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Ann D. Rensel
State University of New York at Buffalo, adrensel@buffalo.edu

June M. Abbas
State University of New York at Buffalo, abbasjm@buffalo.edu

H. Raghav Rao
State University of New York at Buffalo, mgmtrao@buffalo.edu

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Private Transactions in Public Places: An Exploration of the Impact of the Computer Environment on Public Transactional Web Site Use [1]

Ann D. Rensel
School of Management
State University of New York at Buffalo
adrensel@buffalo.edu

June M. Abbas
School of Informatics, Department of Library Science
State University of New York at Buffalo
abbasjm@buffalo.edu

H. Raghav Rao
School of Management
State University of New York at Buffalo
mgmtrao@buffalo.edu

Abstract

Organizations and governments continue to advance toward using electronic means to interact with their customers. However, the use of this medium presents an access-to-service issue for people across the digital divide who do not have private Internet access from their homes. Publicly-available computers connected to the Internet are an important and expanding source of Internet access for consumers. Still, we do not know if people are willing to engage in e-commerce transactions in such environments. We expand the Facilitating Conditions construct of Triandis' (1980) modified theory of reasoned action to develop a model of transactional Web site use in public environments that incorporates the physical and virtual computer environments associated with publicly accessible computers, moderated by the individual's need for privacy. The model was tested in public libraries, and the results indicate that the virtual and physical facilitating conditions of a public computer are determinants of e-commerce use in a public environment, and the user's need for privacy moderates these relationships.

Keywords: Digital divide, facilitating conditions, individual need for privacy, public computing, e-commerce, theory of reasoned action

[1] Robert Kauffman was the accepting senior editor.

Introduction

The Internet is a technology that has migrated across business boundaries into many areas of modern life and has become a necessary information technology (IT) for businesses and other organizations to contact and interact with potential and existing consumers. The Internet has become so pervasive that many people routinely engage in transaction-based e-commerce activities, such as making Internet-based online banking transactions instead of going to the physical bank, purchasing goods from virtual e-commerce stores rather than going shopping, and engaging in information transactions such as submitting job applications online rather than filling out a paper form and sending it to the organization. The pervasiveness of the technology allows many people to do all of this from their homes or other non-business locations (Venkatesh, 1996; Venkatesh and Brown, 2001). In addition, non-profit entities such as governments employ this efficient and cost effective channel to provide access and services to citizens. For example, following recent hurricanes, citizens were instructed to apply for Federal Emergency Management Agency (FEMA) assistance using an Internet-based application process (FEMA, 2005).

The multitude of services provided through the Internet creates a problem for people without access it. Much has been discussed about the presence of a digital divide in the United States and around the globe (Dewan and Riggins, 2005). This *digital divide*, considered in some contexts to be the lack of access to Internet technologies, has been studied along racial lines (Hoffman et al., 2000; Stanley, 2003), along economic lines (Lane, 1999; Preiger, 2003) and along geographic lines (Gabe and Able, 2002; Hoffman et al., 2000; National Telecommunication and Information Administration, 2000). Recent studies of the people using the Internet indicate that even as more people are becoming Internet users, others are dropping out (Horrigan et al., 2003). So the problem of access to technology is expected to continue into the future. Recent census figures indicate that more than 40% of the citizens of the United States do not have access to the Internet from their homes (National Telecommunication and Information Administration, 2000). Thus many people need access to the Internet from other physical locations if they are going to be able to use the economic and information goods available online.

For those who do not have Internet access from their home or place of work, publicly-provided computers with Internet connections have become a critical source of access for people on the other side of the digital divide. Indeed, the integration of Internet technology into everyday life has expanded to such an extent that computers connected to the Internet are provided in many public places including (Nicholas et al., 2002):

- schools and universities where students work in staffed computer labs,
- coffee houses where patrons use their laptops to connect to the Internet,
- government point of service locations,
- community centers that provide access to underserved populations,
- libraries that seek to augment their physical book collections and expand patron services with PC and Internet access, and
- public kiosks that allow users to check e-mail or purchase goods online.

Some public locations use Internet access as a way to draw in customers and increase business activity. While providing such publicly-available Internet connections to allow users to download basic information is an important public policy goal, at this point it is

not clear whether people are willing to adopt the full use of Internet technologies and engage in transaction-based e-commerce activities from these public locations. If users without personal Internet connectivity are not willing to use publicly-provided Internet connections to engage in transaction-based e-commerce, then it is doubtful that these provisions will successfully bridge the digital divide. While we may succeed in bridging the *information digital divide*, we may still be left with an *e-commerce divide* (Dewan and Riggins, 2005).

The adoption of technology has been widely studied in organizations. However, little attention has focused on the use of computer technology in public environments. Orlikowski and Iacono (2001) call for a broader definition and examination of the IT artifact, which includes not only use, but the context of use as well. In this paper we explore the issue of public computer use by specifically examining the use of public computers to engage in transaction-based e-commerce activities. Guided by the suggestions from Orlikowski and Iacono (2001), we examine the transactional use of the Internet within the specific context of the public computing environment. We engage in theory building to expand on Triandis' (1980) *modified version of the theory of reasoned action* to examine the physical and virtual facilitating conditions present in the public computing environment. We then test in a public library environment where we find both physical and virtual facilitating conditions. These are moderated by an individual difference variable, the *need for privacy*, which seems to influence e-commerce activities conducted using public computers. This research examines Internet-based, *private transactions in public places*, an emerging research domain at the intersection of existing e-commerce research and digital divide literature. It contributes to the e-commerce literature by extending current knowledge about online transactions by incorporating the computing environment as a factor in online purchasing. It also contributes to the digital divide literature by exploring the use of transactions-based e-commerce by people without Internet access in their homes.

In the following section we discuss the background of this problem and describe the physical and virtual computing environments present in computers in public places.

Background

Transactional Use

Current information about Internet use indicates that most Internet users engage in information-seeking activities (Nie and Erbring, 2000). However, an important and expanding activity that exploits the full functional capability of the Internet is the use of Web sites to conduct business-to-consumer (B2C) information and business transactions. Activities such as registering for college courses; selecting, ordering, and paying for goods and services; completing stock transactions; or engaging in online banking (Nie and Erbring, 2000) are just a few of the common, daily activities that can now be conducted through the Internet. Exchanges of this type between user and host organization involve the transactional use of a Web site. We note that there are two types of online transactions. An *information transaction* involves the user entering personally-identifying information such as name, social security number, or unique identifying code into a Web-based form and then electronically transmitting it to the host Web site through the Internet. A *monetary transaction* generally involves submitting to the host website personally-identifying information in addition to information linked to a

monetary source of some type, such as a credit card or bank account. A monetary transaction usually occurs during the completion of the purchase of some type of good or service. For the purposes of this discussion, we group both types of transactions together and refer to them in a broad sense as *e-commerce*.

Users of e-commerce have concerns about actually engaging in these types of online activities. Users are concerned about the privacy of the personal information they provide during e-commerce transactions (Sheehan and Hoy, 2000), and they have security concerns about third-party access to personal information and the fraudulent behavior of online retailers (Miyazaki and Fernandez, 2001). In each of these cases, people who choose (or do not choose) to use e-commerce balance the risk they perceive with the convenience e-commerce provides (Bhatnagar et al., 2000). Much of the existing research in this area has explored user concerns about Web sites and hosting organizations. But little is known about whether e-commerce users are sensitive to the risks present in the hardware and software used to access e-commerce Web sites or those risks present in the physical environment where they engage in e-commerce transactions. User concerns may be less pronounced when using a private computer; however, a public computer encompasses a multifaceted physical and virtual environment substantially different from that of a private computer.

An Internet-based transaction involves two elements; the actual computer local to the user and the Web page hosted by the e-commerce organization. The problem is that there is a substantial difference between using the Internet in a unidirectional fashion for downloading information from a Web site and using the Internet in a bidirectional manner for e-commerce transactions that involve submitting information through the Internet to the host organization. The unidirectional download required to view a Web page involves nothing more that receiving information from the host and viewing that information on the local computer. In this case, the Internet presents some risk to the user tracking applications may be installed on the local machine. However, because the user submits nothing to the host Web site, the risk to personal information is limited.

The bidirectional interaction is more complex. It involves receiving the Web page information from the host, entering the return information using the local computer equipment and a host-provided Web page object, and submitting the information back to the host. The data entered through these transactions are subject to a wider range of risks, such as third- party security of the data stored on the retailer's machine or fraudulent use of the data. In addition, the information entered through the local computer is subject to risks inherent in the virtual characteristics of the local machine, even before the information enters the Internet and returns to the retailer. Likewise, the person using the local computer is subject to the physical environment surrounding that computer during the information exchange, such as noise level, interruptions, and eavesdropping. Bidirectional exchanges are generally not an issue when an individual uses a privately owned computer in a quiet location because the user controls both the virtual environment and the physical environment. Problems with bidirectional exchanges occur when the local computer is used by multiple people, the surrounding physical environment is public and noisy, and the virtual computer environment is administered by others.

