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D. Chon Abraham
College of William and Mary

Iris Junglas
University of Houston

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Recommended Citation

Abraham, D. Chon and Junglas, Iris, "Theory Meets Practice: A Proposal Concerning Information Systems Research in Nursing Informatics" (2006). *AMCIS 2006 Proceedings*. 334.
<http://aisel.aisnet.org/amcis2006/334>

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Theory Meets Practice: A Proposal Concerning Information Systems Research in Nursing Informatics

D. Chon Abraham

College of William and Mary
chon.abraham@mason.wm.edu

Iris Junglas

University of Houston
ijunglas@uh.edu

ABSTRACT

This proposal provides an avenue where theory meets practice to enlighten information systems (IS) researchers and nursing informatics personnel domestic and abroad about factors that impact acceptance of technologies supporting ubiquitous IS access. Models were qualitatively developed concerning acceptance based on data from nurses involved in electronic documentation of patient care in four US hospital settings. The intent now is to assess the explanatory power of the models and identity variance contributed by national and organizational culture. These models expand the Theory of Planned Behavior (Ajzen, 1991) and Task-Technology Fit (Goodhue and Thompson, 1995) to describe the impact of (1) evolved behaviors (i.e., innate drives to acquire, bond, defend, and learn (Lawrence and Nohria, 2002)) and (2) novel types of fit that influence acceptance in various task environments. The underlying premise is that patient care efficiencies increase when IS personnel consider these factors in the systems analysis and design process.

Keywords

Mobile Computing, Nursing Informatics, Task-Technology Fit, Theory of Planned Behavior, Ubiquitous Computing

INTRODUCTION

Einstein once said, "It is the theory which decides what one can observe" (Heisenberg, 1975). Theory helps to explain what we perceive and provides a foundation for building knowledge. Practice enables us to put into play that which we have theorized with relative assurance concerning outcomes or consequences. Yet, actual coupling of theory and practice is often times at odds in exploration, explanation, and application. However the conjoining of theory and practice is imperative to obtain the most insight from any inquiry.

Healthcare is one such context, where overwhelming benefits are derived from the marrying of scholarly theory and practice, especially in area of informatics. In particular, nursing informatics, as a discipline, seeks to apply concepts concerning some socio-technical aspects to explain, predict, and alter behavior concerning human computer interaction of nursing personnel. Additionally, much of healthcare improvement via technology initiatives address gaining physician buy-in (Reinertsen, 2005) and does not adequately address engaging nurses, despite the fact that nurses serve as the front-line care givers and are a primary user group (Wiley-Patton and Malloy, 2004). However, the tide is changing and visibility of nurses as information gatherers and processors in the patient care process is increasing (Romano, 2006). Nurses perform the majority of the data oriented tasks involved in patient care and would benefit most from having access to information at the point of care (Bove, 2006). RADM Romano, Chief Professional Officer of Nursing and advisor to the US Surgeon General concerning public health, recently addressed the American Informatics Nursing Informatics Association and stated "This is the year of the nurse. The technologies that have the means to improve the efficiencies in patient care are in the hands of the nurses." Nurses need to embrace technology in our everyday work or continue suffering the consequences of antiquated methods of computing that take us away from where we work – at the point of care (Abbott, 2006).

Healthcare can benefit greatly from ubiquitous IS access to improve quality and safety of patient care by decreasing errors made because of the lack of faster, more comprehensive, and more accessible patient documentation at the point of care (IOM, 2000). Healthcare institutions abroad share similar sentiments according to international healthcare reports by the International Council of Nurses (Buchan and Calman, 2004). In light of these concerns and a severe US nurse shortage (e.g., an estimated 400,000 shortage by 2020 (Bass, 2002)), institutions are beginning to consider employing point-of-care IT as a means to promote patient safety, decrease medical errors, and improve working conditions for overtaxed nurses (TelecomWeb, 2005).

The evolution of computing is moving towards a ubiquitous nature that organizes and mediates social interaction when and where situations occur (Lyytinen and Yoo 2002b). Ubiquitous IS access removes spatial and temporal boundaries between communicating entities (Junglas and Watson, 2006). However, these new computing environments bring formidable challenges in user acceptance and design issues that may not be sufficiently addressed by traditional MIS and behavioral theories (Lyytinen and Yoo, 2002a and b). In light of the advancements in computing technologies, traditional MIS theories need to be re-examined as to their predictive validity for technology acceptance¹ and new theories should emerge to explain human behavior in these new computing environments (Lyytinen and Yoo, 2002a and b). This study answers this call by providing an avenue where theory meets practice to further assess the explanatory power of models developed in a previous qualitative study, which present expansions to the Theory of Planned Behavior (Ajzen, 1991) and Task-Technology Fit (Goodhue and Thompson, 1995). The expansions address the impact of (1) evolved behaviors (i.e., innate drives to acquire, bond, defend, and learn (Lawrence and Nohria, 2002)) and (2) novel types of fit beyond just task and technology that influence acceptance of technologies supporting ubiquitous IS access in various task environments.

