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# A LONGITUDINAL INVESTIGATION OF PERSONAL COMPUTERS IN HOMES: ADOPTION DETERMINANTS AND EMERGING CHALLENGES[1]

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## *Abstract*

*While technology adoption in the workplace has been studied extensively, drivers of adoption in homes have been largely overlooked. This paper presents the results of a nation-wide, two-wave, longitudinal investigation of the factors driving personal computer (PC) adoption in American homes. The findings revealed that the decisions driving adoption and non-adoption were significantly different. Adopters were driven by utilitarian outcomes, hedonic outcomes (i.e., fun), and social outcomes (i.e., status) from adoption. Non-adopters, on the other hand, were influenced primarily by rapid changes in technology and the consequent fear of obsolescence. A second wave of data collection conducted six months after the initial survey indicated an asymmetrical relationship between intent and behavior, with those who did not intend to adopt a PC following more closely with their intent than those who intended to adopt one. We present important implications for research on adoption of technologies in homes and the workplace, and also discuss challenges facing the PC industry.*

**Keywords:** Theory of planned behavior, adoption, household, intention, behavior

**ISRL Categories:** AA0101, AA05, AA07, BD0401, CA0704, DD0502

## Introduction

> *"There is no reason anyone would want a computer in their home."*
>
> Ken Olson
> President, Chairman, and Founder
> Digital Equipment Corporation
> 1997

[1]Allen Lee was the accepting senior editor for this paper.

Early predictions about the adoption and use of a telephone proved to be false as it became a necessity, rather than a luxury, in most American households. Likewise, early assessments about the adoption and use of personal computers (PCs) in homes are quickly proving to be false (Venkatesh 1996). Increasingly, PCs, powered by the ability to deliver Internet services (e.g., e-mail, the world wide web) and support activities in homes (e.g., household financial planning), are being touted as an innovation that will have an impact similar to the telephone. While a number of surveys, including surveys from Times-Mirror (Kohut 1995), Nielsen, and members of the academic community (Kraut 1996; Kraut et al. 1996), indicate that a little over a third of all households have adopted PCs, little systematic research has been conducted to understand the determinants of adoption and diffusion of PCs in homes.

Understanding household adoption has direct implications for the study of electronic commerce (e-commerce), where households can be both consumers and vendors. From this perspective, we focus on the role households play in this burgeoning arena. The current work provides managers with an understanding of the households that could potentially participate in the business-to-consumer (i.e., *household as consumer*) as well as the quickly growing consumer-to-consumer (i.e., *household as vendor*) segments of the e-commerce market. One of the forecasts on business-to-consumer e-commerce projects revenues to be $33 billion in the year 2000 and 5% of global transactions by 2003 (Forrester Research 1998). Factors similar to those important in the adoption of home PCs may be influential in household adoption of, or participation in, e-commerce activities. Thus, understanding the adoption patterns and attitudes of households may provide a useful mechanism for managing information technology resources associated with an organization's e-commerce initiative.

As an additional perspective, we can consider *households to be one type of organization*. Vitalari et al. (1985) suggest that the "household is a microsocial system and is similar in behavior to small, shared work settings" (p. 513 ). Thus, while the current work examines PC adoption in the household, the results can shed light on the selection and deployment of information technology in other organizations. As stated by Lee (1999), "information technology interacts with a social setting" (p. v), and for MIS research to add value, we should "focus on the rich phenomena that emerge whenever the technological and the social come into contact with, react to, and transform each other" (p. v). Household adoption of PCs is an area in which the social and the technological interact. The current work can thus give us an important window into PC (and other emerging technologies) adoption in small organizations. Further, when we consider that "more than 24 million people run either full-time or part-time businesses from their homes" (Small Business From Home 2000), the household as an organization is indeed a reality.

Adoption and diffusion of information technologies has been studied extensively in information systems (IS) research at the individual level (e.g., Davis et al. 1989) and the organizational level (e.g., Cooper and Zmud 1990). The theoretical models employed to study individual adoption and usage behavior include the theory of reasoned action (e.g., Ajzen and Fishbein 1980; Davis et al. 1989), the technology acceptance model (e.g., Davis et al. 1989), the theory of planned behavior (e.g., Ajzen 1991; Mathieson 1991), the decomposed theory of planned behavior (e.g., Taylor and Todd 1995), and innovation diffusion theory (e.g., Agarwal and Prasad 1997, 1998; Brancheau and Wetherbe 1990; Rogers 1995). These models were applied primarily to explain individual adoption and usage of technologies in the *workplace.* In the context of understanding home use of PCs, prior research has studied the role of the PC as a tool to enable working at, or from, the home (see Venkatesh and Vitalari 1992), or a mechanism to connect to, and explore, the Internet (Kraut et al. 1996). We expect the factors affecting household PC adoption decisions to be somewhat different from those affecting workplace decisions due, in part, to the personal nature of the expense, as well as the goals for technology use.

The current research aims to achieve three main objectives:

(1) identify factors that determine household adoption of PCs,

(2) determine the factors influencing household PC adoption among adopters and non-adopters, and
(3) examine the nature of the relationship between the intent to adopt and subsequent purchase behavior in the context of household adoption of PCs.

## Model of Household PC Adoption

We develop a model of adoption of technology in households (MATH) by drawing from established bases of research in IS, marketing, and psychology. Specifically, we focus on the personal computer as the technology of interest. While IS research offers models of workplace technology adoption, issues of consumer behavior are addressed in the marketing literature, and research in psychology provides generalized insights into human behaviors. None of these areas focus specifically on issues of technology adoption behavior in households. Given this dearth of solid theoretical explanations of household PC adoption, the current research sought to begin with a general framework to guide the model development. The theory of planned behavior (TPB; Ajzen 1985, 1991) was chosen to be the guiding framework. TPB is particularly suited for the current work since it is specifically geared to explain/understand volitional behaviors such as PC adoption in homes. Also, TPB has been successfully applied to explain behavior in a wide variety of domains (for a review, see Ajzen 1991), including technology adoption (Mathieson 1991; Taylor and Todd 1995). Furthermore, prior IS research has used TPB as a guiding framework to create a *decomposed* belief structure for student technology adoption/usage (see Taylor and Todd 1995). Rather than utilizing the procedure recommended by TPB researchers for eliciting users' salient belief structure, it is important to note that Taylor and Todd developed the *decomposed* belief structure for technology adoption by drawing from previous research in technology adoption.[2] Consistent with the approach of Taylor and Todd, we propose a decomposed belief structure for home PC adoption by drawing from rich research bases in technology adoption, consumer behavior, and psychology, the key reference domains/fields for the current work.

According to TPB, behavioral intention (BI), the key dependent variable, is determined by attitude toward behavior (A), subjective norm (SN), and perceived behavioral control (PBC). Attitude toward behavior is defined as a person's favorable/unfavorable evaluation of the behavior in question, subjective norm is defined as the perceived social pressure to perform (or not perform) the behavior in question, and perceived behavioral control relates to the extent to which the person believes that s/he has control over personal or external factors that may facilitate or constrain the behavioral performance (Ajzen 1991). A, SN, and PBC are in turn the reflection of underlying cognitions/beliefs. The attitudinal belief structure typically comprises behavioral beliefs that relate to favorable outcomes that result from performing the behavior. It is expected that utilitarian outcomes, hedonic outcomes, and social outcomes form the underlying attitudinal belief structure. Broadly, the importance of such outcome expectancies is also supported by the work of Compeau and Higgins (1995), which identified two types of expectancies. The normative belief structure comprises of the influences of family, friends, and other important referents. The control belief structure relates to barriers to adoption posed by knowledge and cost. In the remainder of this section, we develop the theoretical justification for the role of various underlying cognitions in determining household PC adoption and usage behavior.

[2]This is important to highlight given that research in psychology (Ajzen 1985, 1991; Ajzen and Fishbein 1980; Fishbein and Ajzen 1975) would recommend that salient beliefs should be elicited from subjects and not predetermined by the researchers. However, conceptually, the approach of Taylor and Todd (1995) is justified on the basis that there is a wealth of existing research on technology adoption, thus minimizing the need to elicit beliefs afresh for each new technology adoption setting.

## Attitudinal Belief Structure

Workplace technology adoption decisions of individuals have been typically characterized by a strong productivity orientation. Across the different models, validated and applied in student and workplace settings, constructs related to the use-productivity contingency (e.g., perceived usefulness, relative advantage, job fit, etc.) have emerged as the strongest predictors of adoption and usage behavior (Adams et al. 1992; Agarwal and Prasad 1997, 1998; Chin and Todd 1995; Davis 1989, 1993; Davis and Venkatesh 1996; Gefen and Straub 1997; Igbaria et al. 1997; Mathieson 1991; Segars and Grover 1993; Trevino and Webster 1992; Subramanian 1994; Szajna 1994, 1996; Taylor and Todd 1995; Thompson et al. 1991; Venkatesh and Davis 1996, 2000). The current research adapts this rational basis for technology adoption and usage to the household setting via the construct *utilitarian outcomes*, defined as the extent to which using a PC enhances the effectiveness of household activities.

In addition to utilitarian outcomes, we expect PC adoption in homes to be influenced by *hedonic outcomes*. Consumer behavior research describes hedonic outcomes as the pleasure derived from the consumption, or use, of a product (Babin et al. 1994; Hirshman and Holbrook 1982; Holbrook and Hirshman 1982). In a household setting, in contrast to the workplace, the entertainment potential of PCs is expected to have a strong influence on the adoption decision. PC applications have evolved over the past decade, providing more and more opportunities to *play* with technology. Similar to video games (e.g., Nintendo), PC games (e.g., Myst[3]) are entertaining and render PC use enjoyable (Davis et al. 1992; Holbrook et al. 1984; Malone 1981). Further, they provide an opportunity to escape reality and become absorbed in a new world, thus exhibiting characteristics consistent with a hedonic perspective (Foxall 1992; Lacher and Mizerski 1994). Dating back to the last decade, the importance of hedonic outcomes as a determinant of PC adoption is also borne out by a decline in people's use of other competing forms of entertainment and fun such as radio, movies, fiction reading, and social activities (Kohut 1995; Robinson and Godbey 1997; see also Vitalari et al. 1985).

*Social outcomes* can be thought of as the "public" recognition that would be achieved as a result of adopting an innovation (Fisher and Price 1992). This may lead to an elevation in power, knowledge, and/or status if the decision is thought by others to be a good one. Prior research has emphasized the importance of social outcomes as a determinant of behavior (e.g., McCracken 1988). Similarly, innovation literature suggests that the desire to gain status (i.e., image) is an important reason for the adoption of an innovation (Rogers 1995). Recent research in IS has also highlighted the importance of social outcomes; specifically, it has been suggested that the desire for social outcomes is driven by the resultant referent power, which gives the actor performing the behavior power within her/his social group (Venkatesh and Davis 2000). Although PCs have been in existence in one form or another since the 1970s, they are still relatively new to the household arena. In the context of household adoption of PCs, those who currently have a PC, henceforth known as early adopters, may have valued the status and referent power for being among the first to adopt a PC. Such enhanced status helps them serve as role models for those who come later, henceforth known as later adopters. The role of those who currently have a PC is to adopt the innovation, evaluate it, and communicate their evaluation to members of a social network, thus decreasing uncertainty for others (Rogers 1995).

