	1	1	1	1	1	1	1	1	1	1	6	6	3	3	7	6	6	5
16	63	2	2	34	0.088	2	1	7	2	2	5	3	2	2	5	3	2	1	2	6	6	2	1	3	6	7	6
17	64	25	25	370	1.061	2	2	7	2	1	2	2	2	2	2	1	1	2	2	6	6	3	1	4	6	6	6
18	65	35	35	326	1.600	2	2	7	1	1	2	1	1	1	2	1	1	2	1	6	6	3	1	5	4	6	4
19	66	2	2	13	0.088	1	1	7	1	1	1	1	1	1	2	1	1	1	1	6	6	4	4	6	6	6	7
20	78	8	8	44	0.357	1	3	1	2	1	1	2	1	1	1	1	1	1	1	6	6	6	6	7	6	7	7
21	87	27	27	491	1.949	4	3	6	2	2	4	2	4	4	4	4	4	4	4	6	6	3	1	7	6	6	6
22	92	29	29	513	2.567	1	3	7	2	2	2	1	2	2	5	2	2	2	2	6	6	6	6	6	6	6	7
23	96	4	4	10	0.104	1	1	7	1	1	2	1	1	1	2	2	2	2	1	6	6	6	6	6	6	6	3
24	102	13	13	77	0.557	2	2	7	2	1	2	2	1	2	3	1	1	2	2	6	6	3	4	6	6	6	6
25	103	49	49	1192	6.209	2	2	7	2	2	2	2	2	2	2	2	1	2	2	6	6	4	3	7	6	7	6
26	104	3	3	58	0.024	1	1	7	1	1	2	1	1	1	1	1	1	2	1	6	6	4	3	7	6	6	6
27	105	32	32	681	2.783	1	3	7	1	1	5	2	1	1	1	1	1	1	1	6	6	2	1	5	5	6	5
28	116	1	1	1	0.000	1	1	7	2	1	1	1	1	1	1	1	1	1	1	6	6	4	3	7	6	6	6
29	122	11	11	115	0.401	1	1	7	2	2	1	2	1	2	2	2	2	2	2	6	6	4	1	7	7	6	6
30	123	43	43	374	2.882	1	1	7	1	1	1	1	1	1	1	1	1	1	1	6	6	6	4	7	7	7	7
31	126	8	8	44	0.373	2	2	7	2	2	2	2	2	2	2	2	2	2	2	6	6	5	5	4	6	6	6
32	128	25	25	418	2.634	5	4	6	5	4	4	3	4	4	5	4	3	5	.	4	4	1	2	3	4	5	4
33	132	7	7	44	0.063	2	2	6	1	2	3	2	1	1	2	2	2	2	2	6	6	3	1	5	6	6	6
34	133	34	34	1114	3.492	2	2	6	2	.	5	2	2	2	5	3	5	2	5	6	6	3	3	4	5	3	3
35	135	55	55	2077	9.009	1	1	7	1	1	1	1	1	1	1	1	1	1	1	6	6	5	5	7	4	4	4
36	137	5	5	75	0.380	4	2	7	6	2	2	2	2	2	5	2	2	2	2	6	6	3	3	7	6	5	5
37	152	10	10	82	0.054	7	1	7	1	1	1	1	1	1	1	1	1	1	1	6	6	3	3	7	1	4	7
38	153	9	9	160	0.204	1	1	7	1	2	5	1	1	1	5	1	2	5	1	6	6	3	1	7	6	6	6
39	155	5	5	137	0.188	1	1	7	1	1	2	1	1	1	1	1	1	1	1	6	6	3	1	6	6	6	4
40	159	33	33	553	4.121	1	1	7	1	1	1	1	1	1	2	1	1	2	1	6	6	6	4	7	4	4	6
41	171	10	10	372	0.605	5	5	6	6	3	4	5	5	5	5	5	5	5	5	6	6	6	1	5	6	3	1
42	172	2	2	7	0.009	3	6	7	1	1	5	3	2	1	5	2	1	2	1	6	6	5	1	5	6	6	2
43	175	13	13	145	0.551	7	1	7	1	2	5	2	1	2	6	1	2	2	1	6	6	4	1	4	6	6	6
44	177	19	19	256	1.425	2	2	7	4	3	2	2	2	2	3	2	2	2	2	6	6	6	4	6	4	5	3

Obs	R24	R25	R26	R27	R28	R30	R31	R32	R33	R34	R35	R36	R37	R39	R40	R41	R42	R44	R45	R46	R47	R48	R49	R50	R51	R52	R53	R54	R55	R56	R57	R58	R59
1	6	1	1	2	1	7	1	7	7	4	3	5	4	3	2	2	5	3	2	1	1	1	6	6	6	6	6	4	6	1	6	6	6
2	4	1	1	2	1	6	2	6	4	4	1	1	4	3	1	1	5	4	1	1	3	1	6	6	6	6	7	6	6	1	6	4	5
3	7	2	1	2	1	7	1	7	6	2	3	5	5	5	2	2	5	4	1	1	2	2	6	6	7	6	7	7	7	1	7	7	7
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5	7	1	2	2	1	6	5	6	4	5	2	1	4	4	2	1	4	4	2	3	2	2	7	5	5	5	5	5	5	1	4	4	4
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9	7	2	2	2	1	7	1	6	6	5	2	5	4	3	2	3	5	4	2	1	3	2	7	7	7	7	7	7	7	1	7	6	6
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33	6	4	4	4	4	6	2	6	5	2	2	4	6	2	2	1	3	2	3	6	5	3	7	6	6	6	6	6	6	2	6	6	5
