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Essays on the Digital Divide

Belal Abdelfattah
University of Texas at El Paso, belala@gmail.com

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BELAL M.T. ABDELFATTAH, MBA

International Business

APPROVED:

Kallol Bagchi, Ph.D., Co-Chair

Godwin Udo, Ph.D., Co-Chair

Peter Kirs, Ph.D.

Ousmane Seck, Ph.D.

Benjamin C. Flores, Ph.D.
Dean of the Graduate School

Dedication

I dedicate this dissertation to my role models—My father, Mahmoud Taher Abdelfattah, who passed away from cancer halfway through my completion of the doctoral program. His love and strong confidence in me will always be remembered, and I am forever grateful and honored to share his name as I receive this degree. To my mother, Ebtisam A. Abdelfattah, I cannot thank you enough for your unconditional love, care, and support. Your presence in my life is inexpressible.

ESSAYS ON THE DIGITAL DIVIDE

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BELAL M.T. ABDELFATTAH, MBA

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Abstract

The digital divide is a phenomenon that is globally persistent, despite rapidly decreasing costs in technology. While much of the variance in the adoption and use of information communication technology (ICT) that defines the digital divide can be explained by socioeconomic and demographic variables, there is still significant unaccounted variance that needs to be explained if the world's population is expected to be brought more fully into the digital age. The present research addresses this need with three cross-country studies. Study 1 primarily investigates the time individuals spend with traditional media sources as a likely explanation for their frequency of internet access and use across multiple time periods. Study 2 explores the influence of Schwartz-like human values on individuals' frequency of personal computer use and Study 3 employs gender attitudes as a predictor of PC use behavior across countries that vary in the cultural dimension of gender egalitarianism. Overall, analyses in each study reveal varying support of the proposed hypotheses.

Each study is approached with a multinational perspective and is theoretically justified and tested empirically at an individual-level. In Study 1, the displacement hypotheses is adopted from the mass communication literature to rationalize how traditional media systems associate with internet access and use. Also the knowledge gap hypothesis is utilized to explain why the predictors that are commonly tested in empirical digital divide research can logically explain disparities in ICT adoption and use. In addition, Study 1 tests whether the predictive power of common digital divide variables holds across eleven nations and five time periods. I used data from the European Social Survey, which measures individual attitudes, beliefs, and behavioral patterns in more than 30 countries every two years starting in 2001. Results from Study 1 provide empirical support for socioeconomic status and age as predictors of ICT access and use disparities across countries and time periods. The number of countries with a significant and negative association between age and internet use was consistent across time periods but there was an increase in the number of countries with a significant and positive association between age

and traditional media system use in the same time periods. Gender and use of traditional media sources were found to contribute to both access and use divides; however, their association with ICT access and use decreased across time periods.

In Study 2, the theoretical framework and methodology of Johnson and Jackson (2009) was utilized to factor analyze data from the World Values Survey (WVS) that captures the universal human values developed by Schwartz (1992). The confirmatory factor analysis resulted in a two-factor measurement model that was used to examine how each factor—interdependent values and independent values—associates with citizens' personal computer use behavior across seven countries. For most nations, the assertions put forth in this study that citizens who associate more with interdependent values are less likely to be frequent PC users and those who associate with independent values are more likely to be frequent PC users were partially supported.

For Study 3, biosocial theory from social psychology was adopted to propose a possible explanation for the disparities of ICT use behavior between males and females. It was posited that disparities in PC use behavior by gender is associated with traditional gender attitudes. To begin, data from the World Values Survey that captures gender attitudes was analyzed to develop a single factor of citizens' attitudes towards traditional gender roles. Second, three sample countries were selected using House et al.'s (2004) GLOBE Project's rank of nations based on gender egalitarianism scores to test the hypothesized model. The analysis provides support for the tenet that disparities in PC use behavior vary as a function of citizens' gender attitudes when compared across countries with different gender egalitarian culture scores. More specifically, results indicate that traditional gender attitudes may be partially responsible for the gender divide. Each study provides a discussion and concludes with limitations, contributions, and future research directions.

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Chapter 1

Introduction

When the digital divide was introduced in the 1990's, it was commonly defined as "the gap between those who have and do not have access to computers and the internet" (van Dijk, 2006:221). Since then, researchers have extensively studied factors that affect the gap in *access* to communication technologies (ICTs) and suggested how to attenuate the divide (e.g., through community centers and/or subsidies). Although having physical access to computers and the internet does not guarantee access to the information society, digital divides in access are problematic because individuals who cannot access the internet are denied even the prospect of information retrieval (Warschauer, 2004; Ono and Zavodny, 2007).