The Physical and Virtual Computer Environments

How people set up the *physical environment* to position a computer in a living space has been investigated as part of an ongoing project exploring the use of computers in the home (Kraut et al., 1999; Venkatesh, 1996). Considering that use of computers and the Internet within a business environment are primarily used for business activities, home or non-business computers are the most common means of Internet access for personal use. Research has shown that home computers are used for a wide range of tasks, including personal financial transactions, communications, and home shopping (Venkatesh, 1996; Kraut et al., 1999). Thus, looking at the characteristics of home computer placement will provide insight into the environmental characteristics that are desirable for engaging in online activities from a public computer. A computer located in a public environment is commonly positioned in a somewhat noisy area, frequently surrounded by external activity, and generally lacks privacy for engaging in computer-based activities such as e-transactions. It is apparent that, at times, the public environment does not have many of the physical environment characteristics that people appear to prefer when using a computer at home and by extension, the Internet.

A computer also encompasses a *virtual environment* consisting of the applications and application settings that are installed on the machine. The primary users of private computers control the virtual elements on the computer. Individual users commonly install virus protection software, spyware detecting software, firewalls, and content filtering software in an attempt to control the virtual environment of their Internet-connected computer (Whitman and Mattord, 2005). On a public computer, the virtual environment is set up and maintained by people beyond the control of the individual user, who may add opportunities that log keystroke and gather confidential information (Jesdanun, 2003). Keystroke logging software can also be downloaded onto computers inadvertently by users (Soloman, 2003), who respond to spam e-mail or visit questionable Web sites. Once such software has been downloaded, others using that virtual environment are vulnerable to the same application. The exposure to this type of threat exists in a private setting, but in a public context, where multiple users are engaging in a multitude of activities, the potential is greater. Use of the correct operating systems settings and configurations can reduce these threats in many cases, but public equipment may not be set up and maintained properly.

There are constraints on the activities that can be carried out on a publicly-provided computer (Cullen, 2001) due to the lack of privacy, time restrictions, and equipment availability. These constraints, in combination with the physical and virtual computing environments of the public computer, present an even larger problem when a person seeks to engage in e-commerce. The physical environment of the public computer may deter computer use in general, and the virtual environment may deter transactional use, especially if the user is aware of the risks. Thus even if access to the Internet is provided in a public environment, the gap in information access may be bridged, but not the gap in e-commerce access. Unfortunately, the people most impacted by the physical configurations and the technological advances are those who have no other way to participate in the digital world and are confined to using the computers in a public environment. In the next section we develop a model of public transactional use and then test it in the public library environment.

Theory Development

The use of the Internet for transactions has been quite extensively studied within the context of B2C e-commerce transactions (Gefen et al., 2003; Gefen and Straub, 2000; Heijden et al., 2001; Jarvenpaa and Tractinsky, 1999; Jarvenpaa et al., 2000). The current work is more broadly defined and considers both commerce-based monetary transactions and information transactions. However, the underlying activity is the same, users submit personally significant information to a host Web site using a local device connected to the Internet. Previous work studying the adoption and use of e-commerce provides a particularly relevant framework on which to expand and develop a model of private transactions in public places.

The *theory of planned behavior* (TPB) (Ajzen, 1991) has been successfully used as a reference theory to investigate technology use in many settings and also e-commerce adoption (Mathison, 1991; Morris and Venkatesh, 2000; Taylor and Todd, 1995a and 1995b; Venkatesh et al., 2000). The theory has been used to study the impact of attitude and risk on online shopping behavior (Jarvenpaa et al., 2000), that attitudes toward Internet purchasing are a determinant of the intent to purchase, and that both the intent to purchase and the overall Internet experience lead to Internet purchasing (George, 2002). The TPB has been extended by Pavlou and Fygenson (2006) to help predict information gathering and e-commerce purchasing behavior and the linkage between the two activities. A second and related model, the technology adoption model (TAM) (Davis, 1989), has been another widely-applied model of technology adoption behavior that incorporates perceived ease of use and usefulness in forming attitudes toward technology adoption. TAM can be considered to be a special case of TPB, focusing just on the attitude dimension of the larger model, and has been used to explore the intrinsic and extrinsic dimensions of e-commerce adoption (Gefen and Straub, 2000). Trust has been integrated with TAM to further inform the intention to use e-commerce (Gefen et al., 2003). Research on e-commerce adoption has generally focused on the individual's beliefs and perceptions about engaging in e-commerce, while the impact of the use environment on e-commerce adoption has not been considered. In a private setting such as a home or office, the environment may have little impact, however, in a public setting the use environment becomes important.

The TPB is an extension of an earlier behavior model, the *theory of reasoned action* (TRA) (Fishbein and Ajzen, 1975). The TRA model suggests that attitudes and social norms lead to a behavioral intention, which in turn results in a behavior. The TRA model did not incorporate a dimension to capture situations where people do not have complete control over the situation, so *perceived behavioral control* was added to TRA dimensions of attitudes and norms to form the TPB model. In TPB, perceived behavioral control determines both behavioral intention and the actual behavior. Perceived behavioral control is considered to be quite similar to self-efficacy, and it arises from an individual's beliefs about "the perceived ease or difficulty of performing the behavior" (Ajzen, 1991, pg 188). Ajzen makes a distinction between perceived behavioral control and actual behavioral control. He states that actual behavioral control is the likelihood of achieving a behavior. It is dependent upon the resources and opportunities that are available to the person, whereas perceived behavioral control encompasses the person's belief about performing the behavior.

Triandis (1980) proposed an extension to the TRA that related behavior and behavioral intention to several other constructs, such as habit, culture, and facilitating conditions, in addition to the original social norms and attitude dimensions of TRA. Triandis defined facilitating conditions as the factors in the environment that encourage or discourage a behavior, and these factors directly impact both behavioral intention and the resulting behavior. Ajzen (1991) also alluded to these relationships in his description of actual behavioral control, which is similar to the facilitating conditions construct introduced by Triandis (1980) in his extension of TRA. The facilitating conditions construct has been occasionally incorporated into somewhat larger frameworks considering computer adoption, such as the one proposed by Thompson et al. (1991) and in the decomposed model of planned behavior developed by Taylor and Todd (1995b).

The decomposed TPB model tested by Taylor and Todd (1995b) includes hardware and technology-facilitating conditions as antecedents to perceived behavioral control. In other literature, however, the perceived behavioral control construct has two distinct dimensions: *perceived internal* and *perceived external* behavioral control (Conner and Armitage, 1998; Kidwell and Jewell, 2003). An *internally-controlled behavior* occurs when a person perceives that he has control over personal resources (Armitage and Conner, 1999), similar to the self-efficacy antecedent of perceived behavioral control in the Taylor and Todd (1995b) model and the original definition of perceived behavioral control described by Ajzen (1991). An *externally-controlled behavior* occurs when there are few perceived external influences acting as barriers to performing the behavior (Armitage and Conner, 1999). Thus, an externally-controlled behavior can be considered comparable to Triandis' definition of facilitating conditions (Bagozzi and Kimmel, 1995), the two types of facilitating conditions in Taylor and Todd's model, and the resources described by Ajzen (1991) as part of actual behavioral control. Although facilitating conditions have been considered as determinants of perceived behavioral control, external control has a significant main effect on behavioral intention (Kidwell and Jewell, 2003) as suggested by Triandis. These prior results imply that perceived external conditions exert a direct influence on behavior, thus the presence or lack of external facilitating conditions in a user environment will directly influence e-commerce use.

A computer is used in a specific physical environment and at the same time the computer system itself encompasses a virtual environment. Thus, there are two distinct types of environmental facilitating conditions present in any computer environment, and user perceptions of these environments will exert individual impacts on e-commerce use behavior.

Prior research in innovation adoption has shown that individuals differ in their willingness to adopt and use innovations (Agarwal and Prasad, 1999; Bagchi et al., 2003; Gallivan, 2000; Karahanna et al., 1999). An individual user encapsulates a set of characteristics that influence their adoption and use of a technology. Oldham (1988) suggests that an individual's need for privacy will influence the work activities he or she pursues in a specific environment. Previous research focused on workspace configurations has shown that the need for privacy also moderates the relationship between workspace configuration and the willingness of people to complete tasks (Sundstrom et al., 1980). Individual need for privacy is included in the model as a factor moderating the impact that environmental facilitating conditions exert on e-commerce transactions. Figure 1 illustrates the conceptual model guiding this investigation.