PURPOSE OF STUDY

This study proposes application of the aforementioned models in various healthcare settings across, in which nurses are employed in electronic documentation of patient care. These setting will be in various national and organizational cultures not previously studied to answer the following:

1. How do the new socio-technical dimensions proposed in the models impact acceptance of technologies supporting ubiquitous IS access in domestic and international medical settings?
2. To what extent does organizational and/or national culture change perceptions of fit for the technology (i.e., do other types of fit emerge)?

This study will also seek to add credence to our arguments developed from a prior study pertaining to the following:

1. More effective design and deployment by nursing informatics personnel of IS and IT to support ubiquitous IS access.
2. More exposure to technology in professional training (i.e., needed updates in nursing curricula) in light of expected task performance in these novel computing environments.

In 1997, the US based National Advisory Council on Nurse Education and Practice recognized the need to more adequately prepare the registered nurse workforce to use IS and IT in the hopes of overcoming burdensome manual documentation, decreasing error and improve decision making by affording nurses to access to information. Analogous organizations in Africa (Mbananga, N. and Dennill, 2003), Asia (Singapore Nurses Association established in 1959), Canada (the Canadian Nurses Association established in 1993), and Europe (the Nursing Informatics Europe established in 1990) express similar sentiments. Despite the obvious advantages of the technology, apprehension about use still exists amongst nurses and precludes organizational stakeholders and its customers from true benefit. What is not known is if this is a systemic problem uniformly across organizations in various cultures. "A new future of nursing practice is on the horizon, driven by surging demand, workforce shortages and technological innovation. Now, more than ever, nursing educators who must prepare students for the changing workplace, and nurses who must meet the challenges of patient care must create and adopt new technology" (American Nursing Informatics Association, 2006).

THEORETICAL FOUNDATION

The two models that are applied in this study were developed in a previous qualitative study that were conducted examining ubiquitous IS access in four settings (i.e., the Emergency Department at hospital A performing patient registration, the Post Anesthesia Care department at hospital B performing electronic documentation to monitor patients following surgery, the Ambulatory Care department at hospital B performing electronic documentation to prepare patients for surgery, and a Regular In-hospital Floor at Hospital C electronically documenting medication administration). Data from fifty-two face-to-face interviews of nurses, over 250 pages of archival documents, and fifty-seven direct observations provided 553 text segments that contributed to the development of twelve categories of codes in axial coding. Upon selective coding and subsequent analysis of our interpretation, the analysis promoted formulating additions to the Theory of Planned Behavior (TpB) (Ajzen, 1991) and Task-Technology Fit (TTF) (Goodhue and Thompson, 1995) with novel constructs and relationships.

¹ Acceptance entails both adoption and use of a given technology (Cooper and Zmud, 1990).

TTF Expanded

Seven types of fit (i.e., the fits are labeled as identity, information communication, location, patient interaction, physical, time criticality, user comfort, and work flow) are discerned to be oriented towards the task, technology, *and/or* the individual, which expand what was previously detailed originally in TTF (Goodhue and Thompson, 1995). This study proposes now to quantitatively validate the influence of these fits but introduce national (e.g., propensity to actively support healthcare improvement initiatives) and organizational culture (e.g., propensity to embrace technology) as a construct influencing technology acceptance- a particular type of human behavior. The following paragraph provides descriptions of each fit.

Identity Fit refers to the ease of identifying the task doer and the task recipient to discern the unique encounter. This is particularly important in patient care to ensure that the right person receives their prescribed medical care and that there is a log for the medical personnel performing that care. *Information Communication Fit* refers to the ease of communicating large amounts of information concerning a multitude of patients amongst personnel in the work environment that promotes unison because patient care tasks are interdependent. *Location Fit* refers to the ease of performing the task (to include documenting and accessing needed information) at the point-of-care which is most often at the bedside of or location of the patient. *Patient Interaction Fit* refers to the extent that interacting with the patient is key due to their conscious state, which is confounded by how manipulating the technology subtracts time away from tending or interacting with the patient. *Physical Fit* concerns the ease of maneuverability, with the appropriately designed hardware components of the technology, in and between the work areas because of the limited space in patient rooms. *Time Criticality Fit* refers to the ease of recording the time when actions are performed to promote accuracy in information intensive environment and check vital times to perform actions. *User Comfort Fit* refers to the design being easy enough design of the information systems and hardware components (e.g., being lightweight and on wheels to support easy mobility, having a full key board and large enough form factor to see vital statistics graphs, etc.) to overcome low computer self-efficacy and lack of exposure to IS/IT in professional training as to not incite anxiety about use. *Work Flow Fit* refers to the ability of the technology to aid in the multitasking (e.g., being equipped wireless barcode scanners so that nurses can more easily scan patient barcodes, small printers to print out records to accompany patients or give to units that do employ ubiquitous IS access, etc.).