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Obs	R60	R61	R62	R63	R64	R65	R66	R67	R68	R69	R70	R71	R72	R73	R74	R75	R76	R77	R78	R79	R80	R81	R82	R83	R84	R85	R86	R87	R88	R89	R90	R91	R92
1	6	6	6	6	6	6	6	6	6	6	6	6	4	2	2	3	3	4	3	2	4	3	3	3	2	2	2	2	3	3	3	6	6
2	5	6	6	5	6	6	6	6	6	6	6	6	2	4	5	2	3	4	2	2	2	2	2	3	2	2	3	2	2	2	2	6	6
3	7	7	7	7	7	7	7	7	7	7	7	7	1	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	4	7	4
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8	6	6	6	6	6	6	6	5	6	5	6	6	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	7	5
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14	6	6	6	4	6	6	6	6	6	6	6	6	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	6	5
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23	6	6	6	5	6	6	6	6	6	5	5	6	2	5	5	2	2	2	2	1	2	2	2	2	2	1	2	2	2	1	2	6	7
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38	4	4	4	4	4	4	6	6	6	6	6	6	2	2	2	2	3	2	1	1	2	2	2	2	2	2	2	2	2	2	2	6	2
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41	6	6	7	7	7	7	5	5	6	6	6	5	2	2	3	2	2	2	1	1	1	2	2	1	2	2	1	2	2	2	7	5	6
42	5	5	5	5	5	7	7	7	7	6	7	6	2	2	2	2	3	2	2	2	2	2	1	2	2	2	2	2	2	2	5	7	5
43	6	6	6	6	6	6	6	6	6	6	6	6	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	6	6	6
44	4	6	6	6	6	6	4	5	5	6	5	5	4	3	4	3	4	4	2	2	2	2	2	2	2	2	2	2	2	2	6	6	6

Obs	R93	R94	R146	R147	R148	R149	R150	R151	R152	R153	R154	R155	R156	R157	R158	R159	R160	R161	R162	R163	R164	R165	R166	R167	R168	R169	R170	R171	R172	R173	R174	R175	R176
1	3	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	2	3	5	6	4	6	6	6	6	1	3	1	4	4	5	3	2	1	1	7	2	2	2	2	2	6	6	6	1	1	2	2	2
3	2	6	6	6	4	7	7	7	7	1	3	6	5	1	4	2	2	1	4	7	1	1	1	1	1	6	7	7	4	2	1	1	1
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6	4	4	6	5	5	6	6	6	6	1	4	4	3	3	3	1	1	4	4	6	5	4	5	6	2	6	7	7	1	1	3	3	3
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11	2	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
12	2	2	4	4	6	6	4	2	6	3	4	1	3	4	1	1	1	1	1	7	1	1	1	1	1	6	7	7	1	2	1	1	1
13	2	4	6	6	6	6	7	6	6	1	3	4	2	1	3	3	3	1	2	7	4	1	2	2	2	6	6	6	2	2	1	1	1
14	2	2	4	4	4	6	6	4	4	1	6	5	3	2	5	3	3	1	1	7	1	1	1	1	1	6	7	7	2	2	1	1	1
15	3	4	4	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
16	1	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
17	2	6	6	6	6	7	6	6	7	1	3	4	2	3	4	4	1	1	2	7	2	1	5	1	1	6	7	7	2	2	1	1	1
18	2	3	6	6	4	5	6	4	6	4	4	3	3	3	4	3	2	1	2	7	2	2	2	2	4	6	5	4	2	3	2	2	2
19	4	4	6	6	6	6	6	6	6	2	2	5	3	3	5	3	1	1	1	7	1	1	1	1	5	6	6	4	4	2	1	1	1
20	4	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
21	5	5	3	3	3	6	4	3	6	1	5	1	3	3	5	2	1	4	2	6	2	2	2	2	4	6	6	4	1	2	2	2	2
22	2	6	3	4	6	6	6	6	7	1	3	5	3	3	5	4	2	2	4	6	2	2	2	2	4	6	6	4	2	2	2	2	2
23	2	7	6	6	6	6	6	4	6	2	3	1	3	1	5	5	4	1	1	7	1	2	2	1	2	6	7	7	2	2	1	2	2