There is evidence that ICT access divides are diminishing in some countries but persist in others but ICT *use* divides continue to be widely problematic, even within developed nations. Given that ICT access is becoming increasingly common, while ICT use exhibits an enduring divide, the digital divide research focus has largely shifted from ICT access to ICT use (Dewan and Riggins, 2005). Many digital divide research studies have focused on the individual factors that can contribute to divides in ICT access and use, such as socioeconomic status and demographics (van Dijk, 2006). A minority of other studies have addressed how environments, like urban versus rural settings, prolong digital divides (e.g., Hindman, 2000; Parker, 2000). Regardless of the predictor variables under study, digital divide research has followed the trends of describing factors that contribute to the divide and measuring their significance and magnitude. Most generally, the literature has revealed that those on the advantaged side of the digital divide tend to be white males with high education and income (Attewell, 2001; Fairlie, 2005).

Inequality in access to, and use of, technology in communities attracts the attention of academic, government, and business institutions alike (Wei, Teo, Chan, and Tan, 2011). A combined effort from these parties has led to various policies (e.g., ICT infrastructure investment) and projects (e.g., one laptop per child) being adopted by individual countries with the intent to minimize the digital divide within nations. Yet despite these efforts, acute non-availability of ICTs, and citizens not accessing or using ICTs, are problems that persist. For example, in some nations, digital divide in internet access is less common while the divide in use of the internet remains (see Figure 1).

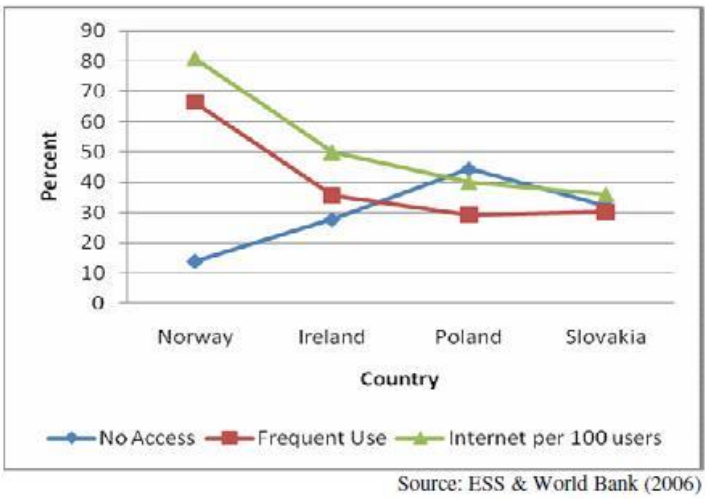


Figure 1: Within and Between Countries Difference: No Internet Access, Frequent Internet Users, and Internet per 100 Users

Even with the volume of digital divide literature, certain likely predictors of the digital divides have not been explored. First, it is uncertain whether the conventional socioeconomic and demographic predictors have an effect on the digital gap within or between developed and less-developed nations when the divide is measured by computer use, internet access, and frequency of internet use. It is also unknown whether or not traditional information delivery sources such

as newspapers, radio, and television, are being displaced by the internet or if their continued use is contributing to the internet digital divide.

Second, the role of human values has not been investigated in relation to individual differences in use of ICTs. According to Schwartz (1992), values are used as a guiding principle of people lives. Thus, variations in ICT use may be contingent on the set of values one primarily associates with (e.g., independence or interdependence). Although the extant research in information systems (IS) has incorporated culture as a predictor of ICT diffusion, most scholars have employed Hofestede's cultural values, or espoused values, to explain diffusion, while few researchers (e.g., Bagchi and Kirs, 2009) have applied Schwartz's values to the same end. Schwartz's human values offer promise in explaining the digital divide because, compared to Hofestede's values, the human values were developed more recently, are more comprehensive, and encompass the values developed by Hofstede.

Finally, little systematic investigation has been conducted regarding the role of culture in digital divide research. For example, research has evidenced gaps between males and females in ICT access and use (e.g., Broos, 2005; Wasserman and Richmond, 2005), yet no research has attempted to investigate underlying causes of this phenomenon. A few studies present ideas for why gender divides may exist (e.g., social development or childbearing; Cooper, 2006; Kennedy, Wellman, and Klement, 2003), while other studies focus on the differences, actual and perceived, in male and female technology skill and/or technology use (Hargittai and Shafer, 2006; Ono and Zavodny, 2003). These studies, however, ignore the gender egalitarianism culture of societies as well as gender attitudes that may significantly influence women's use of technology. Furthermore, the majority of research studies on gender and the digital divide are not theoretically grounded, nor do they provide empirical evidence useful to drawing conclusions

about how to eliminate digital gaps between males and females. More broadly, upon review of this stream of literature, a lack of theory used to justify findings generally characterizes digital divide research.