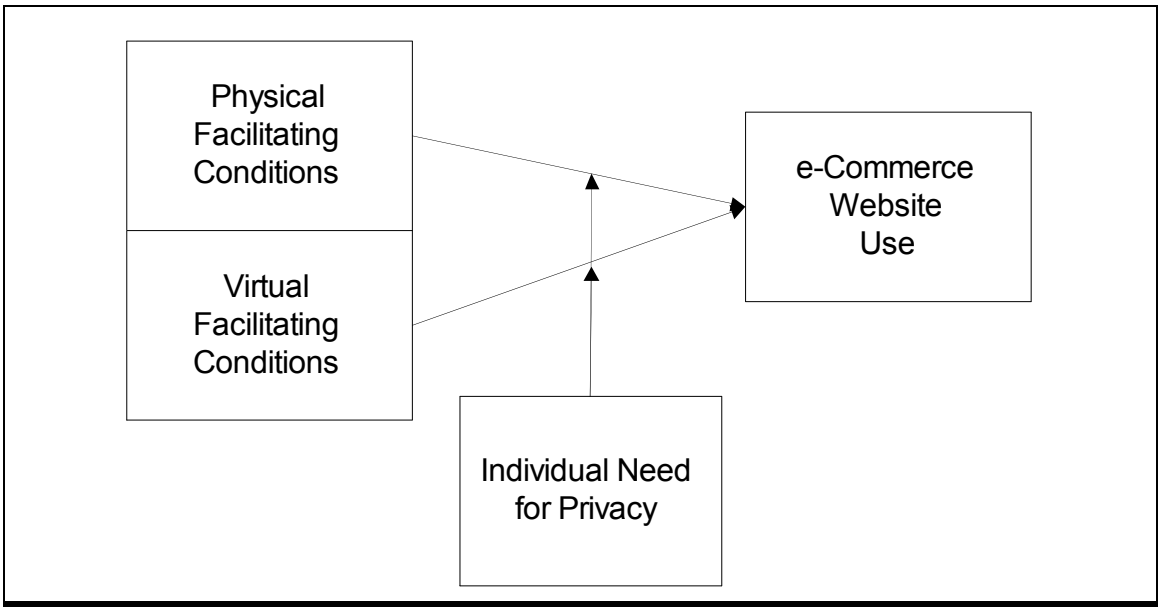

Figure 1: Conceptual Model

Physical Facilitating Conditions

The physical environment surrounding a computer (or any piece of equipment) includes the work area around the device, the presence of other people, the general atmosphere of the equipment location and the availability of staff members and/or others to provide support. Research has found that when a person places a computer in their private home space, the privacy of the work area and the mood of the room are key elements in the computer placement decision. Studies have shown that the most desirable place for a computer is in a private work area, such as a home office, or a room away from the hustle and bustle of the household (Mateas et al., 1996) so that the user is able to concentrate on computer tasks (Frohlich and Kraut, 2003).

The atmosphere of the surrounding environment is also an important dimension. Placement of a personal computer in a private area supports the use of the computer for completing tasks like tracking household finances, while computer placement in a more social area of the home encourages more fun and self-expressive activities (Frohlich and Kraut, 2003). An E-commerce transaction generally requires a fair degree of concentration through a series of steps and involves personal or monetary information. Thus the most desirable environment for supporting e-commerce activities would be a rather quiet, somewhat private work area where other people cannot see what is displayed on the computer monitor. Workspace design research in organizations (Oldham, 1988; Sundstrom, 1986), has found that low levels of workspace privacy leads to people experiencing increased interruptions (Sundstrom et al., 1980), a decreased ability to concentrate on tasks, and an increased reluctance to address confidential matters (Sundstrom, 1986).

Task Privacy

Research in workspace design (Oldham, 1988) has identified *task privacy* as the degree to which a person is able to focus and concentrate on a task. Task privacy is considered to be the perceived characteristics of the workspace such as infrequent interruptions,

protection from distractions, and isolation from disturbances. Triandis (1980) suggests that a behavior will not occur if conditions in an environment do not facilitate the behavior. Therefore, in order for a behavior to occur, the physical environment needs to be supportive. In a public environment the computers are generally positioned in a rather open area, sometimes placed on open tables or inside of carrels. These physical conditions may result in (a) increased interruptions during e-commerce transactions, (b) decreased user ability to concentrate and complete a transaction, and (c) reduced willingness to engage in a confidential information exchange with the e-commerce Web site. Given these physical conditions, we would expect that higher levels of perceived task privacy will support transactional Web site activities.

- **Proposition 1 (Task Privacy):** *Perceived task privacy facilitates transactional use of Internet connections in public places*.

Available Assistance

Some studies have shown that the assistance available to people using technology positively influences technology use in some instances (Bergeron and Berube, 1988; Goodhue, 1995), while other studies involving assistance availability and PC usage found that available assistance had no impact on usage (Thompson et al., 1991). In yet other instances, the presence of assistance had a negative impact on system usage (Bergeron, 1995). The impact of available assistance is revisited in this investigation because of the unique use environment found in public computing locations. Users may perceive that assistance is available to help with hardware, software, and Internet difficulties, and this assistance would be provided by knowledgeable people. In such a case, it is likely that users would perceive less risk in engaging in e-commerce. Prior investigation into the special case of public library Internet use (D'Elia et al., 2002) has found that the availability of assistance does encourage use in this setting. Computers available in most public locations generally have some form of supervision. A staff member associated with a public computing site would be expected to have reasonably good computer skills, and users may perceive that such support personnel will provide assistance with web-basd e-commerce transactions in this environment.

Public computer equipment consists of the physical hardware, a set of installed software programs, and a connection to the Internet. A computer user may encounter difficulties with any of these elements while engaging in e-commerce transactions. A staff person present in the public facility may provide assistance with using the computer, the Internet, and software. We expect that having assistance available to support connecting to the Internet, engaging in web-based activities and using the computer will encourage transactional use in this environment.

- **Proposition 2 (Available Assistance):** *Perceived available assistance facilitates transactional use of Internet connections in public places.*

Virtual Facilitating Conditions

Privacy enhances autonomy and/or minimizes vulnerability, thereby protecting autonomy (Margulis, 1977). Privacy is the control over the transmission of information to others and control over inputs from others. If we consider that the environment in which a public computer user functions is subject to many external influences, it is apparent that privacy, or control over information outputs and inputs, can be compromised.

Privacy in the physical environment can be controlled by physical mechanisms, such as barriers, while the virtual environment of a computer is controlled by the software installed on the system. The installed software can potentially reduce an Internet user's anonymity and control, thereby increasing the person's vulnerability to privacy violations, such as activity tracking and recording. Conversely, public computing occurs in a fairly anonymous manner (Slack and Rowley, 2004), which may encourage transactional Web site use in some situations. Persons using a public computer may perceive their activities to be anonymous, which would enhance their perception of privacy and thus encourage computer use in a public environment.

Perceived Tracking

Privacy is defined as (a) control of information and (b) the control of interactions with others (Archea, 1977; Stone and Stone, 1990). The unauthorized and unbeknownst tracking of an individual's activities on a public computer eliminates the ability of the individual to control information about personal activities and may increase individual concern about negative consequences resulting from engaging in e-commerce transactions. The computer and network a person uses to interact with an e-commerce Web site facilitates the interaction, thus a perception of risk that the computer or Internet connection may be recording, tracking or monitoring a user's activities outside of the confines of the public location infringes on the individual's feelings of control over their personal information and the contents of the e-commerce transaction. Utilities such as network packet sniffers or spyware are outside the purview of the public site but can gather information about a user's activities. We would expect that the user's perception that their activities are being monitored or tracked while they are using a public computer would discourage that person from using a public computer and would also discourage the transactional use of a Web site from that location.

- **Proposition 3 (Perceived Tracking):** *Perceived computer activity tracking inhibits transactional use of Internet connections in public places.*

Anonymous Use

The use of a computer in a public site provides a rather anonymous environment, as user Web activities can generally be linked to a workstation, but are not generally linked to an individual user. In group research, an anonymous environment has been found to promote interaction among group members because it offers a low-threat and low-risk environment (Valacich et al., 1992). The Internet, in general, appears to provide a fairly anonymous environment for users, although communications executed through a computer can be traced back through their ISP to the actual connection, so activities can be traced to a specific machine. Anonymity is greater in a public use environment where users are not specifically linked to a computer. This anonymity may lead users to engage in behavior they would not pursue if they were identifiable (Jessup et al., 1990) because they perceive that the risk is lower. Perceived anonymity may encourage general Web site use in public and then lead to more complex e-commerce use as well. In addition, a person who perceives that Internet activities are anonymous from a public computer may tend to feel that he has control over the amount and content of information that he provides during a transaction. We would expect that higher perceptions of anonymity will support e-commerce use from public computers.