24	4	4	4	4	3	6	5	4	6	1	2	4	2	1	5	3	2	1	2	7	2	2	2	1	2	6	7	4	3	3	1	2	2
25	4	4	5	5	2	5	5	5	5	1	1	5	1	3	5	5	4	1	2	7	2	2	2	2	5	6	7	5	3	2	2	2	3
26	3	4	2	2	2	4	3	3	4	1	3	4	4	1	5	4	3	1	1	7	1	1	2	1	2	6	6	6	2	1	1	1	1
27	4	4	6	5	2	2	6	4	4	1	3	4	3	2	5	3	3	2	4	6	2	2	4	2	2	6	5	6	2	2	2	2	5
28	6	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
29	2	2	6	6	3	4	4	4	4	1	6	3	5	1	5	2	1	1	2	7	4	2	2	2	2	6	7	7	1	2	2	2	4
30	2	6	6	6	6	6	6	6	6	3	3	4	3	2	5	5	4	1	2	7	1	1	2	1	2	6	6	6	2	2	1	1	1
31	3	3	6	5	5	6	5	5	5	1	5	6	5	2	4	3	2	3	2	7	2	1	7	1	6	6	4	3	4	1	1	1	1
32	2	4	4	4	4	6	6	4	6	1	4	3	4	1	3	3	3	5	4	6	5	3	3	2	2	4	6	6	2	2	2	4	5
33	2	2	6	6	6	6	7	4	6	1	3	3	3	2	4	3	3	2	2	6	1	2	2	2	2	6	6	4	2	2	1	2	2
34	2	6	6	6	5	4	6	4	4	1	2	5	5	4	4	3	2	2	2	6	2	2	2	2	2	6	6	5	3	2	2	2	5
35	2	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
36	4	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
37	2	2	5	6	4	4	6	6	4	1	2	3	2	1	5	5	4	7	1	7	1	1	1	1	4	6	6	4	2	1	1	1	1
38	2	2	7	6	6	6	6	4	6	1	6	1	2	1	5	5	2	1	2	7	1	1	7	2	2	6	6	6	1	1	1	1	1
39	4	2	6	3	2	4	6	3	4	1	6	1	4	3	5	5	1	1	1	7	2	1	1	1	4	6	6	6	1	2	1	1	1
40	2	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
41	5	6	4	4	3	6	3	2	6	1	2	4	3	1	3	3	3	2	2	6	2	2	2	2	2	6	6	6	2	2	2	2	2
42	2	2	6	6	2	6	5	5	5	1	4	2	2	2	4	4	2	1	2	7	2	2	3	2	2	6	7	6	2	1	1	1	2
43	2	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
44	2	4	5	6	2	6	6	4	6	1	5	4	3	3	3	3	2	2	2	7	2	2	4	2	2	6	7	6	2	2	2	2	4

Obs	R177	R178	R179	R180	R181	R182	R183	R184	R185	R186	R187	R188	R189	R190	R191	R192	R193	R194	V2	V3	V4	V5	V6	V7	V8	V9	V10
1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	64	41	12	10	12	12	12	54	32
2	2	2	2	2	6	3	3	5	5	6	6	2	4	5	4	4	1	1	70	44	4	11	10	12	12	49	26
3	1	1	1	1	5	2	3	6	6	6	7	1	7	4	3	3	2	2	84	47	12	11	10	11	12	63	33
4	1	1	1	1	7	2	3	6	7	6	7	1	7	5	3	5	5	4	72	46	10	12	12	12	12	62	26
5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	62	38	6	10	11	10	10	33	22
6	3	4	3	5	6	3	3	6	3	5	5	2	6	1	1	2	1	1	56	43	10	11	11	11	12	51	27
7	1	1	1	1	7	1	1	7	7	6	7	1	7	4	2	3	2	1	73	51	7	10	11	11	12	56	35
8	1	1	2	2	6	3	3	6	6	7	7	1	7	1	1	2	2	1	72	31	11	10	11	11	12	54	27
9	1	1	1	1	7	3	3	7	7	7	7	1	7	3	2	3	1	1	84	50	12	10	9	10	12	55	29
10	2	2	2	2	6	5	4	5	4	3	3	6	5	1	1	3	2	1	74	42	14	11	11	11	12	58	19
11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	72	43	16	9	11	10	10	44	33
12	1	1	1	1	7	1	2	4	6	3	7	4	7	2	1	1	1	1	75	40	11	10	10	10	11	35	27
13	1	2	2	2	7	2	2	6	6	6	6	2	7	3	3	3	2	1	74	43	16	9	10	11	12	54	32
14	1	1	1	1	7	3	3	4	7	6	7	1	7	5	2	2	1	1	72	39	13	10	10	12	12	52	34
15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	54	31	8	10	11	10	8	20	27
16	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	81	49	6	11	11	12	12	51	30