The expansion also noted three types of use (i.e., intended use, third-party use, and unintended use) that this study will also propose to assess quantitatively. First, intended use of ubiquitous IS access in patient care relative to tethered computing supports all of the fits on all dimensions between the individual, task, and technology that promoted task effectiveness and efficiency. Third-party use of the technology (i.e., use through another individual manipulating system on one's behalf) happened when at least User Comfort Fit was not attained, which contributed to inefficient employment of the workforce and retarding of patient throughput. Unintended use (i.e., use not at the point of care or work in some location other than at the patient's location such as the hallway) occurred when either, all, or some combination of Patient Interaction Fit, Physical Fit, and User Comfort Fit precluded intended use.

The expansion of TTF is a framework to understand the task in a social context in which the computing method allows for information access at the point of work. This enrichment is provided in Figure 1.

TpB Extended

TpB (Ajzen, 1991) explains how intentions are good indicators of behavior like technology acceptance; however, we also need to explain what causes behaviors that do not correspond with their initial intent. IS research is consistent in finding that attitudes toward the technology have a bearing on adoption. Attitudes also influence acceptance (Fishbein and Ajzen, 1975). Therefore, development of these attitudes should be a focus of IS research (Lucas, 1981; Rice and Aydin, 1991). We have imperfect information about what mechanisms promote the development of attitudes (Ajzen, 1991). The extension to TpB (Figure 2) accounts for how evolved behaviors (i.e., innate drives to acquire, bond, defend, and learn (Lawrence and Nohria, 2002)), are precursors to attitudes and influence behavior. Evolved behaviors are always present in our psyche and many of them can be categorized by how they motivate our actions (e.g., the drive to bond with others and establish mutual trust, the drive to defend ourselves and those we are responsible for from threats, and the drive to learn about our environment to decrease uncertainty (Lawrence and Nohria, 2002)). We might not see the influence of these evolved behaviors until we examine certain tasks being performed in specific environments that amplify their effects. This model posits that evolved behaviors are possibly amplified in environments characterized by some degree of criticality like that of patient care.