- **Proposition 4 (Anonymous Use):** *Perceived anonymous computer use facilitates transactional use of Internet connections in public places.*

Individual Need for Privacy

An individual's need for privacy is derived from psychological privacy and is a characteristic unique to the individual. Psychological privacy need protects an individual at some level from personal intrusions and includes levels of freedom from intentional or unintentional persuasive pressures (Laukka, 2000). The individual level of need for privacy varies among people (McKechnie, 1971), so the level of protection from personal intrusions and persuasive pressures that an individual requires and the sensitivity to privacy intrusion varies as well. Given the nature of the information generally provided during e-commerce transactions, the level of concern over privacy intrusions may weaken or enhance the impact of the facilitating conditions on transactional use behavior in a public environment. Previous research suggests that individual need for privacy interacts with workspace privacy in an organizational setting (Oldham, 1988); the same effect would be expected in a public workspace.

- **Proposition 5 (Individual Need for Privacy):** *Individual need for privacy will diminish the positive impact of task privacy, assistance and anonymity while enhancing the negative impact of activity monitoring perception on transactional Web site use in public environments.*

Hypotheses and Research Model

We test our theoretical model in the library setting because public libraries are a major means of free access to the Internet, especially for people without access to private computers. Libraries are traditionally viewed as a source of information; and have, across history, supported the general public's right to obtain information (Kibirige, 2001). To help address the gap in Internet access and to provide publicly-available electronic resources as a way to bridge the digital divide, initiatives to provide computers in libraries with connections to the Internet have developed both privately and publicly. Microsoft has provided computers to public libraries through the Gates Foundation (Douglas, 2004) and the Federal Government supports public technology through the e-Rate program (Federal Communications Commission, 2004). Public libraries provide an important and relevant environment in which to study public Internet usage behavior, as libraries are widely known to have free public Internet access, are traditionally viewed as a source of information and have, across history, supported the general public's right to obtain information [Kibirige, 2001]. Libraries are common places for people to go to access information electronically and have been heavily involved in incorporating computers and free Internet service to provide access to electronic information resources (American Library Association Office for Intellectual Freedom, 2004; D'Elia et al., 2002; Kibirige, 2001). Since the current Internet technology is no longer limited to information retrieval, users in libraries may engage in e-commerce as well as information seeking when using a machine connected to the Internet. We are now in a position to restate our more general propositions as testable hypotheses for the public library context.

A library presents a public environment where people move freely around the public access areas, and although libraries are traditionally considered places of quiet study, the overall environment in a public library can be somewhat noisy and full of activity. The configurations of libraries range from large institutions with vast physical information resources to tiny, one room buildings with small physical information resources and little space for computers. Computers in public libraries are provided in a variety of different

workspace configurations ranging from open tables to individual carrels to small rooms in rare instances. The physical environment surrounding a computer in a public library affords varying degrees of privacy; generally there is very little work-area privacy available to users in these locations and the computer screens are visible to library staff members and other patrons. In addition, computers are frequently placed in the central areas of the library, resulting in a generally "busy" atmosphere surrounding the user. We hypothesize that in a public library:

- **Hypothesis 1 (The Task Privacy Hypothesis):** *The perception of task privacy will have a positive effect on the transactional use of Web sites in a public library.*

Libraries are generally considered to be sources of knowledge and information staffed by people able to provide assistance in accessing this information. Assistance with using the Internet for e-commerce transactions would be expected to be available, and thus would support e-commerce. We hypothesize that for a public library:

- **Hypothesis 2 (The Available Assistance Hypothesis):** *The perception of available assistance in a library will have a positive effect on the transactional use of Web sites in a public library.*

The virtual environment of public computers differs among libraries. In larger, more sophisticated libraries, the expansion of technological capabilities has resulted in the ability to electronically capturing not only the lending activities of patrons but also other personal confidential data gathered in user profiles. In a multidimensional study of large libraries in the United Kingdom, 93% of the institutions studied generated electronic files containing personal information about patrons, and within this group 28% recorded Internet sites visited (Sturges et al., 2003); most of these data were collected and stored at a central administration site. Patrons depend on libraries to preserve their privacy (Sturges et al., 2003), however, the computers and equipment may record information unbeknownst to the user or library personnel. In some libraries, users can either purposely or inadvertently install spyware or keystroke-logging software on the public computers because computers in many libraries, especially small libraries, receive minimal set up and configuration.

In addition, programs and information stored on the hard drive can remain active and available on such public machines for a substantial time because the equipment receives minimal routine maintenance. Patrons' perception that such programs are on the local computer and their computer activities may be tracked and/or recorded is hypothesized to exert a negative impact on their willingness to use public library equipment for e-commerce transactions.

- **Hypothesis 3 (The Activity Tracking Hypothesis):** *The perception of computer activity tracking will have a negative impact on the transactional use of Web sites in a public library.*

Although some larger libraries use sophisticated electronic applications to support library usage, most libraries depend on daily sign-out lists to reserve computer time, and these lists are destroyed after aggregate daily usage numbers have been compiled. Libraries are very concerned about patron privacy and any archived information of this type is protected (Sturges et al., 2003) to protect user privacy. This concern for patron privacy and the protection of any saved patron records creates an anonymous use environment

that may encourage library patrons to engage in online activities. Specifically, it is hypothesized that:

- **Hypothesis 4 (The Anonymity Hypothesis):** *The perception of anonymity provided by public library computers will have a positive impact on the transactional use of Web sites in a public library.*

The users of computers in public libraries are very diverse (D'Elia et al., 2002), and the individual need for privacy varies among people (McKechnie, 1971). Individual need for privacy influences the workspace privacy needs of individuals (Oldham, 1988). Therefore, we hypothesize that the level of individual need for privacy will moderate the relationship between task privacy available in a library and transactional computer use in the public library environment.

- **Hypothesis 5a (The Need for Privacy Moderation of Task Privacy Hypothesis):** *Individual need for privacy will diminish the positive impact of perceived task privacy on transactional use of Web sites in public in a public library.*

The readily-available assistance found in a library may support e-commerce use in that environment. However, the public environment would not appeal to a person with a high individual need for privacy, thus we hypothesize that a high level of individual need for privacy will tend to decrease the positive impact of having knowledgeable assistance available in the library.

- **Hypothesis 5b (The Need for Privacy Moderation of Available Assistance Hypothesis):** *Individual need for privacy will diminish the positive impact of perceived available assistance on transactional use of Web sites in a public library.*

People with a high need for privacy will be more concerned about privacy invasions and activity monitoring than will those with a lower need for privacy. Thus, we hypothesize that a higher need for privacy will enhance the concerns about activity tracking that may occur through the public computers in libraries, and in turn enhance the impact of perceived anonymity on Internet use, and by extension, e-commerce use. All public libraries have a fundamental reputation for preserving patron privacy regarding other library materials. Thus we hypothesize that a person with a high need for privacy will find the anonymous computer use environment provided by a library to be important.

- **Hypothesis 5c (The Need for Privacy Moderation of Activity Tracking Hypothesis):** *Individual need for privacy will enhance the negative impact of perceived activity tracking on the transactional use of Web sites in public environments.*

- **Hypothesis 5d (The Need for Privacy Moderation of Anonymity Hypothesis):** *Individual need for privacy will enhance the positive impact of perceived anonymity on transactional Web site use in public environments.*

The research model guiding this investigation is provided in Figure 2.