The role of utilitarian, hedonic, and social outcomes as key determinants of the adoption decision is also borne out by motivation theory. Motivation research suggests that there are two main classes of motivators: extrinsic and intrinsic. Extrinsic motivation pertains to achievement of a specific goal whereas intrinsic motivation is the pleasure and satisfaction derived from a specific behavior (Deci and Ryan 1980; Vallerand 1997). A significant body of research has established extrinsic and intrinsic motivation as primary drivers

[3]Myst is produced by Brøderbund and is described as "The surrealistic adventure that will become your world....It provides a first-person experience in which the screen displays exactly what the player is 'seeing'."

of behavior in several domains (for a review, see Vallerand 1997), including technology adoption and usage (Davis et al. 1992; Venkatesh and Speier 1999). In the context of PC adoption in homes, utilitarian and social outcomes represent extrinsic motivators, whereas hedonic outcomes belong to the intrinsic motivator category.

Prior research suggests that individuals with higher perceived utilitarian and hedonic outcomes will have greater intentions to adopt technology (e.g., Davis et al. 1992). Likewise, the desire for social outcomes is more important for earlier adopters than later adopters. Thus, we would expect that the earlier adopters would place greater value on the components of the attitudinal belief structure than would the later and non-adopters.

## Normative Belief Structure

*Social influence* is the extent to which members of a social network influence one another's behavior (Rice et al. 1990). In contrast to social outcomes, social influence is the perceived pressure to perform the behavior in question. This influence is exerted through messages and signals that help to form perceptions of the value of a product or activity (Fulk and Boyd 1991; Fulk et al. 1987; Salancik and Pfeffer 1978). The importance of social influence as a determinant of behavior has been highlighted in prior research (e.g., Ajzen 1985, 1991; Ajzen and Fishbein 1980; Fishbein and Ajzen 1975; Taylor and Todd 1995; Thompson et al. 1991; Warshaw 1980). Although workplace adoption models in IS have incorporated social influences, there is mixed evidence supporting the role of social influences on the individual in the workplace (e.g., Davis et al. 1989; Mathieson 1991; Taylor and Todd 1995). Prior research suggests that the importance of utilitarian outcomes (such as productivity gains from technology use) may actually lessen the importance of social influences in workplace adoption decisions (see Davis et al. 1989). In fact, in other recent work, it has been shown that in voluntary settings, social influences do not have a direct effect on intention or behavior but rather operate indirectly through constructs similar to utilitarian outcomes (Venkatesh and Davis 2000). Household decisions, on the other hand, tend to be characterized by more of a normative orientation (e.g., Burnkrant and Cousineau 1975). Thus, we can expect household PC adoption decisions to be influenced by the views of relevant others, such as friends and family members (Burnkrant and Cousineau 1975; Childers and Rao 1992; Fisher and Price 1992; Miniard and Cohen 1979).

Prior research has identified secondary sources of information, such as TV and newspapers, as influential in early adopters' decisions to adopt (Rogers 1995). Thus, we would expect that household PC adoption decisions would be influenced by the messages conveyed via the mass media. We expect that those who currently have a PC, being among the earlier to adopt, would likely not be influenced by messages from friends and family because knowledge about the product in the social system is not readily available. We would expect that secondary sources (i.e., mass media) will have a significant impact on their adoption decisions. The early adopters are, in turn, expected to exert influence on future adopters. However, future adopters being followers can be expected to wait for PCs to be well-settled in the marketplace and supported by positive "word of mouth" from friends, family, and other adopters. Therefore, we propose that the opinions of relevant others (e.g., friends and family) will have a significant influence on future adopters but may not have been as influential on those who currently have a PC.[4]

[4]A further distinction of the role of social influences is the extent to which friends or family members are influential. We expect this to depend on where the innovation falls on two sets of dimensions: luxury versus necessity and public versus private consumption (Bearden and Etzel 1982; Fisher and Price 1992). Using the classification scheme employed by Childers and Rao (1992), PCs would be considered luxuries since they are not yet commonly owned. However, the nature of PC consumption (i.e., public vs. private) is not as clear. Products that are consumed publicly include clothing and automobiles, while products consumed privately include mattresses and trash compactors (Bearden and Etzel 1982). Consider that PCs can enable connectivity to the Internet and electronic mail, through which household members can communicate with a variety of other people. This type of use can be seen as public consumption as individuals can, through their use, show others that there is a PC in the home. In contrast, in some households, electronic mail may not be used and the PC itself may be located in a bedroom or study. In

## Control Belief Structure

Psychology research in general and TPB research in particular have shown that the presence of constraints can inhibit both the intent to perform a behavior and the behavior itself (for a discussion, see Ajzen 1991). Specifically, IS research has identified knowledge and resources as barriers to technology adoption intent (e.g., Mathieson 1991; Taylor and Todd 1995) and actual usage behavior (Taylor and Todd 1995). Three specific *barriers* (constraints), namely knowledge, difficulty of use, and cost (resources), are expected to be relevant in the context of household PC adoption. Consistent with prior technology adoption research, not possessing the requisite knowledge to use a computer will significantly inhibit adoption in the context of household PC adoption as well. The lack of relevant knowledge as a barrier operates via negative impacts on computer self-efficacy, which has been shown to be a critical determinant of adoption behavior (Compeau and Higgins 1995; Venkatesh and Davis 1996). Next, perceived ease of use has been described and empirically shown to be a barrier to technology adoption (e.g., Venkatesh 1999; Venkatesh and Davis 1996). Also, the role of resources as a barrier is expected to be significant given evidence from prior marketing research (e.g., Erickson and Johansson 1985) that price is a factor in many consumer decisions, especially in the case of expensive goods (e.g., Sahni 1994) such as PCs that cost at least $1,000, about five times the cost of many other consumer durable goods such as TVs, VCRs, etc. There is some evidence to suggest that barriers will be more salient when the individual has less control over the barriers (e.g., Schifter and Ajzen 1985), thus indicating a possible differential role for barriers among adopters and non-adopters.

There is general agreement that early adopters tend to be better educated than later adopters (Brancheau and Wetherbe 1990; Rogers 1995) and more affluent than later adopters (e.g., Feldman and Armstrong 1975; LaBay and Kinnear 1981; Rogers and Shoemaker 1971). Early adopters, who are better educated, are likely to have had more exposure to computers in general, and thus are potentially more computer-literate than later adopters. This is also consistent with the finding by Thompson et al. (1994) that perceived ease of use is more salient to inexperienced users than it is to experienced users. We expect that those who currently have a PC are not likely to have found knowledge and difficulty of use to be significant barriers to adoption, but future adoption and non-adoption will be significantly constrained by knowledge and difficulty of use. Similarly, cost will not be a significant factor to the more affluent (i.e., those who have already adopted) but will be a significant barrier driving future adoption and non-adoption.

## Dependent Variables: Intention and Behavior

Much prior research has relied on intention and behavior as key dependent variables (e.g., Ajzen 1991; Davis et al. 1989; Morwitz and Schmittlein 1992). As supported by extensive prior research (e.g., Ajzen 1985, 1991; Ajzen and Fishbein 1980), intention is the most proximal influence on behavior and mediates the effect of other determinants on behavior. In addition to intention, barriers have a direct effect on behavior. As mentioned earlier, prior research has found intention-behavior correlations from .18 to .84 across a wide range of behaviors (for a review see Ajzen 1991; see also Ajzen 1988; Ajzen and Fishbein 1980; Canary and Seibold 1984; Sheppard et al. 1988). Based on a meta-analysis of 87 studies, Sheppard et al. found a correlation of about .50. Further, constraints and opportunities also have a direct effect on behavior, with correlations ranging from .20 to .78 (for a review, see Ajzen 1991). Typically, intention predicts behavior quite well unless there are constraints beyond the individual's control that completely overshadow intention (e.g., Schifter and Ajzen 1985). Consistent

this case, PC consumption may not be public. Thus, we argue that PC use is neither purely private, nor purely public. In either case, since PCs are a luxury, their adoption will be somewhat of a normative decision. If they are perceived as purely public, friends will exert significant influence; if they are perceived as purely private, family members will exert significant influence. Future research is needed to explore perceptions of the public vs. private nature of PC consumption.

**Table 1. Drivers of Adoption and Non-Adoption**

| | Adopters | Non-Adopters | |
|---|---|---|---|
| | | Intend to Adopt | Do Not Intend to Adopt |
| Attitudinal Belief Structure | | | |
| Utilitarian Outcomes | H | H | H |
| Hedonic Outcomes | H | H | H |
| Social Outcomes | H | L | L |
| Normative Belief Structure | | | |
| Social Influence | L | H | H |
| Secondary Sources | H | L | L |
| Control Belief Structure | | | |
| Lack of Knowledge | L | H | H |
| Difficulty of Use | L | H | H |
| High Cost | L | H | H |

H = expected to have a strong impact
L = expected to have a weak impact

with the overall pattern of findings in psychology and marketing research, research on technology adoption provides evidence to suggest that intention is a fairly good predictor of self-reported usage behavior (Davis et al. 1989; Taylor and Todd 1995) and actual usage behavior (Morris and Venkatesh 2000; Venkatesh and Morris 2000; Venkatesh et al. 2000; Venkatesh and Speier 1999), while issues of control have a direct effect over and above intention (Taylor and Todd 1995).

### Summary

In this research, we seek to understand and explain PC adoption in homes using the determinant structure shown in Table 1. We propose an attitudinal belief structure that comprises utilitarian outcomes, hedonic outcomes, and social outcomes; a normative belief structure that comprises the influence of friends, family, other adopters, and secondary information sources; and a control belief structure that comprises three barriers, namely knowledge, difficulty of use, and cost. We expect the attitudinal beliefs to have played a critical role among those who have adopted a PC to this point. However, among future adopters, social outcomes are not expected to be important. Those who have adopted a PC to this point are not likely to have been driven by social influences, but future adopters are expected to be. However, earlier adopters are more likely to be influenced by secondary sources of information. Finally, control beliefs are expected to more significantly influence non-adoption than adoption.

## Methodology

This study was designed to capture a cross-sectional snapshot and a dynamic longitudinal picture of the underlying phenomena. In order to accomplish this, data were collected in two waves that were six months apart. In Phase 1, data were collected from over 700 households about their PC adoption and usage behavior. Six months later, in Phase 2, we attempted to contact all Phase 1 respondents for a follow-up survey to understand their changing views and follow-up behavior pattern.

A variety of techniques is available to capture consumer perceptions and attitudes. In order to obtain a nationally representative sample of respondents within a limited time frame and budget, mail and telephone surveys are the most appropriate options. Telephone interviews lend themselves to more flexibility and are equal, if not

superior, to other active methods of data collection (Brock 1986; Rogers 1976; Tyebjee 1979). Further, telephone interviews reduce the amount of bias normally associated with an in-person interview due to the elimination of visual cues (Biscomb 1986; Morton and Duncan 1978). Also, the potential for an increased response rate made the telephone interview more appealing, as response rates for random mail surveys tend to be as low as 10% to 15% (Steeh 1981). Finally, the ability to elicit open-ended responses *and* to follow up on those responses using a two-stage questioning methodology allowed us to obtain factors that were not constrained by a priori identification of constructs as in traditional survey research (Babbie 1990; Stone 1978), and also to determine the importance of each of the factors. These two components were very important given the exploratory nature of this work.