Given the gaps in digital divide research identified above, the purpose of the present research addresses the following questions—*Study 1:* How do traditional media systems influence the access and use of ICTs? Do the conventional socioeconomic and demographic predictors of the digital divide hold across multiple nations and time periods? *Study 2:* Which set of human values impact the use of ICTs? *Study 3:* Do gender attitudes contribute to the gender divide in ICT use?

By answering the research questions, several contributions are made. First, the knowledge gap hypothesis (Tichenor, Donohue, and Olien, 1970, Bonfadelli, 2002) and displacement hypothesis (Mutz, Roberts, and van Vuuren, 1993; Ferguson and Perse, 2000; Kayany and Yelsma, 2000) are synthesized to explain and empirically test the digital divide in internet access and use. This is accomplished using five cross-sections of individual-level data from multiple nations. By empirically testing a digital divide model that combines the knowledge gap and displacement hypotheses, an understanding of the interrelations among media types and how they contribute to the digital divide across time periods are gained.

Second, the theoretical framework and methodology of Johnson and Jackson (2009) was utilized to factor analyze data from the World Values Survey (WVS) that captures the universal human values developed by Schwartz (1992) to understand which set of human values predicts PC use behavior. Since individuals differ in value types, this research provides insight into the values that impact PC use, which may be useful for academics, practitioners, and the like who focus on strategies to improve ICT use among individuals. Taken together, the present research

answers the call by van Dijk (2006), who asserts that research on digital divide lacks interdisciplinary approaches and theoretical support.

Third, to address the gender gap in the digital divide, biosocial theory (Wood and Eagly, 2002) is applied to explain and test PC use behavior. By building a model based on biosocial theory, the focus can move beyond mere description of a gender divide to an explanation of that divide. This is studied using an individual-multinational approach that investigates the gender digital divide across a number of cultures that vary in their gender egalitarianism measures adopted from the GLOBE Project (House, Hanges, Javidan, Dorfman, and Gupta, 2004).

In summary, this research explores the association of traditional media systems, human values, and gender attitudes with various sources of information and communication technology sources (see Figure 2 for a summary of the proposed studies). Each study offers theoretical justification for the proposed models that were analyzed. The studies in this research make use of two secondary data sources—European Social Survey (Study 1) and the World Values Survey (Study 2 and Study 3), where data were collected from 2002 to 2010. Both data sources make it feasible to perform multinational research at an individual level. The present research uses a series of individual analyses (per country) and pooled analyses, by combining data from multiple nations, to investigate the aforementioned research questions.

The structure of this manuscript is as follows: the subsequent section provides a literature review of the common predictors in the digital divide; Chapter 2 examines the association of traditional media systems, alongside the common predictors, on internet access and frequency of internet use; Chapter 3 focuses on the role of human values in predicting and understanding PC use behavior; and Chapter 4 investigates the digital divide's gender gap in PC as a function of gender attitudes.