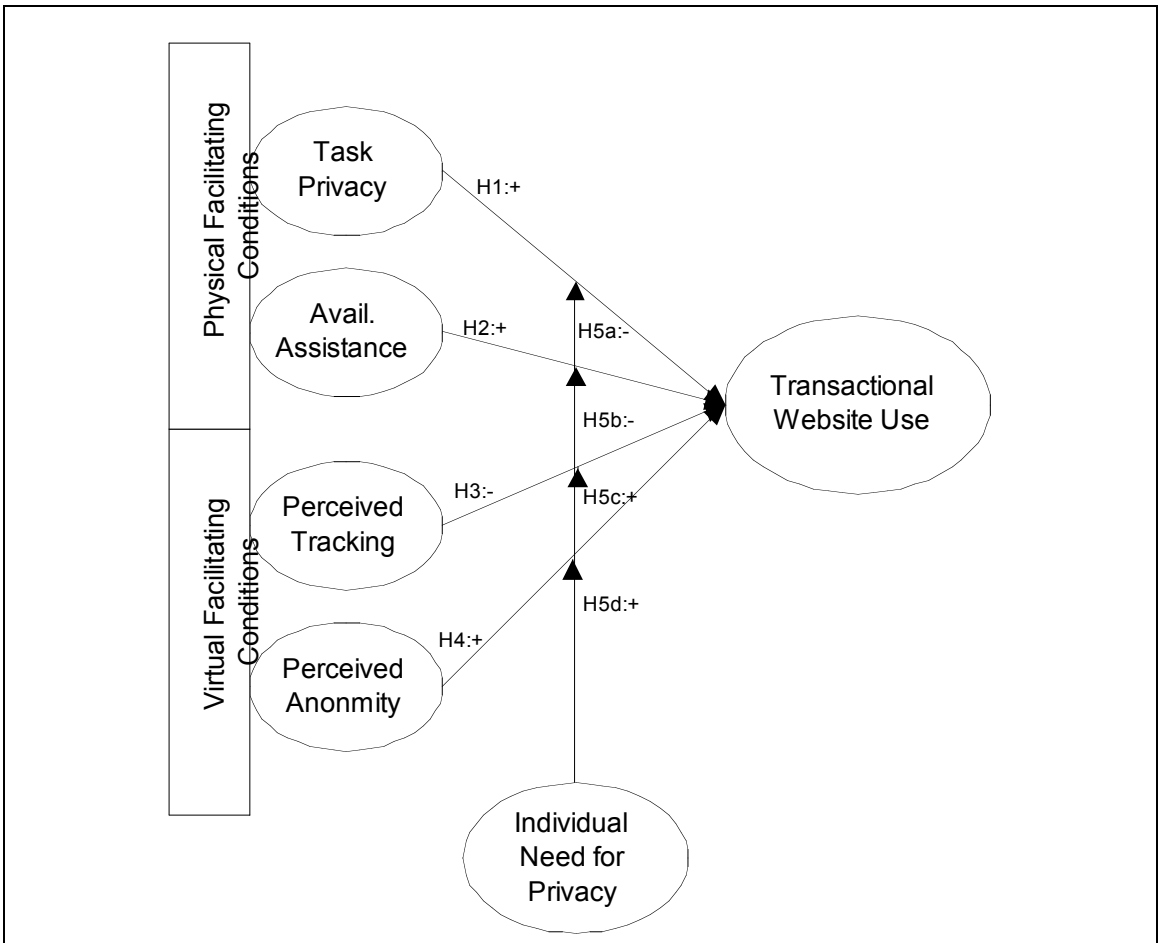

Figure 2: Research Model

Research Methodology

Study Context and Sample

A self-administered survey methodology was employed in this project. The survey was conducted in three library systems involving twelve libraries in the western New York state region. The participating libraries were chosen based upon their willingness to participate and the type of service area (rural/village, suburban/city). Groups of twenty surveys were provided to each library for distribution. Twenty surveys per library were determined to be reasonable number, after conversations with library and system directors. The number of surveys per library needed to be small in order to gain library participation. Discussions with library directors indicated that computer usage is low in some rural areas that getting a large number of surveys completed would be impossible and library staff members did not have the time to handle a large number of surveys. A similar method of surveying library computer users had been used previously (Sturges et al., 2003), in which small samples were gathered from several libraries. Considering this previous research, we felt that the sample generated was representative of library computer users in the survey region.

Library staff members distributed the surveys, according to written instructions and a supporting script provided with the survey materials. The staff members were requested to ask each patron using a computer to participate; participation was totally voluntary and did not impact the patron's subsequent use of the computers. The patrons completed the survey while seated at a computer workstation and the surveys were returned to the library personnel for return to the investigators.

Response Rate and Sample Characteristics

A total of 240 surveys were distributed, 137 were returned, resulting in a return rate of 57.1%. The return rate was impacted by the fiscal crisis facing libraries in the survey area. Staff members in several of the libraries were not always able to cooperate in distributing the surveys, even though the library directors had been very supportive and willing to participate in the project. This unfortunate situation resulted in a lower than expected response. Two of the returned surveys were not completed and were removed from the sample.

The survey administration method did not support a formal test of non-response bias. Since the sample was obtained on an opportunistic basis, we compared the sample demographics to existing literature on public library computer usage to determine if the sample appeared to be representative. About 60% of this sample reported not having Internet access from their homes, almost 56% were male and 82% were white. Approximately 62% lived in urban or suburban areas, and the remainder lived in small towns, villages, or rural areas. Over 65% of the sample indicated annual household incomes of less than $40,000, most of the respondents were between 35 and 65 years old, the largest group was in the 35 to 49 year age group. These results are comparable to the results from other library usage studies (D'Elia et al., 2002; Hoffman et al. 2000). The sample was not nationally comparable on the racial dimension, however, it was reflective of the survey region. Census data indicate that in the region surveyed, 85% of the citizens are white. Based on the majority of demographic characteristics and the U.S. census data, the sample is considered reasonably representative of public library computer users on all except the racial dimension.

The primary focus of this project was the group of people who are on "the other side" of the digital divide and do not have access to the Internet from their homes. Altogether, 82 people in the total sample reported not having Internet access from their homes. Almost 40% of this sub-group reported income less than $20,000 annually, 56% of them were male and 44% were female. Many report being employed full-time (33%), however, a substantial number (24%) indicated that they were unemployed. The respondents were fairly evenly distributed in age from 20 to 65 years old, while 7% were over 65 years of age. A complete description of the sample is provided in Table 1. The characteristics of this subgroup were similar to the full sample, and thus are similar to the library computer user patterns previously reported (D'Elia et al., 2002; Hoffman et al., 2000). The sub-group of library computer users without Internet access from their residences forms the sample considered in this investigation.

The transactional use of Web sites was measured across four dimensions of information and monetary transactions involving both commercial and governmental sites. The respondents were presented with questions that focused on commercial and governmental Web sites individually, with the expectation that they would consider a

Table 1. Sample Characteristics, No Home Internet Access			
		Frequency	**Percent %**
Gender	Male	46	56
	Female	36	44
Age	Under 20	1	1
	20-34	26	32
	35-49	28	35
	50-65	21	26
	Over 65	6	7
Ethnicity	Black	8	10
	White	65	81
	Hispanic	3	4
	Asian/Pacific Islander	0	0
	Native American	3	4
	Mixed Ethnic Heritage	1	1
Education	Some High School	1	1
	H.S. Graduate	19	23
	Some College	23	28
	College Graduate	24	29
	Post 4 Year College	15	19
Employment Status	Full-time Employed	25	34
	Part-time Employed	21	24
	Student	6	6
	Non-employed	21	24
	Retired	9	12
Household Income	Less than $20,000	32	44
	$21,000-$40,000	17	23
	$41,000-$60,000	17	23
	$61,000-$80,000	5	7
	Over $80,000	1	3
Residence Locale	Urban	28	35
	Suburban	22	27
	Village/Town	20	24
	Rural	12	14

Table 2. Transactional Web Site Use Characteristics			
Transactional Use		Freq.	Percent
Monetary Transactions			
	No transactions	55	67.9
	1	3	3.7
	2	7	8.6
	3	8	9.9
	4	3	3.7
	More than 4	5	6.2
Informational Transactions			
	No transactions	38	46.9
	1	10	12.3
	2	12	14.8
	3	9	11.1
	4	3	3.7
	More than 4	9	11.1

broad range of transaction possibilities, not just commercial purchases. The results of this set of questions indicate that users engage in information transactions more frequently than in monetary transactions from public library computers, and the number of respondents reporting multiple transactions is higher for information transactions. A summary table of the transactional use activities for this sample is provided in Table 2.

Instrument Development

The constructs were operationalized adapting existing measures from literature and developing measures of tracking concern and anonymous use. This research involved computer use outside of a traditional business environment. However, the computer-based activities of users in a public library are similar to those in a business environment, so we considered measures developed in the business literature to be reasonable. The new measures, related to tracking concerns and anonymous use, were developed in conjunction with experts in the library science and IS fields. Content validity was considered reasonable after the questions were evaluated by a professor of library science, a professor of IS, and two management doctoral students. The measurement items and sources (where appropriate) are provided in Table 3.

Table 3. Measurement Items and Sources

Physical Facilitating Conditions	Task Privacy	Oldham (1988)
	Assistance Availability	Thompson et al. (1991)
Virtual Facilitating Conditions	Perceived Tracking	Developed
	Anonymity	Developed
E-Commerce Usage	Transactional Use (Dependent)	Developed
Individual Differences	Individual Need for Privacy (Moderating)	McKechnie (1971)

The dependent variable in this study is the number of times the respondent completed either monetary or informational transactions from public library computers. A set of four questions were developed to capture transactional use of both commercial and governmental Web sites. These questions were felt to provide a broad measure of transactional use because they encouraged the participant to consider the major categories of Web sites supporting transactional activities when responding to the questions.

All variables except the transactional use variable were measured using five-point Likert scales. Previous research has shown that, although seven-point Likert scales capture more detail, it is unlikely that respondents make such fine distinctions during the limited time of survey completion (Gupta and Somers, 1992). The smaller scale created a more user-friendly survey instrument, and considering the target respondents, an attractive survey instrument was important to gain participation. Transactional use was measured as 0 indicating no transactions, 1 indicating a single transaction up to 5, which indicated five or more transactions. A complete description of constructs and measures is provided in Table 4.