One drawback of the telephone interview is the potential for nonresponse errors due to inadequate sampling frame specification. In other words, while the population is American households, the sampling frame will include only those households with telephones. Some telephone survey research omits all individuals not listed in telephone directories; the current study has overcome this problem by using random digit dialing (discussed later). Thus, while some households are omitted from the study (i.e., those without telephones), the impact of their omission will be minimal compared to the increased overall response rate.

## Instrument Development

The instrument used in this research featured two broad categories of questions regarding: (1) factors related to PC adoption and usage (see Appendix A) and (2) demographic variables. Open-ended questions were written to elicit factors driving adoption decisions, future adoption intent, and usage behavior. The open-ended questioning allowed us to gather information from the respondents in an unbiased and non-leading way. The questions were evaluated by experts and peers, and minor modifications were made based on their feedback. It was important to keep the survey simple in order to be understandable to the broad audience. A two-stage questioning technique was employed to elicit the importance of each factor. For example, in the first stage, respondents were asked about the key factors influencing their decision and if the respondent indicated that entertainment was a factor driving purchase intent, the second stage of questioning asked how important (on a five-point scale, where 1 was not at all important and 5 was extremely important) entertainment was as a factor. The two-stage questioning method complemented the open-ended questions since it allowed us to determine the importance of each of the individual responses (factor affecting adoption/usage). For each of the different salient factors, response frequencies, and means and standard deviations for the importance values were calculated. This method of assessing the importance using frequency counts has been recently employed in IS research (see Webster 1998); the descriptive statistics (means and standard deviations) of the importance values of the constructs provides additional richness that is not available with frequencies. All responses were handled in the same manner, regardless of how extensive an answer the respondent gave. Additionally, demographic variables were captured using a categorization scheme consistent with the Census Bureau (Day 1996).

## Pilot Study

A pilot study was conducted in a large metropolitan area in the midwestern U.S. Participants were randomly selected from the city's telephone directory. The pilot study was used to conduct a preliminary test of the instrument, to solicit comments and suggestions about the instrument from respondents, and to assess the duration of a typical interview. Sixty households completed the pilot study. The instrument was refined following the pilot study to reduce the duration of the typical interview to about nine minutes in order to minimize refusal rate (see Dillman 1978). Further, the pilot study demonstrated that the researchers did not have the resources, in terms of physical space, telephones, and trained interviewers, that were needed to successfully complete this study

on a national scale. In addition, the researchers were not specifically qualified to hire interviewers, train them, and monitor the interview process. As a result of the pilot study, an external firm, with no prior affiliation with the authors, was employed to perform the data collection for this study. The use of an external firm was deemed necessary due to the large scale and scope of the project.

## Sample

The population of interest in this study is American households. To select a random sample of such households, a random digit dialing technique was employed. First, the random number generator module of the system generated a random area code from among the valid area codes in the U.S. Next, a random seven-digit number was generated. These two steps were repeated to generate about 15,000 numbers. Finally, the numbers generated were forwarded to a centralized system that accessed and dialed numbers when prompted by the interviewer's terminal. The interviewers were not aware of the specific number dialed; however, the number was recorded (electronically) with the survey responses to facilitate follow-up. Although this method increases the probability that a dialed number will not belong to a member of the sampling frame (i.e., American households), it was preferred over national telephone directories since it increases the probability of contacting typically underrepresented populations, such as those with unlisted telephone numbers and new listings (Frey 1989). This method of sample selection has been employed in recent surveys by industry leaders such as Nielsen and Times-Mirror (see Kohut 1995; Robinson and Godbey 1997).

## Data Collection

Nearly 1,000 households were contacted and *the primary decision maker* in the household was invited to participate in the voluntary phone survey during a three-week window in March/April 1997 (Phase 1). The interviews were conducted in different time slots during the day and evening, from 9 a.m. to 8:30 p.m. Monday through Saturday. On average, an interview took just under nine minutes to complete and interviewers produced an average of 5.1 responses per hour. Twelve interviewers were assigned to this project. They had an average of 3.2 years of interviewing experience, including at least six months of telephone interviewing, and were trained on this particular instrument. Supervisors randomly monitored telephone interviews and contacted some respondents at random to verify their participation in the interview. These tactics were necessary to ensure the validity of the data collected (Lavrakas 1993).

Participants in Phase 1 were asked if they had a PC in their home (the interview script is presented in Appendix A). Regardless of the answer, they were further probed as to why this was the case. For instance, a respondent who said yes would be asked to identify the factors that led to the purchase of a PC for home use. Likewise, a respondent who said no would be asked to identify the factors that led to the decision to not purchase a PC. These questions were asked to identify the most salient issues associated with adopting, and not, a home PC. For adopters, the interview continued by asking their reasons for *using* the PC at home. This question served two purposes. First, it required respondents to seriously consider how and why they were using the PC, thus helping them to discern differences between adoption and usage decisions. Second, comparing the responses to the question about adoption and the question about use would provide evidence that respondents were reporting their adoption drivers and not simply their current behavior.

The follow-up survey (Phase 2) was completed six months later. While random digit dialing was employed in Phase 1, in Phase 2, only those who provided completed and usable responses in Phase 1 were contacted. The interviewers did not specifically know who they had reached (in Phase 2 also), but the system tracked responses across the two phases to allow a within-subject comparison, if needed.

# Results

## Preliminary Analysis

The random digit dialing technique employed in this research caused the sampling frame to include phone numbers that did not necessarily belong to households (e.g., business phones, faxes, etc.). Of the 15,007 phone numbers we attempted to contact in Phase 1, 12,271 were valid phone numbers (i.e., excluding disconnected and invalid numbers). Of these 12,271 numbers dialed, we reached 988 households, 10,145 other numbers (e.g., business phones, faxes, cell phones, pagers, voice-mail, etc.), and received no answer on 1,138 numbers even after four call-backs. Of the 988 households we were able to contact, 743 (75% percent) participated in the study and 733 completed the entire survey and provided usable responses for an overall response rate of 74.2%. The three components of non-response error in this case are those who could not be reached, those who refused to participate, and those who started but did not complete the survey. While we had little control over these situations, the design and implementation of the study attempted to minimize potential problems of non-response with up to four follow-up calls to reach numbers that could not be reached when first called. Interviewer effects were assessed by comparing responses across the 12 interviewers. No significant differences were found across the interviewers in terms of duration per interview, number of responses per hour, number of factors in each category (e.g., adopters, intenders, non-intenders) in both phases, and descriptive statistics (mean and standard deviation) for any particular factor within a category. In Phase 2, a follow-up call was made to all respondents from Phase 1. The overall follow-up response rate was 87.9%. Respondent participation in Phase 1 but not in Phase 2 was attributable to two primary reasons: inability to reach respondents (e.g., invalid phone number perhaps due to change of residence and no forwarding information, no response, or voice-mail on all four call-backs) or unwillingness to participate.

We examined the characteristics of the sample in order to ensure that the sample was truly representative of American households. We determined the characteristics of the U.S. population using the U.S. census data from 1990, adjusted for 1997 using the projections provided by an official report from the Census Bureau (Day 1996). Given that all of the categories employed in this research were consistent with the Census Bureau categories, we generated corresponding percentages for the sample. Table 2 presents a breakdown of the sample in terms of different characteristics and compares the corresponding characteristics of the population derived from census data. A comparison of the characteristics of the sample and population indicate that the random sample of households included in this study was highly representative of the population, suggesting that the results from this research are likely to generalize to the population of American households.

## Data Coding

While traditional content coding would rely on an existing, tested coding scheme (e.g., Trauth and Jessup 2000), no such coding scheme exists for household adoption of PCs. Instead, a coding scheme was derived based on the framework of TPB[5] (see Table 3). Two individuals, knowledgeable in coding techniques, were employed to code the open-ended responses. The coders were given a brief overview of the instrument and response types. The coders were given a "start list" (Miles and Huberman 1994, p. 58) that included definitions from prior research for the categories of constructs (and some sub-categories): hedonic outcomes (applications for fun), utilitarian outcomes (applications for personal use, utility for children), social outcomes (status gains), social influences (influence of family and friends), and barriers (knowledge, cost, and difficulty of use). The coders were instructed to hold out responses that did not seem to fit these definitions. An initial pool of 30 interview responses was chosen at random to be coded. The results of the preliminary analysis were carefully studied

[5]This is similar to the approach used by Keil (1995) in which prior review served as a basis for the coding, but additional factors emerged from the coding process.

**Table 2. Population and Sample Characteristics**

| | Population Characteristics | Sample Characteristics |
|---|---|---|
| **Households** | | |
| Family | 69% | 70% |
| Married Couples | 52% | 40% |
| Female—No Husband | 13% | 14% |
| Male—No wife | 4% | 6% |
| Nonfamily | 31% | 30% |
| Female | 17% | 17% |
| Male | 14% | 13% |
| **Racial Background** | | |
| White | 84% | 88% |
| White—Not Hispanic | 76% | 78% |
| Hispanic | 8% | 10% |
| Black | 13% | 9% |
| Asian/Pacific Islander | 3% | 3% |
| **Householder Age** | | |
| 15-24 | 5% | 7% |
| 25-34 | 19% | 20% |
| 35-44 | 24% | 25% |
| 45-54 | 19% | 18% |
| 55-64 | 12% | 10% |
| 65+ | 21% | 20% |
| **Nativity** | | |
| Native U.S. | 89% | 90% |
| Foreign Born | 11% | 10% |
| Not a Citizen | 6% | 5% |
| **Region** | | |
| Northeast | 19% | 20% |
| Midwest | 24% | 26% |
| South | 35% | 34% |
| West | 22% | 20% |
| **Residence** | | |
| Inside Metro Areas | 80% | 75% |
| Inside Central Cities | 31% | 39% |
| Outside Central Cities | 49% | 37% |
| Outside Metro Areas | 20% | 24% |
| **Earnings of Full-time Year Round Workers ($'s)** | | |
| Male | 31,864 | 31,003 |
| Female | 24,272 | 23,650 |
| **Per Capita Income ($'s)** | | |
| All Races | 18,545 | 17,988 |
| White | 19,524 | 19,003 |
| Black | 12,523 | 12,071 |
| Asian/Pacific Islander | 18,830 | 18,225 |
| Hispanic | 10,544 | 10,009 |

**Notes:** 1. All categories used are consistent with those used by the U.S. Census Bureau.
2. Population characteristics reflect U.S. Census Data for 1990, adjusted for the year 1997 using Day (1996).