17	1	1	1	1	6	3	2	6	6	6	7	1	7	4	2	3	2	1	73	42	13	9	9	10	10	57	33
18	2	2	2	2	5	3	2	6	6	4	5	3	5	3	2	2	2	2	66	40	12	10	10	10	12	47	27
19	1	1	1	1	7	2	3	6	6	6	6	2	7	3	2	3	1	1	71	41	14	12	12	12	12	53	30
20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80	48	14	11	11	12	12	62	27
21	2	2	2	2	7	3	2	6	6	6	6	2	6	2	1	2	1	1	55	37	7	12	12	12	12	45	25
22	3	2	2	2	5	3	3	4	4	5	5	2	6	5	3	3	2	2	79	40	10	6	6	4	10	48	24
23	2	2	2	2	7	2	2	6	6	5	7	1	7	1	1	2	1	1	75	46	6	4	4	4	8	53	35
24	1	1	2	1	6	2	2	4	4	6	7	1	6	3	2	3	2	2	72	44	11	8	8	8	12	54	30
25	2	2	2	2	7	1	2	7	7	6	7	1	7	3	1	3	1	1	71	49	14	9	10	9	11	54	30
26	1	1	1	1	7	3	4	6	6	6	6	4	6	2	1	2	1	1	67	30	5	6	4	6	7	34	26
27	2	2	2	2	6	3	2	4	6	6	5	3	6	3	2	4	2	1	60	41	8	4	4	6	9	50	34
28	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60	24	4	12	12	12	12	48	31
29	2	2	2	2	6	4	4	6	6	4	6	2	4	1	1	2	1	1	72	49	11	6	6	6	7	55	33
30	1	1	1	1	7	2	2	6	6	6	6	2	6	5	3	4	3	3	78	47	10	12	12	10	11	48	29
31	1	1	1	1	4	4	3	5	6	3	4	4	6	5	2	2	1	1	72	37	11	12	12	12	12	54	15
32	4	4	4	4	3	3	3	4	4	4	6	2	5	3	3	4	1	3	72	37	10	10	5	8	9	54	30
33	2	2	2	2	5	2	2	6	6	6	6	2	6	2	2	2	1	1	74	45	9	7	5	7	4	53	29
34	2	2	2	2	5	2	3	5	6	6	6	2	4	4	2	4	3	3	72	39	10	12	12	12	12	56	30
35	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75	33	14	12	10	10	11	51	25
36	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	72	43	10	8	10	8	12	36	25
37	1	1	1	1	7	2	2	6	6	6	6	2	6	3	1	5	1	1	72	41	6	6	4	6	6	42	26
38	1	1	1	1	7	5	1	7	6	6	6	2	6	1	1	2	1	1	74	47	9	7	5	10	11	38	28
39	1	1	1	1	7	5	3	4	6	2	6	2	6	1	1	2	1	1	72	39	10	10	10	11	12	54	30
40	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	72	40	15	12	12	12	12	36	30
41	2	2	2	2	6	3	3	4	4	4	6	2	6	4	2	2	2	2	77	47	9	11	10	11	10	58	21
42	1	1	1	2	6	3	2	6	6	6	7	2	6	2	1	2	1	1	73	41	10	8	7	7	12	47	34
43	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	72	38	9	10	10	10	10	54	29
44	2	2	2	2	6	3	3	4	6	4	6	2	6	4	2	3	2	1	72	48	11	7	9	9	11	46	27

Obs	UserID	Udays	V1	Uhits	Uhrs	R1	R2	R3	R4	R5	R6	R7	R8	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	R22	R23
45	178	18	18	325	0.638	1	1	7	1	1	1	1	1	1	1	1	1	1	1	6	3	1	1	7	7	7	7
46	179	4	4	14	0.039	4	4	6	4	4	5	4	4	5	5	5	2	4	5	6	6	1	1	6	5	5	6
47	180	64	64	1576	8.625	1	4	7	1	1	1	1	1	2	4	2	1	2	1	6	6	6	6	6	4	6	6
48	181	9	9	138	0.225	5	4	7	2	2	2	2	2	2	4	2	2	2	2	6	6	4	3	6	6	6	6
49	192	54	54	1476	12.213	1	1	7	1	1	1	1	1	1	2	1	1	1	1	6	6	6	4	6	6	6	6
50	193	11	11	64	0.483	2	2	7	1	1	2	2	1	1	1	1	1	1	1	6	6	4	5	6	4	6	6
51	194	1	1	14	0.009	1	2	1	2	1	1	1	1	1	1	1	1	2	1	6	6	5	6	7	6	6	6
52	201	28	28	265	2.260	1	3	7	2	1	3	3	2	2	5	3	2	2	2	6	6	4	4	7	6	6	6
53	202	7	7	102	1.223	1	1	7	1	1	1	1	1	1	1	1	1	1	1	6	6	5	5	6	4	4	6