Table 4. Constructs and Measures		
Construct/Variable Name		Measures
Task Privacy (TP)	TP1	- I am able to concentrate fully on my task when using a public computer in a library
	TP2	- I can work with few distractions when using a library computer
Available Assistance (AA)	AA1	- I feel that assistance with using computer software is available in the library
	AA2	- I feel that assistance with hardware difficulties is available in the library
	AA3	- I feel that assistance with using the Internet is available in the library
Perceived Tracking (TRACK)	TRACK1	- I feel apprehensive about using a public library computer
	TRACK2	- I am concerned that a record of my computer activities will be saved in the library computer
	TRACK3	- I am concerned that any personal information I put into a public library computer will be saved in that computer
	TRACK4	- I am concerned that anyone who uses the library computer after me will be able to track my activities
	TRACK5	- I am concerned that someone located outside of the library may be able to track my activities on the library computer
	TRACK6	- I am apprehensive that a government authority can get records of my computer usage in a public library
Anonymity (ANON)	ANON1	- I feel that my computer activities are anonymous when using a computer in a public library
	ANON2	- I am confident that the public library computers are well managed and do not record user activities
Individual Need for Privacy (INP)	INP1	- It is annoying to have to share my workspace with someone
	INP2	- There is too little emphasis on privacy in our society
	INP3	- I have my best thoughts when I am alone
Transactional Use	TRANS1	- Have you ever completed a monetary transaction using a credit card on a Government Web site while using a public computer in a library? If yes, number of transactions?
	TRANS2	- Have you ever completed the submission of personal information to a Government Web site while using a public computer in a library? If yes, number of transactions?
	TRANS3	- Have you ever completed a monetary transaction with a credit card on a commercial Web site while using a public computer in a library? If yes, number of transactions?
	TRANS4	- Have you ever completed the submission of personal information to a commercial Web site while using a public computer in a library? If yes, number of transactions?

Results

The survey data was analyzed using partial least squares structural (PLS) equation modeling software PLS-Graph Version 3.00 Build 1066. PLS has been used previously in IS research (Agarwal and Karahanna, 2000; Compeau and Higgins, 1995; Gefen et

al., 2000; Venkatesh, 2000) and is appropriate due to the small sample size (Agarwal and Karahanna, 2000) and ordinal measurement scales. The latent variables were modeled from reflective indicators using all measurement items as recommended by Chin (1998). A two-step approach to model testing was employed in which the measurement model was first assessed and then the structural model was tested. The interactions were analyzed using a hierarchical PLS modeling approach, as suggested by Chin et al. (2003). This approach involved forming the interaction terms by multiplying the standardized variable indicators from the predictor and moderator variables together and submitting the original indicators and interaction variables to PLS for analysis. The construct indicators were standardized using SPSS 11.5 prior to calculating the interaction product variables. The standardization approach was employed because of the Likert-scale items used in the survey (Chin et al., 2003). In applying this approach, the fit of the main effects model was considered first, followed by the model that included the interaction components. An improvement in the model fit statistics indicated the importance of the interaction terms. The measurement model results are presented in the next sub-section, followed by the structural model results for the main effects model and the complete model.

Measurement Model

The psychometric properties of the measures were assessed by considering the item reliabilities and discriminant validity. The item reliabilities were evaluated by examining the composite reliability of the main effects and the interaction components. The descriptive statistics for the main effects portion of the model are provided in Table 5, as well as the composite reliabilities. All of the constructs indicated reasonable internal consistency as evidenced by the composite reliability values above the 0.70 threshold (Nunnally, 1978), most were above 0.80. The results indicate that the main effects and interaction constructs can be considered to be internally consistent. Discriminant validity was analyzed by comparing the average variance extracted (AVE) to the R^2 among the latent variables (Fornell and Larcker, 1981). This comparison indicates that more variability is within a latent variable and its indicators than between the latent variables themselves. The results of the correlation matrix are provided in Table 5. Discriminant validity is indicated when the square root of the AVE (provided on the diagonal of the chart) is larger than the correlations among the other constructs. An examination of Table 5 indicates reasonable discriminant validity.

To further evaluate the discriminant validity of the model, the factor loading measurement for each item was examined to ensure that each item loaded higher on its own construct than on any of the other constructs. The results of the analysis of the main effects constructs are presented in Table 6. The reader should note that the mean of the transactional use variable has a rather large standard deviation. This aberration is probably due to the large group of respondents who had never participated in online transactions. The results of the reliability and validity analyses indicate that the measurement model exhibits reasonable reliability and discriminant validity, thus we proceed to consider the structural model.

Structural Model

The main effects structural model was evaluated using the bootstrap procedure within PLS using 500 resamples. The fit of the main effects model exhibited $R^2 = 0.274$ with

Table 5. Statistics, Correlations and Reliabilities of the Measures

	Mean	Std. Dev	C.R.	TP	AA	TRACK	ANON	USE	INP	TP x INP	AA x INP	TRACK x INP	ANON x INP
TP	3.72	1.12	0.833	**(0.850)**									
AA	3.54	0.91	0.837	0.316**	**(0.798)**								
TRACK	2.60	1.10	0.903	-0.101	-0.115	**(0.782)**							
ANON	2.54	1.17	0.925	-0.028	-0.032	-0.289**	**(0.928)**						
USE	4.63	5.21	0.791	0.198	0.186	-0.292*	-0.151	**(0.563)**					
INP	3.42	0.89	0.817	-0.047	0.049	0.14	-0.117	-0.117	**(0.775)**				
TP x INP			0.835	0.118	-0.002	-0.040	-0.031	-0.188	-0.188	**(0.684)**			
AA x INP			0.782	0.176	0.059	0.051	-0.048	-0.242	-0.242	-0.397	**(0.569)**		
TRACK x INP			0.532	-0.172	0.004	-0.146*	-0.074	0.344	0.344	0.039	-0.040	**(0.301)**	
ANON x INP			0.903	-0.070	-0.054	0.222*	-0.098	-0.187	-0.187	0.031	-0.088	-0.205	**(0.779)**

N = 82; √AVE is provided in parentheses on the diagonal. Generally the value of the √AVE should be greater than the correlations in the body of the chart. ** Correlation is significant at the .01 level, * Correlation is significant at the 0.05 level.

Table 6. Cross-Factor Analysis and Factor Loadings

	Task Privacy	Assistance Available	Perceived Tracking	Anonymity	Individual Need for Privacy	Trans Use
TP1	0.9998	0.3370	-0.0924	0.0161	-0.0591	0.1848
TP2	0.6004	0.3494	-0.1885	0.1508	0.0429	0.0349
AA1	-0.2718	0.8937	-0.1451	-0.0256	-0.0241	0.0606
AA2	-0.3410	0.9748	-0.1178	-0.0050	0.0136	0.0330
AA3	-0.3523	0.8439	-0.0208	0.0098	0.0866	0.0531
TRACK1	0.1099	-0.0666	0.7530	-0.0143	0.1109	0.0815
TRACK2	0.0412	-0.1795	0.8330	0.3741	0.0979	0.0523
TRACK3	0.0015	-0.1223	0.8898	0.3837	0.1045	0.1117
TRACK4	0.0920	-0.1410	0.8208	0.3203	0.1307	0.1526
TRACK5	0.0680	-0.2082	0.7121	0.4102	0.0418	-0.0020
TRACK6	0.0511	-0.1734	0.5839	0.3880	0.0975	0.0064
ANON1	0.0081	-0.0152	-0.2231	0.9803	-0.1173	0.0739
ANON2	0.0210	0.0758	-0.3559	0.8787	-0.0995	0.0271
INP1	-0.0463	0.0258	0.0597	0.1115	0.6156	0.1275
INP2	0.1020	-0.0888	0.0478	0.0932	0.7176	0.0847
INP3	-0.2034	0.1716	0.0594	0.0821	0.5875	0.1358
TRANS1	-0.1120	0.0687	0.1009	0.0409	0.0885	0.8486
TRANS2	-0.0657	0.1037	-0.0204	0.0549	0.0601	0.5135
TRANS3	-0.0373	0.1969	-0.1643	0.1006	-0.0117	0.3392
TRANS4	-0.0391	0.2223	0.0669	0.0336	0.0281	0.6601

Table 7. PLS Results

		Main Effects Model	Interaction Model
Hypothesis	Path	Path Coefficient	Path Coefficient
H1	TP → TRANS	0.316***	0.175**
H2	AA → TRANS	0.247**	0.217**
H3	TRACK → TRANS	-0.346***	-0.288**
H4	ANON → TRANS	-0.276**	-0.264**
H5a	TP X INP → TRANS		-0.328***
H5b	AA X INP → TRANS		-0.357***
H5c	TRACK X INP → TRANS		0.218**
H5d	ANON X INP → TRANS		-0.114
		R^2 = 0.274	R^2 = 0.457

** p<0.05, *** p<0.01
Controls: Income level, education level and experience

four paths indicating significance at the 0.05 or 0.01 level. The results of the main effects model are summarized in Table 7.