**Table 3. Factor Definitions and Codes**

| Belief Structure | Factor | Definition | Code | Detailed Factor |
|---|---|---|---|---|
| Attitude | Utilitarian Outcomes | The extent to which using a PC enhances the effectiveness of household activities. Specific words would include budget, homework, and work. | U1 | Applications for personal use |
| | | | U2 | Utility for children |
| | | | U3 | Utility for work-related use** |
| | | | U4 | Reduced utility due to obsolescence of current PC** |
| | Hedonic Outcomes | The pleasure derived from PC use. Specific words include games, fun, enjoyment, pleasure. | H1 | Applications for fun |
| | Social Outcomes | The change in status that coincides with a purchase decision. Specific phrases include "others will perceive..." and "I will look smarter..." | SO1 | Status gains from possessing current technology |
| | | | SO2 | Status losses due to obsolete technology at home** |
| Subjective Norm | Social Influences | The extent to which members of a social network influence one another's behavior. Specific phrases include "others expect me to...," "my family thinks...," and "my friends think..." | SI1 | Influences from friends and family |
| | | | SI2 | Influence of information from secondary sources (such as news on TV, newspaper, etc. |
| Perceived Behavioral Control | Barriers | Factors inhibiting adoption. These include anything that would stand in the way of adoption, such as lack of knowledge, cost, no interest, and fear. | B1 | Rapid change in technology and/or fear of obsolescence** |
| | | | B2 | Declining cost** |
| | | | B3 | High cost |
| | | | B4 | Ease/difficulty of use |
| | | | B5 | Requisite knowledge for PC use |

**These factors were not included in the initial coding, but were derived through the coding process. Appendix B includes sample quotes to demonstrate which quotes were coded according to which categories.

by one of the authors, and found to be quite accurate. Following discussion of discrepancies between coders, further clarifying instructions were given. Additionally, items that did not fit into the initial set of definitions were further analyzed. Consistent with Miles and Huberman's recommendations, this resulted in minor refinement of definitions and additional constructs being identified (i.e., utility for work-related use, reduced utility, status losses, influence of secondary sources, fear of obsolescence, and declining costs). The resulting definitions and codes are presented in Table 3. Once this preliminary phase was completed, the remaining data were coded by both coders. The entire coding process took six months to complete (i.e., through May 1998). The inter-coder reliability was .89, which is well above the minimum of .70 identified by Miles and Huberman.

The coding suggested that most of the major categories of determinants identified in the theoretical development were multi-dimensional. Specifically, there were four dimensions of utilitarian outcomes, one dimension of hedonic outcomes, two dimensions of social outcomes, two dimensions of social influences, and five dimensions of barriers. Thus, while the overarching categories were chosen based on prior research, the breakdown into more detailed dimensions was possible due to the use of open-ended questions. In fact, the data coding process helped identify dimensions that had not been accounted for in prior research, providing further support that the use of open-ended items helped to overcome a priori expectations, resulting in a more complete understanding of the phenomenon. The detailed factors and representative quotes are provided in Appendix B.

It is important to note that a given response could have been coded along a number of dimensions. For instance, if a respondent indicated that they acquired the computer to help them with their taxes and to store recipes, the item would be coded as utilitarian for personal use—i.e., one factor. If, however, the same respondent said that they acquired the computer to help them with their taxes, to store recipes, and for their children to do homework, the item would have been coded as utilitarian for personal use and utility for the children—i.e., two factors.

## Drivers of Adoption and Non-Adoption

### PC Adoption: Current Level and Future Projections

Using the data collected in Phase 1, we examined the frequency breakdown of households based on whether or not they possessed a PC. Also, households without PCs were asked about their intent to purchase a PC, and households with PCs were asked about their intent to purchase another PC. Table 4 summarizes these results. The results indicated that a third of all households owned a PC, suggesting a certain extent of stagnation given the results from earlier surveys, such as those conducted by Times-Mirror (Kohut 1995) and Kraut and colleagues (Kraut 1996; Kraut et al. 1996). However, given the potential for some sampling error, we do not want to read too much into possible stagnation. On average, households with PCs indicated they had a PC for 1.98 years with a standard deviation of 0.82. Interestingly, nearly two-thirds of *those* households intended to purchase another PC. Further, about 23% of households not possessing a PC currently (16% of the total sample) intended to purchase in the next six months, suggesting that the number of households with PCs would grow from 33% to almost 50% at the time of the follow-up survey (six months later).

### Factors Affecting Current Purchase Decision

We conducted a detailed cross-sectional analysis of the determinants of purchase behavior, based on Phase 1 (Table 5). As suggested by Yin (1994, p. 103) and Miles and Huberman (1994, p. 253), frequencies were tabulated for each of the responses by adopter category. As expected, attitudinal beliefs, namely utilitarian outcomes, hedonic outcomes, and social outcomes, were determinants of purchase behavior in current users. In contrast to expectations, the results suggested social influences were also significant determinants of purchase behavior. Specifically, the status impact from possessing current technology was most important, followed by applications for fun, the influence of friends and family members, and applications for personal use, both in

**Table 4. Phase 1: Frequency Breakdown of Households with and Without PCs and Their Future Purchase Intent (N = 733)**

| | |
|---|---|
| (1) Households with a PC (N = 245) | |
| Average length of time they have owned a PC: | 1.98 years (SD = .82) |
| Intend to purchase another PC | |
| Yes | |
| In < 6 months | 136 |
| In > 6 months | 24 |
| No | 40 |
| Don't know | 45 |
| (2) Households Without a PC (N = 488) | |
| Intend to purchase a PC | |
| Yes | |
| In < 6 months | 114 |
| In > 6 months | 0 |
| No | 304 |
| Don't know | 70 |

**Table 5. Phase 1: Factors Affecting Current Purchase Decision (N = 733)**

| | Adopters (N = 245)[a] | | | Non-Adopters (N = 488)[a] | | |
|---|---|---|---|---|---|---|
| | Frequency | M[b] | (SD) | Frequency | M | (SD) |
| Number of factors reported per household | | 1.5 | (0.2) | | 2.0 | (0.4) |
| Utilitarian Outcomes | | | | | | |
| U1: Applications for personal use | 37 | 3.5 | (0.7) | | | |
| U2: Utility for children | | | | | | |
| U3: Utility for work-related use | 4 | 4.0 | (0.2) | | | |
| | 2 | 4.0 | (0.0) | | | |
| Hedonic Outcomes | | | | | | |
| H1: Applications for fun | 110 | 3.8 | (0.6) | | | |
| Social Outcomes | | | | | | |
| SO1: Status gains (current technology) | 146 | 4.1 | (0.6) | | | |
| Social Influences | | | | | | |
| SI1: Friends and family | 62 | 3.7 | (0.5) | | | |
| SI2: Secondary sources | 5 | 3.2 | 9.3) | 320 | 4.4 | (0.6) |
| Barriers to Adoption | | | | | | |
| B1: Rapid change in technology | | | | 287 | 3.8 | (0.5) |
| B3: High cost | | | | 187 | 3.7 | (0.7) |
| B5: Requisite knowledge | | | | 197 | 3.8 | (0.6) |

[a]Respondents were asked to identify *all* factors affecting their current purchase decision. Thus, the total frequency is greater than the sample size.
[b]M and SD represent the mean and standard deviation of the importance of each factor, as recorded on a scale of 1 to 5.

| Table 6. Phase I: Factors Affecting Current Use Among Adopters (N = 245)[a] | | | |
|---|---|---|---|
| | **Frequency** | **M[b]** | **(SD)** |
| Number of factors reported per household | | 1.2 | (0.3) |
| Utilitarian Outcomes | | | |
| U1: Applications for personal use | 169 | 3.9 | (0.7) |
| U2: Utility for children | 5 | 4.0 | (0.3) |
| U3: Utility for work-related use | 4 | 4.0 | (0.0) |
| Hedonic Outcomes | | | |
| H1: Applications for fun | 112 | 4.0 | (0.8) |
| Social Outcomes | | | |
| Social Influences | | | |
| Barriers to Adoption | | | |

[a]Respondents were asked to identify *all* factors affecting their current use. Thus, the total frequency is greater than the sample size.
[b]M and SD represent the mean and standard deviation of the importance of each factor as recorded on a scale of 1 to 5.

terms of number of households reporting the factor to be important (frequencies) and in terms of the importance of the factor on a five-point scale (mean). For non-adopters, social influences and barriers were most significant. Specifically, we identified four drivers of non-adoption, one of which was a normative influence and three were barriers: information from secondary sources (such as TV or newspapers), rapid change in technology, high cost, and lack of knowledge. In this case, the negative normative influence from secondary sources of information was the strongest determinant, both in terms of frequencies and in terms of the importance of the factor (mean). Particularly, negative information from secondary sources influenced parents who feared the safety of their children from objectionable content and even people (e.g., pedophiles) on the Internet. As shown in Table 5, the factors influencing non-adoption are not simply the lack of factors favoring adoption, suggesting that the underlying decision-making processes of adopters and non-adopters do not lie on opposite ends of the same continuum. Clearly, barriers to entry are more salient to non-adopters, whereas among adopters other factors are salient possibly because adopters have scaled the barriers. Finally, the factors influencing current use among adopters are shown in Table 6.

### Factors Affecting Future Purchase Intent

We examined factors influencing future purchase intent among (current) non-adopters (Table 7). As mentioned earlier, among the 488 households without PCs, 114 (about 23%) intended to purchase in less than six months (i.e., later adopters), while the rest did not intend or reported "don't know." Consistent with expectations, utilitarian outcomes (applications for personal use) were the key drivers of intenders, both in terms of frequency of responses (100 out of 114 intenders) and in terms of the importance of the factor. In contrast, those who did not intend to adopt were driven primarily by barriers, most notably rapid change in technology. About 90% of all respondents reported this to be a factor influencing their decision, and on average the importance of this factor was a 4.0 on a five-point scale.

### PC Purchase Behavior: Six Months Later

To understand PC purchase behavior, the data were partitioned into three categories based on intentions expressed in Phase 1: (1) those who intended to purchase, (2) those who intended not to purchase, and (3) those who were uncertain. Among the 488 households in Phase 1 that were

**Table 7. Phase 1: Factors Affecting Future Purchase Intent Among Non-Adopters (N = 488)**

| | Intenders (N = 114)[a] | | | Non-Intenders (N = 304)[a] | | |
|---|---|---|---|---|---|---|
| | Frequency | M[b] | (SD) | Frequency | M | (SD) |
| Number of factors reported per household | | 2.4 | (0.4) | | 1.2 | (0.3) |
| Utilitarian Outcomes | | | | | | |
| U1: Applications for personal use | 100 | 4.1 | (0.6) | 43 | 3.8 | (0.5)[c] |
| U2: Utility for children | | | | | | |
| U3: Utility for work-related use | 5 | 4.0 | (0.3) | | | |
| | 4 | 4.0 | (0.0) | | | |
| Hedonic Outcomes | | | | | | |
| Social Outcomes | | | | | | |
| Social Influences | | | | | | |
| SI1: Friends and family | 68 | 3.7 | (0.8) | | | |
| SI2: Secondary sources | | | | 5 | 4.0 | (0.0) |
| Barriers to Adoption | | | | | | |
| B1: Rapid change in technology | | | | 270 | 4.0 | (0.7) |
| B2: Declining cost | 47 | 3.8 | (0.6) | | | |
| B4: Ease/difficulty of use | 51 | 3.8 | (0.5) | 37 | 3.7 | (0.6) |

[a]Respondents were asked to identify *all* factors affecting their future purchase intent. Thus, the total frequency is greater than the sample size.
[b]M and SD represent the mean and standard deviation of the importance of each factor, as recorded on a scale of 1 to 5.
[c]In the case of non-intenders, they reported a lack of application for personal use (i.e., lack of utilitarian outcomes).