54	203	33	33	401	2.407	5	5	7	1	1	1	1	1	1	1	1	1	2	1	6	6	3	2	5	6	6	7
55	207	13	13	193	0.620	2	3	7	1	1	2	2	4	2	6	2	1	2	2	6	6	3	1	5	4	6	6
56	208	4	4	7	0.001	1	2	7	2	2	2	1	1	1	1	1	1	1	1	6	6	4	2	5	3	5	5
57	209	3	3	259	0.275	1	4	7	2	2	4	2	2	2	3	2	2	2	2	6	1	1	1	6	6	4	6
58	215	1	1	7	0.016	1	2	7	1	1	1	1	1	1	1	1	1	1	1	6	6	4	3	6	4	6	6
59	216	4	4	23	0.016	5	5	7	6	6	2	2	2	2	2	2	3	2	2	6	6	6	4	3	5	6	6
60	217	12	12	61	0.026	1	1	6	2	1	6	1	1	1	2	2	2	2	2	6	6	3	2	7	4	6	6
61	218	15	15	275	1.076	1	2	7	1	1	2	1	1	1	1	1	1	1	1	6	6	6	4	6	4	3	4
62	219	7	7	58	0.032	5	6	7	6	5	6	3	2	2	2	3	5	5	5	6	6	4	2	7	6	6	5
63	229	19	19	127	0.449	1	1	7	1	1	4	1	1	1	1	1	1	1	1	6	6	6	2	7	6	7	6
64	230	14	14	155	0.637	1	2	7	1	1	1	1	1	1	2	1	1	1	1	6	6	1	1	7	1	6	6
65	245	4	4	32	0.134	1	2	7	2	2	2	2	2	2	2	2	2	2	2	6	6	2	1	7	4	6	5
66	249	3	3	25	0.037	1	2	7	1	1	2	1	1	1	2	1	1	2	1	6	6	6	6	6	6	6	6
67	250	11	11	45	0.064	1	2	7	1	1	1	1	1	1	1	1	1	1	1	6	6	4	2	6	4	6	5
68	251	4	4	34	0.239	1	1	7	1	1	1	1	7	1	1	1	1	1	1	6	6	6	4	7	4	1	6
69	252	5	5	17	0.031	1	2	7	3	2	2	2	2	2	2	2	2	2	2	6	6	6	3	6	6	6	6
70	261	48	48	1309	7.927	1	1	7	1	1	1	1	1	1	1	1	1	1	1	6	6	5	3	7	6	6	5
71	262	12	12	224	0.537	1	1	7	2	2	1	1	1	1	1	1	2	2	2	6	6	4	4	7	4	4	4
72	263	4	4	22	0.016	1	1	7	1	1	2	1	1	1	1	1	1	2	1	6	6	6	6	6	6	4	6
73	265	1	1	15	0.009	1	1	7	1	1	1	1	1	1	1	1	1	1	1	6	6	5	4	3	7	7	6
74	268	1	1	3	0.000	1	4	7	2	1	1	1	1	1	3	1	1	1	1	6	6	6	4	7	4	7	6
75	277	5	5	68	0.363	2	5	7	3	4	6	3	2	2	5	2	2	2	2	6	6	4	2	5	4	2	6
76	278	12	12	79	0.085	1	1	7	2	1	3	1	1	1	2	1	1	2	1	6	6	6	3	6	7	7	7
77	279	52	52	1522	5.867	1	2	7	1	1	1	1	1	1	1	1	1	1	1	6	6	6	5	7	1	7	7
78	281	8	8	155	0.356	2	2	6	2	2	6	2	2	1	2	2	2	2	2	6	6	6	6	7	2	6	6
79	282	8	8	31	0.122	1	2	7	1	1	2	1	1	1	1	1	1	2	1	6	6	2	4	7	6	6	7
80	295	35	35	2092	3.932	2	2	6	2	2	2	2	2	2	2	2	2	2	2	6	6	3	1	7	6	6	6
81	296	13	13	300	0.363	1	1	7	1	1	2	1	1	1	5	1	1	5	1	6	6	3	1	7	4	4	7
82	303	5	5	44	0.146	2	2	7	2	2	3	1	1	1	2	1	2	2	1	6	6	6	3	7	6	6	6
83	305	9	9	58	0.856	1	2	4	2	2	2	2	2	2	2	2	2	2	2	6	6	6	6	6	6	6	6
84	312	8	8	31	0.161	7	1	7	1	1	1	1	1	1	1	1	1	1	1	6	6	6	6	7	7	7	7
85	317	5	5	27	0.288	1	1	7	1	1	1	1	1	1	2	1	1	1	1	6	6	6	4	6	6	7	6
86	318	14	14	157	0.908	1	1	7	1	1	5	1	1	1	1	1	1	1	1	6	6	5	1	7	7	6	6

Obs	R24	R25	R26	R27	R28	R30	R31	R32	R33	R34	R35	R36	R37	R39	R40	R41	R42	R44	R45	R46	R47	R48	R49	R50	R51	R52	R53	R54	R55	R56	R57	R58	R59
45	7	2	1	1	1	6	1	7	7	1	3	4	5	4	3	3	4	4	1	1	1	1	7	7	7	7	7	7	7	1	7	7	7
46	5	4	3	3	3	6	4	6	6	5	3	3	2	2	2	1	2	2	3	3	4	3	5	6	6	6	6	4	6	1	5	6	5
47	7	2	3	3	1	7	1	7	6	1	6	6	2	2	5	4	1	2	3	2	2	2	6	6	6	7	6	5	7	1	7	6	6
48	6	4	3	3	3	4	4	2	4	4	3	5	5	4	1	4	4	4	3	2	4	3	7	7	7	7	7	7	7	1	7	7	7
49	5	1	1	2	2	7	1	7	6	1	5	6	5	4	4	3	4	3	1	1	2	2	5	6	6	7	7	6	7	1	6	6	5