Testing for the interaction effects was carried out as described by Chin et al. (2003). The predictor and moderator variables were modeled as latent constructs. The moderation variables were created by calculating the product of the predictor and moderator variables and adding these new variables into the model. Standardized measures were used in this product calculation as recommended by (Chin et al., 2003) so that no

emphasis was given to any member of the indicator set. The standardized measures were calculated using the SPSS 11.5 statistical package. Controlling for income, education level and experience, a hierarchical process, was followed looking first at the structural main effects model and then at the structural model incorporating the interaction constructs. The results of this additional analysis are summarized in Table 7 and displayed in Figure 3.

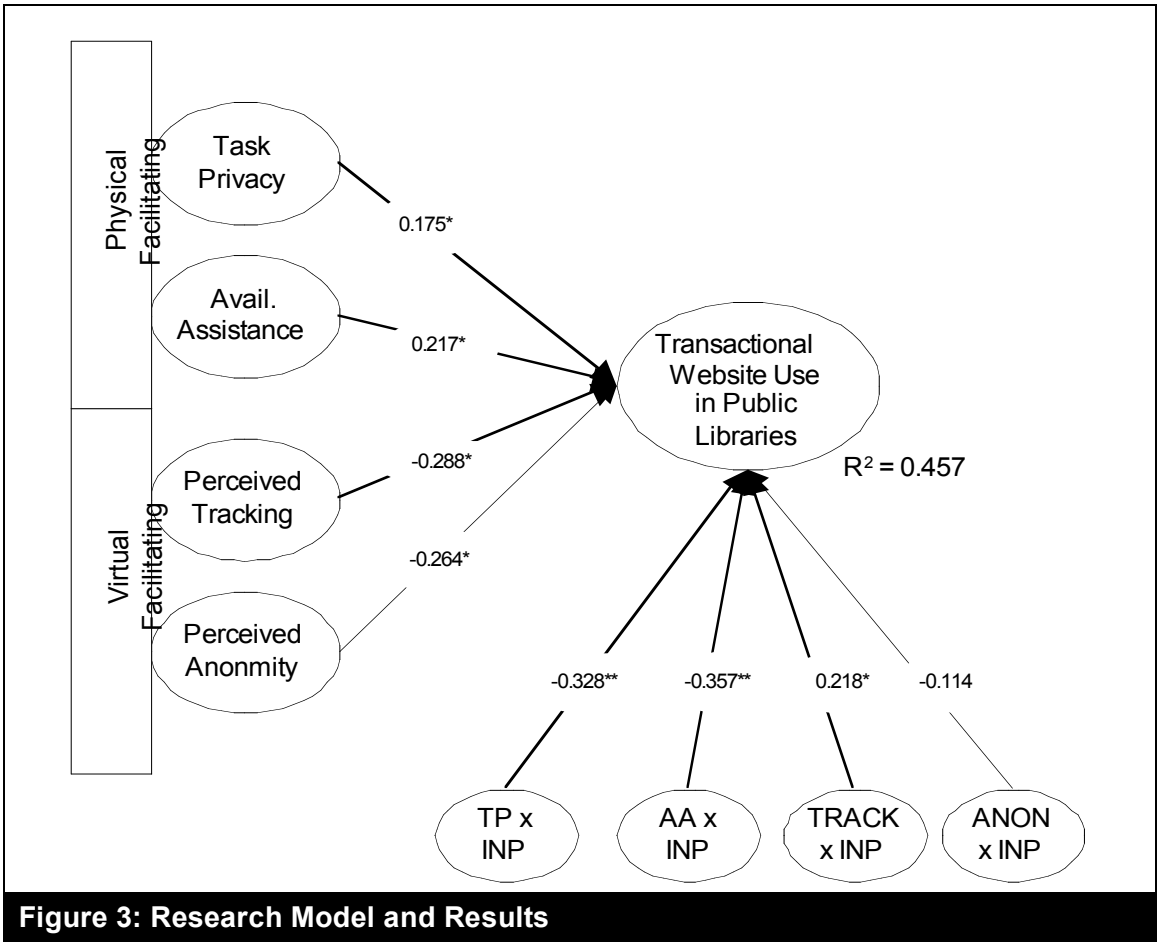

Figure 3: Research Model and Results

Notes: - INP designates individual need for privacy
- Highlighted lines indicate supported hypotheses
- Confidence levels: * p< .01, **p < .05

The impact of the interaction variable was evaluated by examining the difference in model variation explained with the interaction effect added to the model. The inclusion of the moderator resulted in a substantially increased R^2 = .457. The effect size of this change was 0.25, which is considered to be moderate to large (Chin et al., 2003). These overall results indicate that interaction factors add to the overall explanatory power of the model and suggest that individual need for privacy does moderate the impact of the physical and virtual facilitating conditions on transactional use.

Hypotheses 1 though 4 were tested using PLS analysis of the main effects variables. The use of the main effects model is suggested in this portion of the analysis due to the possibility of confounding main and moderating effects (Carte and Russell, 2003). The

path coefficient of 0.318 ($p < .01$) between task privacy and transactional use indicates that task privacy is important to transactional use in a public environment. Likewise, the path coefficient of 0.248 ($p < .05$) between available assistance and transactional use also indicates an important relationship exists between these variables. The Activity Tracking Hypothesis, H3, and the Anonymity Hypothesis, H4, focus on the virtual environment within a public computer. The path coefficient of -0.346 ($p < 0.01$) indicates that the perception of being tracked is a deterrent to public computer users and exerts a negative influence on transactional use. The path between anonymous use and transactional use, while significant, is in the opposite hypothesized direction and does not support the Anonymity hypothesis. This unforeseen result may indicate
that since Web-based transactions generally involve some type of personal information, anonymity is not a determinant of transactional use, and this result may in fact indicate that those people who perceive their actions to be anonymous on a public computer are not inclined to complete Web site transactions in any environment. This unexpected but interesting result needs to be further investigated.

The Need for Privacy Moderation of Task Privacy Hypothesis, H5a, and the Need for Privacy Moderation of Available Assistance Hypothesis, H5b, explore the impact of the individual difference variable, need for privacy, on facilitating conditions. Interval scales were used in this investigation, therefore the change in R^2 and the effect size were used to evaluate the moderating effects. A direct interpretation of the path values is not recommended (Carte and Russell, 2003), however, the direction of the path values adds insight into each of the interactions and suggests that individual need for privacy diminishes the impact of task privacy on transactional use. At the same time, individual need for privacy appears to enhance the effects of perceived tracking on transactional use. Individual need for privacy was found to diminish the impact of available assistance, and it does not appear to influence the impact of anonymity on transactional use.

The results of this analysis indicate that the two dimensions of the physical facilitating conditions, task privacy and available assistance, provide support for transactional use. Task privacy exhibited a slightly weaker path than did available assistance. This would be expected in the libraries studied because there was essentially no privacy in any of the locations. Perceived tracking does appear to discourage transactional Web site usage, as this was the strongest path (0.288, $p < .01$). Therefore this suggests that public computer users are concerned about these issues. fairly large and significant (-.264, $p < .01$) negative relationship was found between anonymity and transactional use. This was contrary to the expected direction of this relationship and should be further investigated. This unexpected result might be explained by considering that people who are conscious about preserving their anonymity would not engage in an e-commerce activity, which in and of itself requires that a person provide personal information. While the original hypothesis may be supported in a public environment where people are just using the Internet for information access, it is understandable why it would have been unsupported in this study where specific information transactions were required.

The interaction of individual need for privacy markedly improved the explanatory power of the model. The strongest interaction effects of individual need for privacy were with task privacy and available assistance. In both cases, the individual need for privacy diminished the primary relationship. The moderating effect of individual need for privacy on the relationship between perceived tracking and transactional use was fairly strong

and significant (.218, $p < .01$). This suggests that the individual's need for privacy enhances the negative relationship between perceived tracking and transactional use. These results support the hypotheses and indicate that an individual's unique characteristics do influence the effect of the facilitating conditions on their use of public computers for e-commerce transactions. The interaction with anonymity yielded an insignificant relationship, which is not unexpected based upon the main effects and the information exchange-nature of the Internet activities under study. A summary of the overall results is provided in Table 8.

Engaging in private transactions from public computers appears to be a somewhat limited activity, even among people without Internet access from their residences. A majority of the public computer users participating in this study reported no monetary or information transaction activity while using the public access computers. However, among the people who have engaged in e-commerce transactions in this environment, the facilitating conditions do exert an impact. Both the physical environment and the virtual computer environment significantly influenced e-commerce behavior among study participants, as suggested by Triandis (1980) in his extension to TRA and Ajzen (1991) in his definition of actual behavioral control.