**Note:** The table reports an analysis of intenders and non-intenders. Those who responded with a "don't know" (n = 70) were not asked about specific factors due to the uncertainty conveyed by the response.

non-adopters, we successfully collected responses from 435 households in Phase 2, resulting in a follow-up response rate of 89%. Table 8 reports on the follow-up purchase behavior among those who intended to purchase in Phase 1, and an analysis of the factors driving the follow-up behavior. Only 46 out of 107 (43%) intenders actually purchased a PC in the six-month time frame. Among those who intended to purchase (in Phase 1) and did actually purchase (by Phase 2), the factors influencing the purchase decision were not entirely consistent with those reported in Phase 1 (see Table 7). Although four factors emerged with nearly the same level of importance from the analysis of those who purchased (n = 46), status gains and social influences were cited more than twice as frequently as utilitarian outcomes. Also, some households did not directly purchase a new PC but rather acquired a PC as a result of a "gift." Those who did not adopt feared rapid change in technology, coupled with declining costs. Only a very small percentage of those who did not intend in Phase 1 (1%) and reported "don't know" in Phase 1 (11%) actually purchased a PC in the six-month period leading up to the follow-up survey (Tables 9 and 10). Thus, a large percentage of the non-adopters (in Phase 1) conformed with their intent of not purchasing a PC in the six-month time frame leading up to Phase 2. Consistent with the

**Table 8. Phase 2: Factors Reported as Affecting PC Purchase Among Intenders from Phase 1 (N = 107)[a]**

| | Purchased (N = 46)[b] | | | Did Not Purchase (N = 61)[b] | | |
|---|---|---|---|---|---|---|
| | Frequency | M[c] | (SD) | Frequency | M | (SD) |
| Number of factors reported per household | | 2.3 | (0.3) | | 2.2 | (0.4) |
| Utilitarian Outcomes | | | | | | |
| U1: Applications for personal use | 9 | 4.0 | (0.3) | 43 | 3.8 | (0.5) |
| U2: Utility for children | 13 | 4.1 | (0.9) | | | |
| Hedonic Outcomes | | | | | | |
| Social Outcomes | | | | | | |
| SO1: Status gains (current technology) | 29 | 3.9 | (0.5) | | | |
| Social Influences | | | | | | |
| SI1: Friends and family | 28 | 3.9 | (0.5) | | | |
| SI2: Secondary sources | | | | 3 | 4.0 | (0.0) |
| Barriers to Adoption | | | | | | |
| B1: Rapid change in technology | | | | 48 | 4.1 | (0.5) |
| B2: Declining cost | 3 | 4.0 | (0.0) | 37 | 3.7 | (0.7) |
| B3: High cost[d] | 25 | 4.0 | (0.6) | | | |

[a]In Phase 2, we reached 107 out of the 114 intenders in Phase 1.

[b]Respondents were asked to identify *all* factors affecting their future purchase intent. Thus, the total frequency is greater than the sample size.

[c]M and SD represent the mean and standard deviation of the importance of each factor, as recorded on a scale of 1 to 5.

[d]These households reported a PC as being too expensive ("high cost") to buy but indicated that they acquired it via a "gift" from a close friend or family member. In some cases, it was not a new PC.

**Table 9. Phase 2: Factors Reported as Affecting PC Purchase Among Non-Intenders from Phase 1 (N = 284)[a]**

| | Purchased (N = 4)[b] | | | Did not Purchase (N = 280)[b] | | |
|---|---|---|---|---|---|---|
| | **Frequency** | **M[c]** | **(SD)** | **Frequency** | **M** | **(SD)** |
| Number of factors reported per household | | 3.0 | (0.0) | | 1.1 | (0.2) |
| Utilitarian Outcomes | | | | | | |
| U1: Applications for personal use | 4 | 4.0 | (0.0) | 68 | 3.2 | (0.7)[d] |
| U2: Utility for children | 4 | 4.0 | (0.0) | | | |
| Hedonic Outcomes | 4 | 4.0 | (0.0) | | | |
| Social Outcomes | | | | | | |
| Social Influences | | | | | | |
| SI2: Secondary sources | | | | 2 | 4.0 | (0.0) |
| Barriers to Adoption | | | | | | |
| B1: Rapid change in technology | | | | 208 | 4.0 | (0.8) |
| B4: Ease/difficulty of use | | | | 27 | 3.8 | (0.6) |

[a]In Phase 2, we reached 284 out of the 304 non-intenders in Phase 1.

[b]Respondents were asked to identify *all* factors affecting their future purchase intent. Thus, the total frequency is greater than the sample size.

[c]M and SD represent the mean and standard deviation of the importance of each factor, as recorded on a scale of 1 to 5.

[d]In the case of those who did not purchase, they reported a lack of application for personal use (i.e., lack of utilitarian outcomes).

**Table 10. Phase 2: Factors Reported as Affecting PC Purchase Among Those Who Were Uncertain in Phase 1 (N = 44)[a]**

| | Purchased (N = 5)[b] | | | Did not Purchase (N = 39)[b] | | |
|---|---|---|---|---|---|---|
| | Frequency | M[c] | (SD) | Frequency | M | (SD) |
| Number of factors reported per household | | 3.0 | (0.0) | | 1.3 | (0.3) |
| Utilitarian Outcomes | | | | | | |
| U1: Applications for personal use | 5 | 4.0 | (0.0) | 8 | 4.2 | (0.2)[d] |
| U2: Utility for children | 5 | 4.0 | (0.0) | | | |
| Hedonic Outcomes | 5 | 4.0 | (0.2) | | | |
| Social Outcomes | | | | | | |
| Social Influences | | | | | | |
| SI2: Secondary sources | | | | 9 | 4.2 | (0.2) |
| Barriers to Adoption | | | | | | |
| B1: Rapid change in technology | | | | 32 | 4.0 | (0.7) |

[a]In Phase 2, we reached 44 out of the 70 households that were uncertain in Phase 1.
[b]Respondents were asked to identify *all* factors affecting their future purchase intent. Thus, the total frequency is greater than the sample size.
[c]M and SD represent the mean and standard deviation of the importance of each factor, as recorded on a scale of 1 to 5.
[d]In the case of those who did not purchase, they reported a lack of application for personal use (i.e., lack of utilitarian outcomes).

**Table 11. Intention-Behavior Relationship**

| Adoption Intent Expressed in Phase 1 | Adoption Behavior Reported in Phase 2 | | Intention-Behavior Conformance |
|---|---|---|---|
| | Yes | No | |
| Intenders (n = 107) | 46 | 61 | 43% |
| Non-Intenders (n = 284) | 4 | 280 | 99% |

**Note:** The above analysis is based on responses gathered in both phases of this data collection. As can be expected, the response rate in the follow-up survey was lower than the initial survey, which was 114 Intenders, 304 Non-Intenders, and 70 Uncertain. The 70 uncertain are not included in the analysis in this table.

reasoning reported in Phase 1 (see Table 5), the key barrier reported in Phase 2 was the rapid change in technology, both in terms of frequency of responses and in terms of highest mean level of importance (4.0 on a five-point scale).

Based on their intention in Phase 1 and follow-up behavior reported in Phase 2, Table 11 summarizes the intention-behavior conformance among intenders and non-intenders. Clearly, the pattern of conformance is nearly perfect among non-intenders. However, less than half of all intenders conformed with their original intent, suggesting an asymmetrical relationship between intention and behavior across intenders and non-intenders.

## Discussion

The longitudinal study with two waves of measurement, an initial survey and a follow-up survey six months later, yielded several important and interesting insights. First, it helped identify several dimensions *within* each construct included in the theoretical development (e.g., reduced utility, status losses, fear of obsolescence, influence of secondary sources), thus leading to a more detailed understanding of PC adoption in American homes. Second, the factors salient to those who had adopted and those who intended to adopt were different from those who did not intend to adopt. Third, it was apparent that non-adopters were constrained by barriers, with obsolescence of technology emerging as a critical hurdle that had not been theoretically anticipated. This overall pattern of results was also supported by the second wave of data collection six months later. Finally, Phase 2 (six months after the initial survey) revealed that nearly all non-intenders followed up with their intention not to adopt a PC. However, less than half of all intenders followed up with their intent to adopt a PC. As suggested earlier, such an intention-behavior relationship pattern suggests an asymmetrical relationship between intention and behavior across intenders and non-intenders.

### Limitations

As with any empirical research, this study has limitations. The primary limitation of this study is the potential for response bias. While respondents were asked specifically to identify the factors that led them to purchase a PC for household use, the possibility of recall bias (e.g., Nisbett and Wilson 1977) is not ruled out. In other words, a respondent's recall of prior events may be biased in favor of current events. In this context, this suggests that individuals may not be capable of ignoring what has occurred since the purchase. Thus, the results for adopters (i.e., those respondents who already owned a PC at the time the study began) have to be interpreted with this limitation in mind. It was also with this potential limitation in mind that we chose not to query individuals about the factors that influenced their decision to buy their first PC, as in some cases that could have been over a decade ago. However, it is important to recognize that the remaining respondents are not impacted by this limitation. It is also important to note that this approach of eliciting salient beliefs is consistent with prior TPB research (Ajzen and Fishbein 1980; Fishbein and Ajzen 1975).

A second limitation concerns the differences in how questions were asked regarding initial adoption and continued use. The phrasing of the questions—"What factors led you to buy/lease a computer?" versus "What are the current uses of the computer?"—virtually guarantees that the usage responses will be utilitarian in nature. In other words, the way the question was stated might have focused the adopter's attention on outcomes and the non-adopter's on barriers. In retrospect, this wording was not appropriate to capture factors that would be comparable to the adoption factors. However, given the greater focus on adoption and limited focus on current use, this was seen to be less of an issue in the current work. Thus, the utilitarian nature of the responses for continued use should be interpreted with this limitation in mind. However, future work that attempts to understand an innovation from its infancy to maturity should carefully try to understand and distinguish between factors influencing adoption and those influencing usage.

A third limitation concerns the length of the interview. Due to cost constraints coupled with a desire to obtain a reasonable response rate, we chose to have a shortened interview. This decision is not without drawbacks. A longer survey could have resulted in richer responses. For example, we could have asked respondents to describe the situation when they bought their computer and probed more deeply into the factors underlying their decision. This approach could have provided greater insights, helped to isolate the aforementioned recall bias, and potentially provided a richer model. Future work that attempts to capture greater depth of the household adoption decision may choose to use this approach.

## Theoretical Contributions and Implications

This research presents one of the first efforts toward understanding technology acceptance and usage behavior in households and outside the workplace. Specifically, by identifying and developing the role of hedonism, social outcomes, and fear of obsolescence in household PC adoption, we depart from the *traditional* technology acceptance research in workplace settings that has emphasized utilitarian outcomes (e.g., Davis et al. 1989). The current research presents evidence that social influences play a key role in household adoption of PCs. A related strength of this work and the findings that resulted from it is that, by employing a combination of qualitative data and quantitative data, we have been able to acquire a rich understanding of the different factors that play a role in influencing adoption and non-adoption, both in terms of frequencies and the importance of factors. The evidence regarding the characteristics of adopters and non-adopters indicates that there could be gaps/cracks in the household PC adoption life cycle (bell curve), similar to what is suggested by Moore (1991). Overall, this pattern of results yields several theoretical contributions and implications.