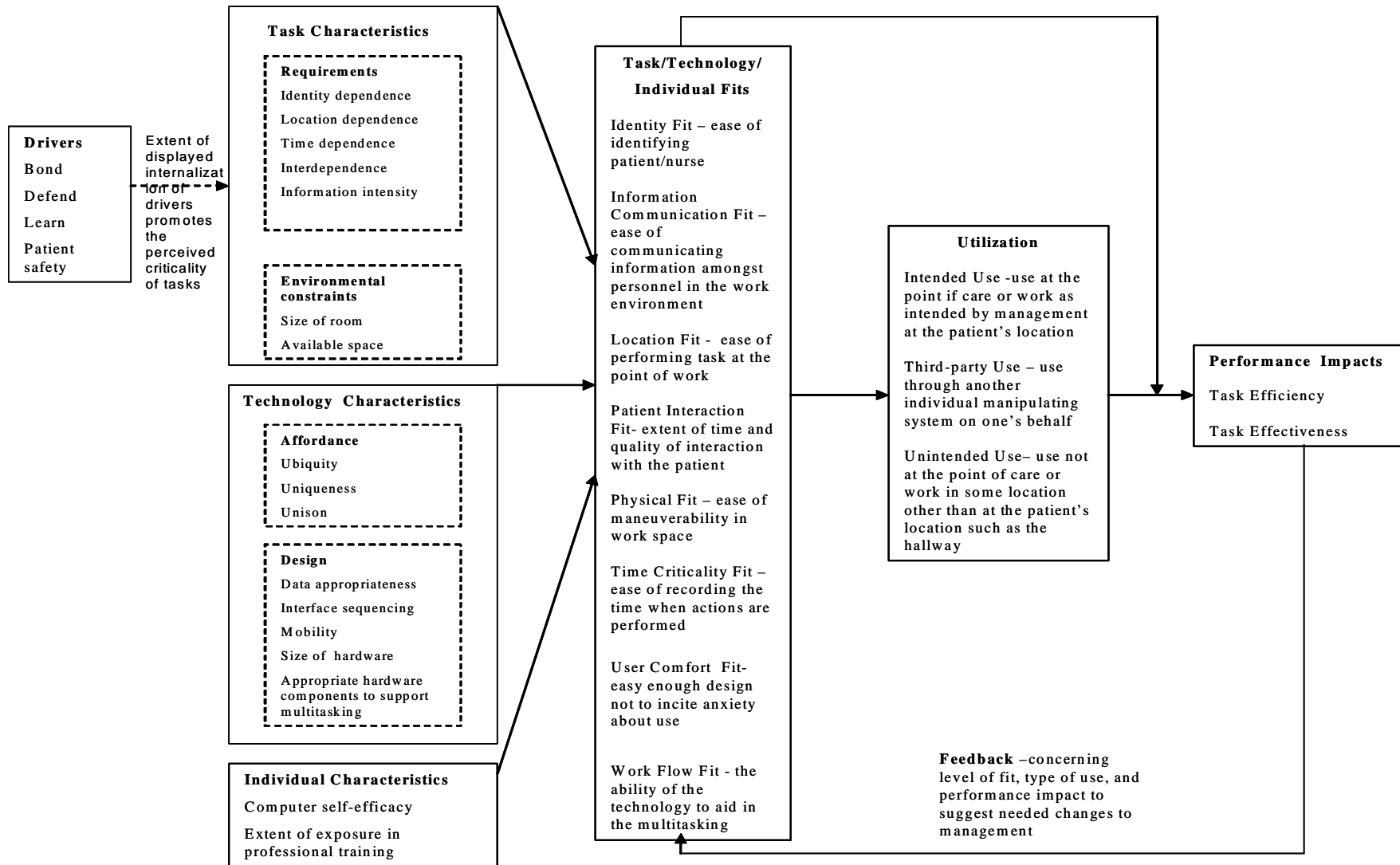


Figure 1 TTF Expanded

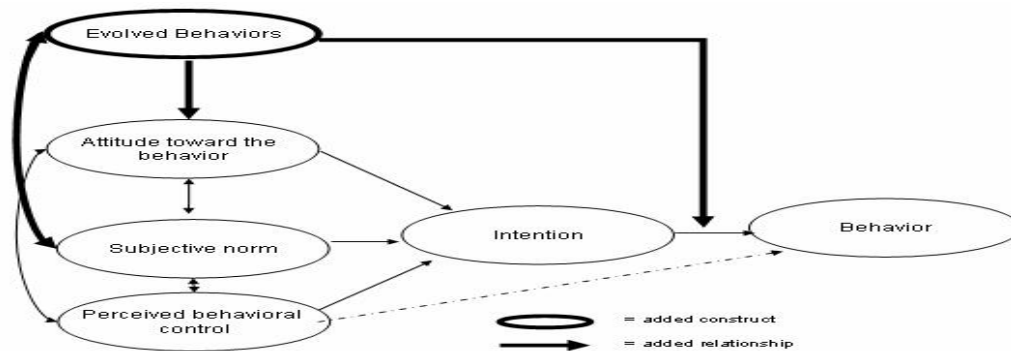


Figure 2 Extension of the Theory of Planned Behavior

METHODOLOGY

The aforementioned models were developed and validated using qualitative methods espoused by Strauss and Corbin (1998) and Kirk and Miller (1986). This study proposes applying quantitative methods (specifically, two surveys instruments that we intend to validate) to evaluate the explanatory power of these models in medical settings employing ubiquitous IS access across various cultural environments. A survey for each model will be used to collect data from nurses working in domestic or international healthcare settings that have had ubiquitous IS access technologies implemented and in use for at least three months, which is a sufficient time period for nurses to be able to articulate their experiences with the technology. We also intend to compare and contrast the predictive accuracy of each model. National nursing informatics associations domestic and abroad (e.g., American Nursing Informatics Association, Singapore Nurses Association, Canadian Nurses Association, and Nursing Informatics Europe) will be engaged to discern healthcare settings meeting our research inclusion criteria. This study will control for organizational size and type (i.e., teaching hospital, clinic, group practice, non-teaching hospital, nursing home, and home healthcare agency). Partial least squares (PLS) technique will be used to analyze the data, which is applicable when the research objective is predictive accuracy and explaining intricate relationships (Chin, 1998). This technique simultaneously tests all relationships in the research model, is apt for dealing with second order constructs (like evolved behaviors), and is robust even when using small sample sizes, in the event the resulting sample sizes are not sufficiently large (Chin, 1998).

EXPECTED OUTCOMES AND SIGNIFICANCE

Embracing innovative technologies to improve efficiencies in patient care is a political and social agenda both domestically and abroad (Romano, 2006). This study promises to broaden knowledge of technology acceptance, as a type of human behavior, to recognize importance of different types of “fit” not just task-technology and evolved behaviors such as innate human drives that influence attitudes and subjective norms, which may vary across organizational and national cultures. The broadening of knowledge will be most beneficial to information systems design personnel such as those in the nursing informatics field to afford them with more holistic factors to consider as having a bearing on technology acceptance.

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