Table 8. Results Summary

H1 (Task Privacy Hypothesis)	Supported	The relationship between task privacy and public transactional use is positive and significant.
H2 (Available Assistance Hypothesis)	Supported	The relationship between available assistance and public transactional use is positive and significant
H3 (Perceived Tracking Hypothesis)	Supported	The relationship between perceived activity tracking and public transactional use is negative and significant.
H4 (Anonymity Hypothesis)	Not Supported	The relationship between anonymous use and public transactional is negative and significant
H5a (INP Moderation of Task Privacy Hypothesis)	Supported	The effect of INP on the relationship between task privacy and transactional use is negative and significant.
H5b (INP Moderation of Available Assistance Hypothesis)	Supported	The effect of INP on the relationship between Available Assistance and public transactional use is negative and significant.
H5c (INP Moderation of Activity Tracking Hypothesis)	Supported	The effect of INP on the relationship between perceived tracking and public transactional use is positive and significant.
H5d (INP Moderation of Anonymity Hypothesis)	Not Supported	The effect of INP on the relationship between Anonymity and public Transactional is not significant.

We also find that individual differences are a factor in these behavioral relationships. A person's individual need for privacy moderates the impact of the physical and virtual environments on e-commerce behavior in these locations. The results from our model suggest that the facilitating conditions found in a public situation will influence the use of the Internet in that context.

Discussion and Conclusions

Engaging in e-commerce transactions in public places carries an inherent risk to the user that is not found in e-commerce activities conducted through private computers, due to the environmental conditions found in and around publicly provided computers. Users have shown a reluctance to engage in e-commerce due to risks they perceive in these activities (Jarvenpaa and Tractinsky, 1999; Miyazaki and Fernandez, 2001) in these activities. Perceived risk can be considered to be the uncertainty a person feels regarding the possible negative consequences of an action (Featherman and Pavlou, 2003). People have expressed concerns about the privacy of their personal transaction information, the use of their personal information for fraudulent purposes, and the security of the transaction information (Miyazaki and Fernandez, 2001). However, public computer users are exposed to a wider array of risks, both in the physical environment and in the virtual environment of the computer. The uncertainties that people have about the negative consequences of using a public computer for e-commerce may be reflected in their unwillingness to adopt e-commerce in a public environment and may be a consequence of the facilitating conditions present in the computer environment.

Public computers are provided in many public environments as a way to narrow the digital divide by providing a means to access the Internet for all people. The publicly-available computers should be provided in such a manner that people will perceive less risk in the public computer environment and be willing to fully use all aspects and functionality of Internet resources and services. The goal of this research was to define characteristics of the public computer use environment that influence e-commerce adoption in public and to investigate the impact of each of these dimensions on e-commerce usage. This investigation included an expansion of the Facilitating Conditions construct defined by Triandis (1980) to include two distinct types of facilitating conditions, the facilitating conditions perceived in the physical environment and the facilitating conditions perceived in the virtual environment of the computer used to interface with the Internet. Our results show that a lack of task privacy and user concerns about activity tracking impede the use of public computers for Web site transactions, while the availability of on-site staff to provide assistance with the equipment supports e-commerce use in this environment. Perceived anonymity was not found to be a motivating factor for completing transactions in this environment. Anonymity may be more of an issue for people engaging in unidirectional information gathering from the Internet because e-commerce transactions, of necessity, contain personally identifying information. The results further indicate that an individual difference characteristic, *individual need for privacy*, influences the significant relationships, except for the negative relationship between anonymity and transactional use. Overall, these factors explained 45.7% of the variability in e-commerce use in the public environment.

Before we discuss the implications of this study, the limitations of this work should be noted. Self-report data was used throughout this project. Problems regarding self-report data have been discussed in IS literature (Straub et al., 1995; Trice and Treacy, 1986) however multiple report measures were not possible in collecting data for this type of research. This research project was focused on the respondents' perceptions, thus a self-report measure of transaction usage would reasonably reflect these factors. A further limitation of this study was the lack of a pilot study to evaluate the survey instrument. Gaining support from libraries and encouraging patron participation was a large problem with this initial study, therefore experts were used to review the survey

and the data gathered was used for analysis. It is noted that this is a limitation of the study, and subsequent work will involve a pilot study to validate the survey instrument. The sample was, by necessity, a convenience sample, although every effort was made to gather input from a diverse group of public library computer users. Such constraints occur when pursuing research such as this, and thus are noted as limitations. A further limitation of this work is the lack of racial diversity in the study sample. Research in the digital divide indicates that minorities are heavy users of public computers (Hoffman et al., 2000). This was not reflected in this sample, due possibly to the racial profile of the region in which this study was conducted, where 85% of the population is white. This flaw in the sample may lead to a lack of generalizability of these results outside of this area. An expansion of this work to gather input from a broader cross section of public computer users will add further insights into this problem.

In conclusion, the results of this research suggest that environment is an important facet of technology use, especially in public computing. Our findings suggest that providing greater task privacy may promote transactional use in a public environment, however individual characteristics will moderate the impact of these environmental factors. The availability of assistance appears to be a supporting factor in public transactional use, even among those people with a high individual need for privacy however, individual need for privacy moderates this relationship as well. The activity tracking results indicate that users have concerns about being tracked and monitored while using public library computers, and this concern impacts transactional use. The impact is amplified by the individual's need for privacy. The overall results of this study suggest that just providing public Internet access is not sufficient to fully bridge the digital divide. It is apparent that people are willing to use the computers provided in public libraries to access the Internet and reduce the information divide, but they are unwilling to fully use this public equipment to participate in Web-based transactions, thus we are still left with an e-commerce divide.

Future Research

The installation and use of publicly-available information devices is expanding quickly to provide access to information resources from a variety of places like stores, malls, airports, hospitals, offices, schools, libraries, and community centers, to name a few. In addition to wired access, wireless access is also becoming ubiquitous in many public areas as another source of Internet access. As public computer availability burgeons, we are encouraged to consider the IT context (Orlikowski and Iacono, 2001) and include the impact of computing environment on technology adoption and use. The current work suggests that the technology environment can be viewed in at least two dimensions; the physical environment and the virtual environment, and each should be considered when investigating technology adoption in public environments. Subsequent work needs to investigate different types of public environments, for instance community centers, which tend to be more socially focused and may be used more frequently for e-commerce than computers located in libraries. Public computers in retail environments may receive more e-commerce activity than public access sites in airports.

Risk perception in the public environment is another area that warrants investigation. Previous research has found that time risk, privacy risk, and financial risk are all concerns of people adopting an e-service (Featherman and Pavlou, 2003). Extending these finding by also considering the computing environment suggests a series of further

research areas. For example, the results of the current work indicate that people are concerned about possible activity tracking and information gathering that might occur through a public computer. These concerns could be further decomposed into concerns about the perceived risk to a person's privacy and perceived financial risk from these activities; both risks are a direct result of the environment, and each may exert a different influence on e-commerce adoption. Further research into how to best address these user concerns or reduce the perceived risk in this environment would be valuable to enterprises seeking to support e-commerce activities through public computers and to organizations seeking to provide Internet access to people across the digital divide.

The measures for capturing perceived tracking and anonymous use have not been previously established, so this leads to validity concerns. Further work and testing of these measures in a variety of use environments also needs to be completed in order to develop empirically sound environmental measures necessary to support further research focused on the impact of the environment on technology use.

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About The Authors

Ann D. Rensel is currently a Ph.D. candidate in the Department of Management Science and Systems at the State University of New York School's of Management and an adjunct faculty member at Niagara University in the department of Computer and Information Sciences. Her current research interests include digital divide issues both at the individual level and in the gap that exists in small business use of technology.

June M. Abbas is currently an assistant professor of Library Science & Information Studies in the School of Informatics at the State University of New York at Buffalo. Her current interests lie on both sides of the information interface. She is interested in how to create better tools and systems for organizing information for users. Her research is concerned with the retrieval and representation of information objects. The current focus of her research activities is on retrieval strategies and representation issues within digital libraries. She is continuously intrigued by natural human information organization and categorization activities.

H.R. Rao is interested in the areas of management information systems, decision support systems, expert systems and information assurance. He has chaired sessions at international conferences and presented numerous papers. He has authored or co-authored more than 100 technical papers, of which more than 60 are published in archival journals. His work has received best paper and best paper runner up awards at AMCIS and ICIS. Dr. Rao has received funding for his research from the National Science Foundation, the Department of Defense and the Canadian Embassy and he has received the State University of New York at Buffalo's prestigious Teaching Fellowship. He has also received the Fulbright Fellowship in 2004. He is a co-editor of a special issue of *The Annals of Operations Research*, the *Communications of ACM*, associate editor of *Decision Support Systems*, *Information Systems Research* and *IEEE Transactions in Systems, Man and Cybernetics,* and co-editor-in-chief of *Information Systems Frontiers*.

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