While the present work explains differences between adoption and non-adoption, future work is necessary to understand more thoroughly the cracks/gaps in the bell curve between each of the different categories proposed by Rogers (1995). The current research ties in well with prior research (e.g., Agarwal and Prasad 1997; Karahanna et al. 1999; Szajna 1996; Venkatesh and Davis 1996, 2000) that has found differences in the pre- and post-adoption beliefs and attitudes of adopters in workplace settings. For example, Karahanna et al. suggest that normative influences are important in making the adoption decision, while attitudinal factors and perceptions of voluntariness are influential in determining continued use. Thus, future work in this area could investigate this question by tracking an innovation from its infancy through the entire technology adoption life cycle. Such an approach would address the potential limitation of the current work that there may be some retrospective justification in the responses (about factors influencing adoption) among those who had already adopted at the time of the initial survey.

Prior technology adoption research has typically seen the presence of certain factors (e.g., perceived usefulness) as leading to adoption, while a lack of those factors is seen as the cause of rejection. This research broadens that perspective by presenting preliminary evidence that non-adoption (rejection) decisions are based on critical barriers (i.e., rapid change, high cost, and lack of knowledge) while factors relevant to adopters are not as salient in the decision to reject. One avenue for further exploration in the context of home PC adoption is understanding whether removal of the barriers to adoption makes the reasons for adoption (as identified by current users) more salient to non-adopters in their decision-making process. Although the results are situated in the context of PC adoption in homes, the differences between adopters and non-adopters invite the examination of such boundary conditions (using models/theories such as innovation diffusion theory, technology acceptance model, etc.) in the workplace. A similar pattern of results in the workplace would suggest the need to refine current models explaining acceptance and use of information technology in the workplace. In any case, the present research emphasizes the need to carefully consider factors that are salient to non-adopters, especially if the ultimate goal is to increase technology adoption.

While one of the key factors emerging as a barrier to adoption was the fear of obsolescence, this is a finding subject to volatility due to the declining cost of PCs. As with most consumer purchase decisions, particularly with an expensive product like a PC, cost may play a critical role, possibly by changing the dynamics of the role and importance of other determinants of adoption and non-adoption. For instance, high cost coupled with the rapid change in technology results in a cost-to-useful life ratio that is possibly unacceptable to many consumers. However, if the cost were lower and the perceived useful life higher, cost and/or obsolescence may not be significant factors. Under these conditions, other factors might emerge as significant. Thus, not only does cost represent an important issue for future research to address, but it also represents a key aspect for researchers and practitioners to track and understand, potentially to establish non-linear and/or interaction effects on purchase intent and behavior (see Sahni 1994).

Much work in the area of home computing remains to be done to better understand adoption of technologies at home given its potential implications for society in general and for the workplace in particular. Some of the essential theoretical extensions can be directly inferred from prior work on technology adoption in the workplace. Future work should model the interrelationships across the different model constructs (such as the influence of the lack of knowledge on attitude) and the potential moderating role of some constructs (such as the potential moderation of the intention-behavior relationship by barriers). Additional work is necessary to understand the role of several external variables (e.g., demographic characteristics, training, etc.) on the decomposed belief structure and, ultimately, adoption and usage. In addition to being able to address the above issues, a study that employs a survey with items/questions measuring the various dimensions/constructs will help achieve methodological triangulation and examine generalizability. Such a quantitative study will also help shed more light on the asymmetry between the belief structure influencing intenders and non-intenders.

To the household consumer, adopting a PC is a decision about hardware *and* software. Thus, the results of this research very likely pertain to the combination rather than hardware *or* software per se. Further research is necessary to examine differences in factors influencing adoption and non-adoption of software in homes, especially given the significant cost differences between hardware and software and the potential for sunk costs on hardware to influence software purchases. The issues related to constant upgrading and potential obsolescence can be expected to be significantly more complex in the case of software adoption. In the case of hardware, upgrading may have key implications only from the perspective of cost and compatibility. Software upgrades, however, may create the need to invest time and effort to learn a new package. Also, from the perspective of daily usage, constant upgrades create situations wherein the end user has to expend significant cognitive energy and effort just to use the software. From a pragmatic standpoint, especially for earliest adopters of new PCs and even software, it may also create issues of system incompatibility with a majority of users.

## Implications for Practice

For practice, the results of this study offer four key implications. First, our findings offer insights into the facilitators and inhibitors of consumer-oriented e-commerce. Second, managers who implement technology in workplace settings need to re-examine the role played by non-utilitarian outcomes associated with technology use. Third, the results point to the salience of cost as a significant factor, which has implications for organizational adoption. Finally, we point out the implications of our results for managers in the technology industry that provides the PCs used in homes.

The area of consumer-oriented e-commerce is approximately a $33 billion industry and is estimated to account for 5% of global transactions by the year 2003 (Forrester Research 1998). The success of the business-to-consumer and consumer-to-consumer segments of e-commerce is predicated upon PC ownership and Internet access. While it could be argued that PC and Internet access in the workplace provides the necessary technology for e-commerce parti-

cipation, more and more organizations are limiting personal use of workplace computers (Duffy 2000; McCarthy 1999). Thus, the household PC is a critical first step in enabling the growth of e-commerce. The factors that are influential in adoption, non-adoption, and use of household PCs should provide insight into adoption and non-adoption of e-commerce. For example, similar to this study's findings regarding cost as a barrier to PC adoption, a recent Forrester report identifies income level as the key factor in determining who does and does not have access to the Internet (Walsh 2000). However, even when cost is overcome as a barrier, PC and Internet use tend to decrease over time (Kraut et al. 1999). Thus, while cost may be a barrier to entry, there are additional factors that are associated with sustained usage. In this study, we found that utilitarian and hedonic outcomes were influential in determining PC use. Future research is necessary to determine if these same factors also influence Internet usage and subsequent participation in e-commerce activities. Future research is also necessary to identify the barriers, besides cost, that keep consumers from joining in the burgeoning e-commerce market. Possible impediments on the consumer side may be similar to those identified on the organizational side: download delays, search problems, and security issues (Rose et al. 1999). These same impediments may influence the adoption of the "market choice box," which will be the "consumer's interface between the many electronic devices in the home (television, telephone, and computers), the information superhighway, and the vast variety of market choices" (Benjamin and Wigand 1995, p. 62). In any event, improving our understanding of the factors influencing adoption and use of household PCs provides at least a prelude to understanding the factors influencing the household adoption of the Internet and participation in e-commerce.

As managers implement technology in organizational settings, it is important to consider the influence of non-utilitarian (i.e., hedonic, social) technology outcomes. Further work is necessary to systematically explore the role of hedonism in order to enhance user acceptance in the workplace. Constructs such as playfulness (Webster and Martocchio 1992, 1993), enjoyment (Davis et al. 1992; Venkatesh 1999), and personal innovativeness (Agarwal and Prasad 1998) present starting points for work that aims to leverage hedonism in the workplace to create more favorable user perceptions about technology. An additional area of future research would be to examine the interplay of household adoption and workplace adoption. For example, is having a PC at home associated with increased workplace adoption, greater understanding of utilitarian and hedonic outcomes, or perhaps ease of learning new applications? One is very likely to feed the other, and their mutual relationship should be examined.

Cost is a significant factor to the household adopter. While the individual adopter inside an organization may not be immediately concerned with cost, the organization is. In their review of innovation research, Tornatzky and Klein (1982) found mixed results with respect to cost as a factor influencing adoption. Some studies found that cost was positively related to adoption, while others found it negatively related. Nearly two decades later, research is still needed to discern the issues that lead to cost being an influential factor in the adoption decision. In this context, as discussed earlier, obsolescence has not been previously considered as an issue in adoption decisions. While it is unlikely to be a factor for the individual adopter in the organization, it is, however, very likely a concern at the organizational level. Our findings can bear implications for organizations at large. The reason we believe such generalizability can occur is because the household is similar to an organization, albeit small, with one or possibly two key decision makers. Cost is a factor that is considered very carefully by decision makers in the process of procuring technology. Thus, the current results could bear implications for cost as a factor among decision makers in organizational settings. The class of technology (e.g., Fichman 1992) and its associated rate of change are likely to be influential factors in the importance of obsolescence, particularly as cost continues to be an issue.

For the technology industry, it appears that cost, coupled with rapid obsolescence, is essentially

keeping a large segment of the population out of the PC market and, consequently, out of the national information loop. One potential solution is to retard the pace of technological innovation, thus challenging the PC industry's wisdom that "newer is better." It is, however, difficult to argue with newer, better, and cheaper. Thus, while the industry itself may not retard technological advances, it may be possible for households to control the advances that enter their home. However, this could lead to households being left behind and, possibly, being incompatible with those who have elected to keep pace with the industry. In such a situation, one possible solution for the IT industry is to place an increased emphasis on backward compatibility, thus potentially allaying some fears of obsolescence. For instance, to some consumers the introduction of Windows 98 was a call to upgrade their systems; for others, it was just another reason to avoid adopting a PC. Although an upgrade to Windows 98 was not necessary for most people and resulted only in a minimal improvement in performance, its existence exacerbated the perception of rapid obsolescence to many consumers. Another approach is to offer "insurance" against obsolescence, such as what Gateway's "Your:)Ware[SM]" program (Gateway 1998) has done. Whether this is truly insurance, or merely perceived insurance, remains to be seen. However, future research could examine the impact of such practices on overcoming fear of obsolescence.

## Conclusions

The present research examined the relatively unexplored area of PC adoption in American households using a two-wave, nationwide phone survey. The findings suggested that there were important differences between adopters and non-adopters. While adopters were influenced by different outcomes (utilitarian, hedonic and social), non-adopters were influenced strongly by the fear of obsolescence. Based on a longitudinal analysis, we found that the purchase behavior of non-intenders was very much in line with their original decision, whereas less than half of all intenders followed up on their original decision. We presented important implications for adoption of technologies in homes and workplaces. Finally, key challenges facing organizational practice in the PC industry are outlined.

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## References

Adams, D. A., Nelson, R. R., and Todd, P. A. "Perceived Usefulness, Ease of Use, and Usage of Information Technology: A Replication," *MIS Quarterly* (16:2), June 1992, pp. 227-247.

Agarwal, R., and Prasad, J. "A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology," *Information Systems Research* (9:2), June 1998, pp. 204-215.

Agarwal, R., and Prasad, J. "The Role of Innovation Characteristics and Perceived Voluntariness in the Acceptance of Information Technologies," *Decision Sciences* (28:3), Summer 1997, pp. 557-582.

Ajzen, I. *Attitudes, Personality, and Behavior*, The Dorsey Press, Chicago, 1988.

Ajzen, I. "From Intentions to Actions: A Theory of Planned Behavior," in *Action Control: From Cognition to Behavior,* J. Kuhl and J. Beckmann (eds.), Springer Verlag, New York, 1985, pp. 11-39.

Ajzen, I. "The Theory of Planned Behavior," *Organizational Behavior and Human Decision Processes* (50:2), 1991, pp. 179-211.

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

Babbie, E. *Survey Research Methods* (2nd ed.). Wadsworth Publishing Company, Belmont, CA, 1990.

Babin, B. J., Darden, W. R., and Griffin M. "Work and/or Fun: Measuring Hedonic and Utilitarian Shopping Value," *Journal of Consumer Research* (20:4), March 1994, pp. 644-656.

Bearden, W. O., and Etzel, M. J. "Reference Group Influence on Product and Brand Purchase Decisions," *Journal of Consumer Research* (9:2), 1982, pp. 183-94.