50	7	1	1	3	1	7	1	7	7	1	3	4	2	3	2	4	4	3	1	1	4	3	6	6	7	6	7	7	7	2	6	5	4
51	6	1	2	2	1	6	2	7	6	2	2	4	2	2	2	1	2	2	2	1	1	2	6	6	6	6	6	6	6	1	6	6	6
52	6	3	3	1	1	4	4	4	4	4	4	3	5	3	4	2	5	3	3	1	1	3	6	6	6	6	6	6	6	1	5	6	6
53	6	3	1	3	4	6	2	6	4	4	2	4	1	1	1	1	4	2	1	1	4	3	6	6	6	6	6	6	6	1	6	6	6
54	7	5	4	4	2	6	1	7	6	5	2	4	3	3	2	2	4	3	4	4	5	3	7	6	6	6	6	6	6	1	6	6	6
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86	7	1	1	1	1	6	5	6	5	2	3	3	4	3	2	1	4	3	1	1	1	1	6	6	7	7	7	6	7	1	7	7	7

Obs	R60	R61	R62	R63	R64	R65	R66	R67	R68	R69	R70	R71	R72	R73	R74	R75	R76	R77	R78	R79	R80	R81	R82	R83	R84	R85	R86	R87	R88	R89	R90	R91	R92
45	7	7	7	7	7	7	6	6	6	6	6	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6	7	7
46	6	6	6	5	6	5	6	5	5	5	5	5	5	6	5	3	4	4	5	2	2	2	2	2	3	2	3	3	3	3	5	6	4
47	7	7	7	6	7	7	6	6	6	6	6	6	1	1	2	1	1	3	2	2	2	1	2	2	2	2	2	2	2	2	4	6	7
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49	6	6	7	6	6	6	6	5	6	6	5	6	2	2	3	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	6	7
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52	6	6	6	6	6	6	6	6	6	6	6	6	3	2	2	3	3	6	2	2	2	2	2	3	2	2	2	2	2	2	4	6	4
53	6	6	6	6	6	6	6	6	6	6	6	6	2	2	2	1	2	2	2	2	2	2	2	2	2	2	1	2	2	2	4	7	7
54	6	6	6	6	6	6	5	5	5	5	4	5	4	4	4	3	3	3	2	2	3	3	2	2	2	2	2	2	3	3	4	7	4
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57	6	6	6	6	6	6	6	5	6	5	6	6	2	3	6	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	7	6	1
58	1	1	2	2	2	2	6	4	4	4	6	4	4	4	4	3	5	6	4	4	4	4	4	4	4	4	4	4	4	4	6	2	6
59	6	5	6	6	7	7	5	5	5	5	6	6	2	3	5	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	3	5	6
60	5	4	5	5	5	5	5	4	5	5	5	4	3	4	4	3	3	4	2	2	2	3	2	2	2	2	3	2	3	3	4	6	5
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73	6	6	7	6	7	6	6	6	6	6	6	6	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	7	5	7
74	7	7	6	7	7	7	6	6	6	6	6	6	2	4	5	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	5	6	6
75	6	6	6	5	6	6	2	3	4	3	3	4	4	5	5	3	2	2	3	3	2	3	3	3	5	3	3	3	5	4	6	5	6
76	4	4	4	4	4	4	4	3	3	3	4	5	5	5	5	3	4	4	4	3	3	4	4	2	4	2	4	4	5	3	6	5	6
77	7	7	7	7	7	6	5	6	6	6	6	6	6	4	7	1	1	7	1	1	1	1	1	1	1	1	1	1	1	1	7	7	1
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80	6	6	6	6	6	6	6	6	6	6	6	6	6	2	3	2	1	2	1	2	2	2	2	2	2	2	2	2	2	1	2	6	2
81	4	4	4	4	4	4	4	4	5	4	4	4	4	4	4	3	4	4	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4
82	6	6	6	6	6	6	6	6	6	6	6	6	2	2	2	3	3	4	3	3	3	3	3	3	3	3	3	3	3	3	4	6	6
83	6	5	6	5	6	6	5	5	5	3	4	5	6	5	6	3	4	4	3	3	3	3	2	2	3	3	3	3	3	3	5	5	6
84	6	6	7	5	7	6	7	7	7	7	7	7	5	1	1	1	1	7	1	1	1	1	1	1	1	1	1	1	1	1	4	7	4
85	6	6	6	4	6	6	6	6	6	6	6	6	5	2	6	2	3	2	2	2	2	2	2	2	2	2	2	3	3	3	5	6	5
86	6	6	7	6	7	6	6	6	6	6	6	6	1	1	6	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	7	2