Benjamin, R. and Wigand, R. "Electronic Markets and Virtual Value Chains on the Information Superhighway," *Sloan Management Review* (36:2), Winter 1995, pp. 62-72.

Biscomb, V. J. "Detailed Planning Makes Telepolling Effective," *Marketing News*, January 1986, p. 5.

Brock, J. J. "Phone Interviews Equal in-Person Methodology," *Marketing News*, January 1986, p. 29.

Brancheau, J. C., and Wetherbe, J. C. "The Adoption of Spreadsheet Software: Testing Innovation Diffusion Theory in the Context of End-User Computing," *Information Systems Research* (1:2), 1990, pp. 115-143.

Burnkrant, R. E., and Cousineau, A. "Informational and Normative Social Influence in Buyer Behavior," *Journal of Consumer Research* (2:2), 1975, pp. 206-215.

Canary, D. J., and Seibold, D. R. *Attitudes and Behavior: An Annotated Bibliography*, Praeger, New York, 1984.

Childers, T. L., and Rao, A. R. "The Influence of Familial and Peer-Based Reference Groups on Consumer Decisions," *Journal of Consumer Research* (19:2), September 1992, pp. 198-211.

Chin, W. W., and Todd, P. A. "On the Use, Usefulness, and Ease of Use of Structural Equation Modeling in MIS Research: A Note of Caution," *MIS Quarterly* (19:2), June 1995, pp. 237-246.

Compeau, D., and Higgins, C. A. "Application of Social Cognitive Theory to Training for Computer Skills," *Information Systems Research* (6:2), 1995, pp. 118-143.

Cooper, R. B., and Zmud, R. W. "Information Technology Implementation Research: A Technological Diffusion Approach," *Management Science* (36:2), 1990, pp. 123-139.

Davis, F. D. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly* (13:3), 1989, pp. 319-340.

Davis, F. D. "User Acceptance of Information Technology: System Characteristics, User Perceptions and Behavioral Impacts," *International Journal of Man-Machine Studies* (38:3), 1993, pp. 475-487.

Davis, F. D., Bagozzi, R. P., and Warshaw, P. R. "Extrinsic and Intrinsic Motivation to Use Computers in the Workplace," *Journal of Applied Social Psychology* (22:14), 1992, pp. 1111-1132.

Davis, F. D., Bagozzi, R. P., and Warshaw, P. R. "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models," *Management Science* (35:8), August 1989, pp. 982-1003.

Davis, F. D., and Venkatesh, V. "A Critical Assessment of Potential Measurement Biases in the Technology Acceptance Model: Three Experiments," *International Journal of Human-Computer Studies* (45:1), 1996, pp. 19-45.

Day, J. C. "Projections of the Number of Households and Families in the United States: 1995 to 2010," U.S. Bureau of the Census, Current Population Reports, P25-1129, U.S. Government Printing Office, Washington, DC, 1996.

Deci, E. L., and Ryan, R. M. "The Empirical Exploration of Intrinsic Motivational Processes," in *Advances in Experimental Social Psychology*, L. Berkowitz (ed.), Academic Press, New York, 1980, pp. 39-80.

Dillman, D. A. *Mail and Telephone Surveys: The Total Design Method,* John Wiley, New York, 1978.

Duffy, T. "Watching Your Workers," *Network World* (17:25), June 2000, pp. 91-92.

Erickson, G. M., and Johansson, J. K. "The Role of Price in Multi-Attribute Product Evaluations," *Journal of Consumer Research* (12:2), 1985, pp. 195-199.

Feldman, L. P., and Armstrong, G. M. "Identifying Buyers of a Major Automotive Innovation," *Journal of Marketing* (39:1), 1975, pp. 47-53.

Fichman, R. G. "Information Technology Diffusion: A Review of Empirical Research," in *Proceedings of the Thirteenth International Conference on Information Systems,* J. I. DeGross, J. D. Becker, and J. J. Elam (eds), Dallas, TX, 1992, pp. 195-206.

Fishbein, M., and Ajzen, I. *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research,* Addision-Wesley, Reading, MA, 1975.

Fisher, R. J., and Price, L. L. "An Investigation into the Social Context of Early Adoption Behavior," *Journal of Consumer Research* (19:3), 1992, pp. 477-486.

Forrester Research. "Preparing for Dynamic Trade in the Internet Economy," Forrester Forum, Forrester Research Inc, Boston, November 5-6, 1998.

Foxall, G. R. "The Behavioral Perspective Model of Purchase and Consumption: From Consumer Theory to Marketing Practice," *Journal of the Academy of Marketing Science* (20:2), 1992, pp. 189-198.

Frey, J. H. *Survey Research by Telephone* (2nd ed.), Sage Publications, Newbury Park, CA, 1989.

Fulk, J., and Boyd, B. "Emerging Theories of Communication in Organizations," *Journal of Management* (17:2), 1991, pp. 407-446.

Fulk, J., Steinfield, C. W., Schmitz, J., and Power, J. G. "A Social Information Processing Model of Media Use in Organizations," *Communication Research* (14:5), 1987, pp. 529-552.

Gateway. "Gateway Introduces Your:)WareSM, a Revolutionary Way to Buy a PC," 1998 (http://www.gateway2000.com/home/aboutgw/pressreleas/pr052798/; Home: About Gateway: About Gateway: Press Releases: Press Releases: pr052798; accessed May 1998).

Gefen, D., and Straub, D. W. "Gender Differences in the Perception and Use of E-Mail: An Extension to the Technology Acceptance Model," *MIS Quarterly* (21:4), December 1997, pp. 389-400.

Hirschman, E. C., and Holbrook, M. B. "Hedonic Consumption: Emerging Concepts, Methods and Propositions," *Journal of Marketing* (46:1), 1982, pp. 92-101.

Holbrook, M. B., Chestnut, R. W. Olivia, T. A., and Greenleaf, E. A. "Play As Consumption Experience: The Roles of Emotions, Performance, and Personality in the Enjoyment of Games," *Journal of Consumer Research* (11:4), 1984, pp. 728-739.

Holbrook, M. B., and Hirschman, E. C. "The Experiential Aspects of Consumption: Consumer Fantasies, Feelings, and Fun," *Journal of Consumer Research* (9:2), 1982, pp. 132-140.

Igbaria, M., Zinatelli, N., Cragg, P., and Cavaye, A. L. M. "Personal Computing Acceptance Factors in Small Firms: A Structural Equation Model," *MIS Quarterly* (21:3), September 1997, pp. 279-305.

Karahanna, E., Straub, D. W., and Chervany, N. L. "Information Technology Adoption Across Time: A Cross-Sectional Comparison of Pre-Adoption and Post-Adoption Beliefs," *MIS Quarterly* (23:2), June 1999, pp. 183-213.

Keil, M. "Pulling the Plug: Software Project Management and the Problem of Project Escalation," *MIS Quarterly* (19:4), December 1995, pp. 421-447.

Kohut, A. *Technology in the American Household,* Times-Mirror Center for People and the Press, Washington, DC, 1995.

Kraut, R. "The Internet@Home," *Communications of the ACM* (39:12), December 1996, pp. 32-35.

Kraut, R., Mukhopadhyay, T., Szczypula, J., Kiesler, S. and Scherlis, W. "Communication and Information: Alternative Uses of the Internet in Households," *Information Systems Research* (10), 1999, pp. 287-303.

Kraut, R., Scherlis, W., Mukhopadhyay, T., Manning, J., and Kiesler, S. "The Home Net Field Trial of Residential Internet Services," *Communications of the ACM* (39:12), December 1996, pp. 55-63.

LaBay, D. G., and Kinnear, T. C. "Exploring the Consumer Decision Process in the Adoption of Solar Energy Systems," *Journal of Consumer Research* (8:3), 1981, pp. 271-278.

Lacher, K. T., and Mizerski, R. "An Exploratory Study of the Responses and Relationships Involved in the Evaluation of, and in the Intention to Purchase New Rock Music," *Journal of Consumer Research* (21:4), 1994, pp. 366-380.

Lavrakas, P. J. *Telephone Survey Methods Sampling, Selection, and Supervision* (2nd ed.), Sage Publications, Newbury Park, CA, 1993.

Lee, A. "Inaugural Editor's Comments," *MIS Quarterly* (23:1), March 1999, pp. v-xi.

Malone, T. W. "What Makes Computer Games Fun?" *Byte,* 1981, pp. 258-276.

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

McCarthy, M. J. "Virtual Morality: A New Workplace Quandary," *The Wall Street Journal*, October 21, 1999, p. B1.

McCracken, G. D. *Culture and Consumption: New Approaches to the Symbolic Character of Consumer Goods and Activities*, Indiana University Press, Bloomington, IN, 1988

Miles, M. B., and Huberman, A. M. *Qualitative Data Analysis: An Expanded Sourcebook,* Sage Publications, Inc., Thousand Oaks, CA, 1994.

Miniard, P. W., and Cohen , J. B. "Isolating Attitudinal and Normative Influences in Behavioral Intentions Models," *Journal of Marketing Research* (16:1), 1979, pp. 102-110.

Moore, G. A. *Crossing the Chasm: Marketing and Selling Technology Products to Mainstream Customers*, HarperCollins Publishers, New York, 1991.

Morris, M. G., and Venkatesh, V. "Age Differences in Technology Adoption Decisions: Implications for a Changing Workforce," *Personnel Psychology* (53), 2000, 375-403.

Morton, R., and Duncan, D. "A New Look at Telephone Interviewing Methodology," *Pacific Sociological Review* (21:3), July 1978, pp. 259-273.

Morwitz, V. G., and Schmittlein, D. "Using Segmentation to Improve Sales Forecasts Based on Purchase Intent: Which 'Intenders' Actually Buy?" *Journal of Marketing Research* (29:4), 1992, pp. 391-405.

Nisbett, R. E., and Wilson, T. D. "Telling More Than We Can Know: Verbal Reports on Mental Processes," *Psychological Review* (84:3), 1977, 231-259.

Rice, R. E., Grant, A. E., Schmitz, J., and Torobin, J. "Individual and Network Influences on the Adoption and Perceived Outcomes of Electronic Messaging," *Social Networks* (12:1), 1990, pp. 27-55.

Robinson, J. P., and Godbey, G. *Time for Life: The Surprising Ways Americans Use Their Time*, The Pennsylvania State University Press, University Park, PA, 1997.

Rogers, E. M. *Diffusion of Innovations* (4th ed.), Free Press, New York, 1995.

Rogers, E. M., and Shoemaker, F. F. *Communication of Innovations: A Cross-Cultural Approach*, Free Press, New York, 1971.

Rogers, T. "Interviews by Telephone and in Person: Quality of Responses and Field Responses and Field Performance," *Public Opinion Quarterly* (40:1), Spring 1976, pp. 51-65.

Rose, G., Khoo, H., and Straub, D. "Current Technological Impediments to Business-to-Consumer Electronic Commerce," *Communications of the AIS* (1:16), June 1999.

Sahni, A. "Incorporating Perceptions of Financial Control in Purchase Prediction: An Empirical Examination of the Theory of Planned Behavior," *Advances in Consumer Research* (21:4), 1994, pp. 442-448.

Salancik, G. R., and Pfeffer, J. "A Social Information Processing Approach to Job Attitudes and Task Design," *Administrative Science Quarterly* (23:2), 1978, pp. 224-253.

Schifter, D. B., and Ajzen, I. "Intention, Perceived Control, and Weight Loss: An Application of the Theory of Planned Behavior," *Journal of Personality and Social Psychology* (49:4), 1985, pp. 843-851.

Segars, A. H., and Grover, V. "Re-Examining Perceived Ease of Use and Usefulness: A Confirmatory Factor Analysis," *MIS Quarterly* (17:4), December 1993, pp. 517-525.

Sheppard, B. H., Hartwick, J., and Warshaw, P. R. "The Theory of Reasoned Action: A Meta-Analysis of Past Research with Recommendations for Modifications and Future Research," *Journal of Consumer Research* (15:3), 1988, pp. 325-343.

Small Business From Home. http://www.smallbusinessfromhome.com, 2000.

Steeh, C. "Trends in Nonresponse Rates 1952-1979," *Public Opinion Quarterly* (45:1), Spring 1981, pp. 40-57.

Stone, E. F. *Research Methods in Organizational Behavior,* Goodyear Publishing Company, Santa Monica, CA, 1978.

Subramanian, G. H. "A Replication of Perceived Usefulness and Perceived Ease of Use Measurement," *Decision Sciences* (25:5/6), September-December 1994, pp. 863-874.

Szajna, B. "Empirical Evaluation of the Revised Technology Acceptance Model," *Management Science* (42:1), January 1996, pp. 85-92.

Szajna, B. "Software Evaluation and Choice: Predictive Validation of the Technology Acceptance Instrument," *MIS Quarterly* (18:3), September 1994, pp. 319-324.

Taylor, S., and Todd, P. A. "Understanding Information Technology Usage: A Test of Competing Models," *Information Systems Research* (6:2), June 1995, pp. 144-176.

Thompson, R. L., Higgins, C. A., and Howell, J. M. "Personal Computing: Toward a Conceptual Model of Utilization," *MIS Quarterly* (15:1), March 1991, pp. 124-143.

Tornatzky, L. G., and Klein, K. J. "Innovation Characteristics and Innovation Adoption-Implementation A Meta-Analysis of Findings," *IEEE Transactions on Engineering Management (EM-291)*, 1982, pp. 28-45.

Trauth, E. M., and Jessup, L. M. "Understanding Computer-mediated Discussions: Positivist and Interpretive Analyses of Group Support System Use," *MIS Quarterly* (24:1), March 2000, pp. 43-79.

Trevino, L. K., and Webster, J. "Flow in Computer-Mediated Communication: Electronic Mail and Voice Mail Evaluation and Impacts," *Communication Research* (19:5), October 1992, pp. 539-573.

Tyebjee, T. T. "Telephone Survey Methods: The State of the Art," *Journal of Marketing* (43:3), Summer 1979, pp. 68-78.

Vallerand, R. J. "Toward a Hierarchical Model of Intrinsic and Extrinsic Motivation," *Advances in Experimental Social Psychology* (29), 1997, pp. 271-360.

Venkatesh, A. "Computers and Other Interactive Technologies for the Home," *Communications of the ACM* (39:12), December 1996, pp. 47-54.

Venkatesh, A., and Vitalari, N. P. "An Emerging Distributed Work Arrangement: An Investigation of Computer-Based Supplemental Work at Home," *Management Science* (38:12), December 1992, pp. 1687-1706.

Venkatesh, V. "Creation of Favorable User Perceptions: Exploring the Role of Intrinsic Motivation," *MIS Quarterly* (23:2), June 1999, pp. 239-260.

Venkatesh, V., and Davis, F. D. "A Model of the Antecedents of Perceived Ease of Use: Development and Test," *Decision Sciences* (27:3), Summer 1996, pp. 451-481.

Venkatesh, V., and Davis, F. D. "A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies," *Management Science* (46:2), February 2000, pp. 186-204.

Venkatesh, V., Morris, M. G., and Ackerman, P. L. "A Longitudinal Field Investigation of Gender Differences in Individual Technology Adoption Decision Making Processes," *Organizational Behavior and Human Decision Processes* (83), 2000, pp. 33-60.

Venkatesh, V., and Speier, C. "Computer Technology Training in the Workplace: A Longitudinal Investigation of the Effect of Mood," *Organization Behavior and Human Decision Processes* (79:1), 1999, pp. 1-28.

Vitalari, N. P., Venkatesh, A., and Gronhaug, K. "Computing in the Home: Shifts in the Time Allocation Patterns of Households," *Communications of the ACM* (28:5), May 1985, pp. 512-522.

Walsh, E. O. "The Truth About the Digital Divide," *The Forrester Brief*, April 11, 2000 (http:/ /www.forrester.com/ER/Research/Brief/ 0,1317,9208, FF.html).

Warshaw, P. R. "A New Model for Predicting Behavioral Intentions: An Alternative to Fishbein," *Journal of Marketing Research* (17:2), 1980, pp. 153-172.

Webster, J. "Desktop Videoconferencing: Experiences of Complete Users, Wary Users, and Non-Users," *MIS Quarterly* (22:3), September 1998, pp. 257-286.

Webster, J., and Martocchio, J. J. "Microcomputer Playfulness: Development of a Measure With Workplace Implications," *MIS Quarterly* (16:2), June 1992, pp. 201-226.

Webster, J., and Martocchio, J. J. "Turning Work into Play: Implications for Microcomputer Software Training," *Journal of Management* (19:1), 1993, pp. 127-146.

Yin, R. K. *Case Study Research* (2nd ed.), Sage, Newbury Park, CA, 1994.

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# Appendix A

## Interview Scripts

### Phase 1: Interview Script

1. Do you have (or have you had) a personal computer at this address?

   **Answer: Yes**

   1.a. How long have you had a computer?
   1.b. How many computers do you presently have?
   1.c. How did you acquire each of the different computers that you currently have?
   1.d. Could you please tell me why you acquired the computer? In other words, what are the factors that led you to (buy/lease) the computer?
      1.d.i. Please rate each of the factors you gave on a five-point scale where 1 is not at all important, and 5 is extremely important. *[Please walk the respondent through the list they gave.]*
   1.e. What are the current uses for the computer?

   **Answer: No**

2. Are you considering buying or leasing a computer?

   **Answer: Yes**

   2.a. When do you plan to buy or lease a computer?
   2.b. Could you please tell me why you plan to acquire a computer? In other words, what are the factors that have prompted this decision?

2.b.i. Please rate each of the factors you gave on a five-point scale where 1 is not at all important, and 5 is extremely important. *[Please walk the respondent through the list they gave.]*

2.c. What do you expect the uses of the computer to be?

**Answer: No**

3. Could you please tell me why you are not planning to buy or lease a computer? In other words, what are the factors that have prompted this decision?

3a. Please rate each of the factors you gave on a five-point scale where 1 is not at all important, and 5 is extremely important. *[Please walk the respondent through the list they gave.]*

4. Is there anything that could change your mind?

**Answer: Yes**

5. Could you please tell me what would change your mind?

**Answer: No**

## Phase 2: Interview Script

1. Have you purchased a PC in the past six months? In other words, since we at <market research firm> called you last, have you purchased a PC?

**Answer: Yes**

1.a. How did you acquire each of the different computers that you currently have?

1.b. Could you please tell me why you acquired the computer? In other words, what are the factors that led you to (buy/lease) the computer?

1.b.i. Please rate each of the factors you gave on a five-point scale where 1 is not at all important, and 5 is extremely important. *[Please walk the respondent through the list they gave.]*

1.c. What are the current uses for the computer?

**Answer: No**

2. Could you please tell me why you did not buy or lease a computer? In other words, what are the factors that have prompted this decision?

2.a.i. Please rate each of the factors you gave on a five-point scale where 1 is not at all important, and 5 is extremely important. *[Please walk the respondent through the list they gave.]*

# Appendix B

## Sample Quotes and Their Codes

| Belief Structure | Factor | Detailed Factor | Respondent Quotes |
|---|---|---|---|
| Attitude | Utilitarian Outcomes | Applications for personal use (U1) | • "...my wife uses that cooking program a lot."<br>• "I saw some neat programs like Quicken and Turbo tax so I got a computer." |
| | | Utility for children (U2) | • "We have a ninth-grader who uses it for his school work..."<br>• "The kids have to know computers these days. We make sure they are learning how to use it." |
| | | Utility for work-related use (U3) | • "I just work from home a lot more now. There's no way I could have kept my job if I didn't get a computer."<br>• "I can drive in to work after rush hour because I get work done at home." |
| | | Reduced utility due to obsoles-cence of current PC (U4) | • "...I don't know but the machine is just too old, none of the new software program things work on it."<br>• "Our machine is like 2 years old, that's like 20 years or something because it doesn't help me get anything useful from it." |
| | Hedonic Outcomes | Applications for fun (H1) | • "We play all sorts of games on it. It's fun."<br>• "I just have fun... surfing the net, talking with people on golf newsgroups, and what not." |
| | Social Outcomes | Status gains from possessing current technology (SO1) | • "My friends are counting on me to tell them what machine to get. I gotta keep up with this stuff because that's why they think I'm cool."<br>• "I don't know I just always got these toys because people who are smart get them." |
| | | Status losses due to obsolete technology at home (SO2) | • "The new computer which is like 2 months old we got even though the old one works because the old stuff is no good because people think we are like the previous generation."<br>• "I don't know, just newer is better and older is bad for my image. That's true even if the old one does the job." |
| Subjective Norm | Social Influences | Influences from friends and family (SI1) | • "My sons advised me to buy it."<br>• "…two of my church friends who said they are doing amazing stuff with it." |
| | | Influence of information from secondary sources (e.g., news on TV, newspaper, etc.) (SI2) | • "There was a 60 Minutes or Dateline special that said something about a stalker or kidnapper…ever since that we don't want our kids to have anything to do with it."<br>• "It's too scary… there are so many stories in the papers about all these porn on the Internet… I wouldn't want my son to get near all that….This is just another problem like drugs were when I was growing up." |

| Belief Structure | Factor | Detailed Factor | Respondent Quotes |
|---|---|---|---|
| Perceived Behavioral Control | Barriers | Rapid change in technology, and/or fear of obsolescence (B1) | • "It's just changing way too fast. If I buy a computer today, it's like too old tomorrow."<br>• "I am just plain scared that if I buy something, it's going to be like obsolete in like a year. Then who knows, I have to buy another one." |
| | | Declining cost (B2) | • "I wanna wait till they're like VCR prices, so may be in like five years."<br>• "Prices are dropping so fast, and I didn't buy for so long so I am just going to wait till it's…50 bucks or…maybe 100." |
| | | High cost (B3) | • "We don't have the money."<br>• "Computers are for rich people." |
| | | Ease/difficulty of use (B4) | • "I did that Windows stuff for a while at work, they're like too hard to use. I heard that Apples...that's the same as Macintosh, right? Anyway, they are easy to use but not that Windows stuff, but people are saying like there's no use learning the Apple stuff."<br>• "It's way too hard for me. I'm a tailor, even using a cash register is like too hard for me." |
| | | Requisite knowledge for PC use (B5) | • "I don't even know how to type. It'll take me forever to learn it."<br>• "I don't know a darn thing about computers other than everyone wants to learn something about them." |