Obs	R93	R94	R146	R147	R148	R149	R150	R151	R152	R153	R154	R155	R156	R157	R158	R159	R160	R161	R162	R163	R164	R165	R166	R167	R168	R169	R170	R171	R172	R173	R174	R175	R176
45	6	6	2	2	1	1	1	1	1	1	5	5	5	5	5	2	1	1	1	7	1	1	1	1	1	6	7	6	3	2	1	1	1
46	4	4	6	3	5	4	5	5	5	1	4	3	5	1	3	1	1	4	3	6	2	2	3	4	5	6	7	6	3	3	2	5	5
47	1	2	6	6	6	7	6	6	6	4	3	6	2	5	5	5	3	1	1	7	2	2	2	1	1	6	6	6	5	4	1	1	3
48	2	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
49	2	6	6	6	6	6	6	5	6	3	3	6	2	3	4	3	3	1	2	7	1	2	2	1	2	6	6	6	6	4	1	1	2
50	1	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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53	7	6	4	3	6	6	6	6	6	4	3	3	3	3	5	3	3	1	7	7	1	1	1	1	5	6	6	3	4	2	1	1	1
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56	3	3	4	5	3	2	5	6	5	1	3	5	4	1	4	4	2	1	1	7	1	1	3	1	5	6	6	5	3	1	1	1	1
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65	2	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
66	4	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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70	3	3	1	6	6	6	6	6	6	1	1	5	2	4	5	3	3	1	2	7	1	1	2	1	4	6	5	4	3	3	1	1	1
71	2	4	2	4	2	4	2	2	4	1	2	4	4	3	5	4	3	1	1	7	1	1	1	1	4	6	6	4	3	2	1	1	1
72	2	5	4	4	3	2	5	3	4	1	3	3	4	3	5	4	3	1	1	7	2	1	2	1	5	6	4	3	1	1	1	1	2
73	2	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
74	4	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
75	3	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
76	3	5	4	6	3	2	5	2	2	1	2	2	5	1	5	5	3	1	1	7	1	1	4	1	4	6	6	4	2	2	1	1	2
77	1	1	4	3	6	4	6	1	4	1	3	1	1	4	5	5	1	1	1	7	1	1	1	1	1	6	7	4	1	3	1	1	1
78	5	7	.	.	.	.	.	.	.	.	.	.	.	3	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
79	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
80	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
81	4	4	3	4	2	4	2	2	4	1	3	4	3	3	5	3	5	1	1	7	4	1	4	1	4	6	6	4	3	2	1	4	4
82	4	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
83	5	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
84	1	4	7	6	6	4	6	4	6	1	4	1	2	3	5	5	5	4	1	7	1	1	1	1	4	6	7	4	1	2	1	1	1
85	2	5	4	6	5	6	7	6	7	1	2	1	4	1	5	5	4	1	1	7	1	2	1	2	2	6	6	6	2	1	1	1	3
86	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Obs	R177	R178	R179	R180	R181	R182	R183	R184	R185	R186	R187	R188	R189	R190	R191	R192	R193	R194	V2	V3	V4	V5	V6	V7	V8	V9	V10
45	1	1	1	1	7	5	5	6	6	3	6	1	7	5	4	4	1	1	84	50	13	12	11	12	12	63	34
46	4	2	2	5	7	4	4	5	5	5	6	4	5	1	1	2	1	1	64	40	9	8	6	8	8	50	25
47	1	1	2	1	6	2	2	6	6	6	6	2	6	6	6	5	4	3	73	44	21	8	10	9	11	60	34
48	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	72	50	13	8	6	8	9	63	18
49	1	1	1	1	6	2	2	6	7	6	6	2	7	6	6	4	3	2	72	45	18	11	11	11	11	54	34
50	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	74	48	13	10	9	10	12	49	35
51	1	2	2	1	7	2	2	6	6	6	6	2	6	3	2	2	2	1	72	43	9	10	12	10	12	54	31
52	2	2	2	2	7	4	3	4	4	4	4	4	4	4	4	3	2	3	71	43	13	10	10	8	12	53	20
53	1	1	1	1	6	2	3	6	6	6	5	2	6	3	5	3	2	2	73	43	8	10	7	10	9	54	26
54	1	1	1	1	5	3	3	6	6	6	6	2	7	4	2	4	3	2	68	44	10	6	4	7	8	54	29
55	1	4	2	2	6	3	3	6	6	6	7	3	6	4	2	3	3	1	67	36	9	12	12	12	12	54	24
56	1	2	2	1	5	3	2	5	5	5	3	5	6	3	2	2	1	1	72	39	11	9	9	9	9	51	23
57	4	4	4	4	6	3	3	4	4	4	4	4	4	1	1	1	1	1	71	39	6	10	9	10	7	54	32
58	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	48	33	4	7	8	9	9	13	28
59	1	3	2	2	4	4	4	4	6	3	6	2	5	2	1	2	2	2	72	46	5	12	11	12	12	53	30
60	2	2	2	2	7	3	3	4	4	6	6	2	6	1	1	2	1	1	68	32	4	8	7	8	9	41	28
61	1	1	1	1	7	4	3	4	3	3	6	2	6	4	2	3	3	2	56	31	10	6	6	6	7	39	26
62	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	68	27	10	6	6	6	8	44	31
63	1	1	1	1	6	3	3	7	7	6	6	2	7	1	1	2	2	2	58	47	12	12	11	12	12	43	26
64	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	78	46	10	11	11	11	11	49	34
65	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	68	42	11	12	12	12	12	54	24
66	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	64	44	8	12	12	12	12	54	28
67	1	1	1	1	5	1	1	6	6	6	6	2	6	3	1	2	1	1	72	31	11	10	9	9	11	41	33
68	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	64	43	8	10	9	8	9	55	27
69	1	2	2	2	7	3	3	4	6	6	6	2	6	2	1	2	1	1	69	42	10	12	12	12	11	49	24
70	1	1	1	1	7	3	3	6	6	5	5	4	6	5	3	5	5	5	69	37	18	12	11	12	12	54	27
71	1	1	1	1	7	3	3	4	4	4	6	4	4	4	3	3	3	2	68	33	11	10	11	11	12	36	24
72	1	1	1	1	5	3	3	4	5	6	4	4	6	1	1	1	1	1	64	34	6	8	7	10	11	32	19
73	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	70	50	10	11	11	12	12	57	29
74	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	72	46	8	8	10	10	10	62	31
75	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	56	44	10	8	6	9	10	53	25
76	1	1	2	1	6	2	4	3	4	4	6	4	3	1	1	2	1	1	54	39	7	12	12	12	10	36	27
77	1	1	1	1	7	5	1	4	4	4	4	4	7	5	3	4	4	1	84	41	12	12	12	12	12	61	32
78	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	58	30	4	9	7	10	7	27	24
79	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	82	41	9	11	10	11	12	53	32
80	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	74	43	16	12	12	12	12	54	32
81	4	4	4	4	7	3	3	4	4	4	6	4	4	3	2	5	3	3	52	37	9	6	7	8	10	36	32
82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60	43	10	12	12	11	9	54	34
83	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	62	32	6	10	10	11	12	50	30
84	1	1	1	1	7	3	1	7	4	6	7	1	4	3	3	3	3	1	84	47	9	12	12	12	12	51	31
85	2	2	2	2	6	3	3	6	7	7	6	2	6	4	2	2	1	1	69	42	7	7	7	7	6	46	30
86	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	84	47	9	12	12	12	12	59	26

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