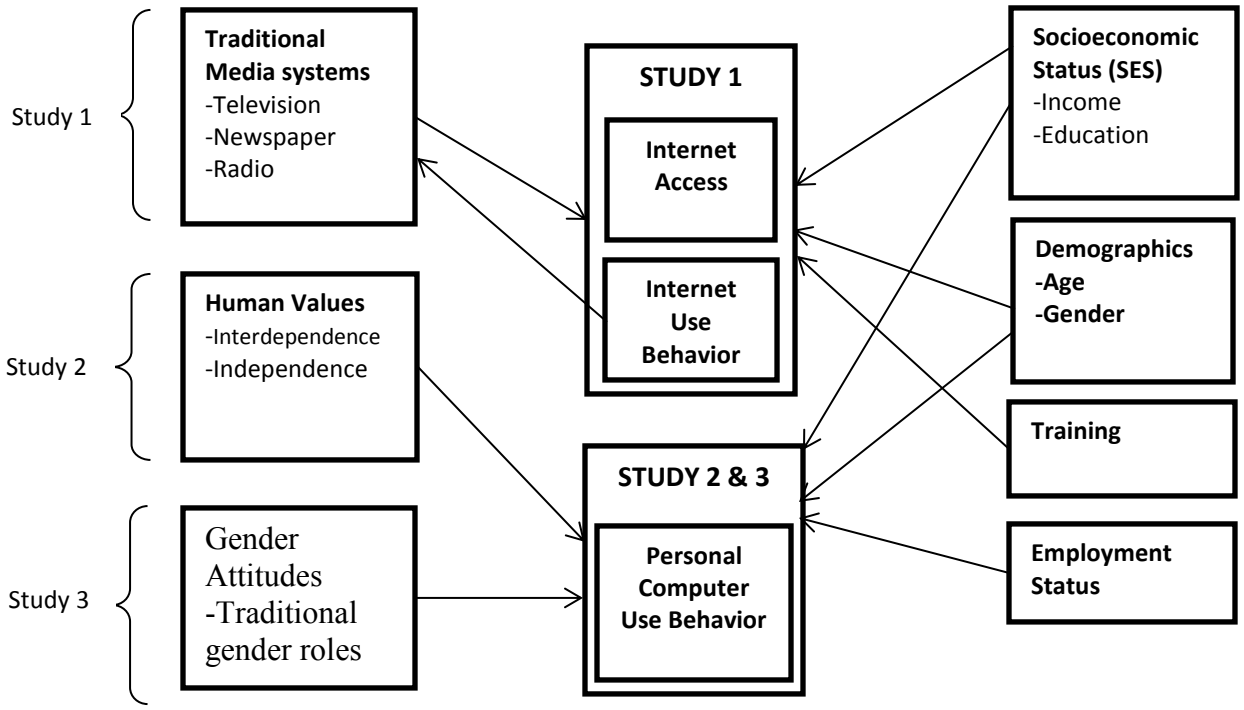


Figure 2: Research Structure

LITERATURE REVIEW

Digital divides can take several different forms. This section begins by defining the relevant terms related to digital divides in the access and use of the ICTs under study in the present research—personal computer use, internet access, and internet use. These ICT distinctions are followed by a review of the literature on the common factors that contribute to the inequality of ICT adoption and use. Each factor will be empirically tested considered as either a main predictor or a control variable, depending on the study.

Differentiating Between Access and Use of ICTs

Internet access is distinct from internet use. *Internet access* means that an individual has available to them a digital device on which they can utilize the internet (Wasserman and Richmond-Abbott 2005). *Internet use* is defined as the actual use by an individual who has available access and basic knowledge to function the medium. (Internet World Stats, 2013).

Relevant digital devices include, for example, personal computers, laptops, tablets and mobile phones. An individual does not necessarily have to own a digital device to have access to the internet because access to devices that connect to the internet is possible through social referents (e.g. family or friend), community centers such as a local library, or places of employment. Internet use is also distinct from *personal computer (PC) use* since individuals may use PCs without necessarily using the internet since availability of a computer with internet capability does not guarantee individuals will utilize the internet periodically, utilize it frequently (Hsieh, Rai, and Keil, 2008), or gain access to the information society (Warschauer, 2004; Ono and Zavodny, 2007). Individuals who engage in the internet utilize the technology for a variety of hedonic, utilitarian, and social outcomes (Venkatesh and Brown, 2001). Technology use for fun or enjoyment purposes is classified under hedonic outcomes whereas utilitarian outcomes focus on tasks that involve personal or work use. Social outcomes occur when individuals utilize technology and are recognized by others which can lead perceptions of higher status, knowledge, and/or profile.

Socioeconomic and Demographic Measures in the Digital Divide

There is a profusion of literature on the inequalities of ICT adoption and use that consider socioeconomic and demographic factors. Studies in this research stream generally focus either on country-level divide (e.g., Cilan, Bolat, and Csokun, 2008; Campbell, 2001; Crenshaw and Robinson, 2006; Dewan, Ganley, and Kraemer, 2005; and Dewan, Ganley, and Kraemer, 2010), or individual-level divide (e.g., Robinson, Dimaggio, Hargittai, 2003, Hargittai and Hinnant, 2008, Hassani, 2006; Bimber, 2000; and Sipior, Ward, and Connolly, 2011). Country-level divide studies use national-level data to explain the digital gap between countries and individual-level divide studies utilize data from individuals to explain the digital gap within a given

location. Common explanatory factors at the individual level are age, gender, income, and education, described below.

Income

Income is recognized as an important predictor of internet access and internet use (Robinson, DiMaggio, and Hargittai, 2003). Income inequality may result in access barriers for those with limited incomes and, consequently, slower diffusion of ICT adoption and use within lower income groups (Sipior et al. 2011, Lorence et al., 2006, Martin and Robinson, 2007). Goldfarb and Prince (2008) examine the patterns of internet access and internet use based on socioeconomic and demographic factors. These authors find income has a positive relationship with internet adoption. They also find that among those with internet access, individuals with higher income spend less time utilizing the internet compared to individuals with lower income (i.e., those on the disadvantaged side of the divide). Another difference related to income is that low-income internet users have been found to utilize the medium more for hedonic purposes (e.g., chat and gaming), in contrast to high-income internet users, who more often use it for utilitarian purposes (e.g., e-commerce and research). One justification suggested for the pattern differences associated with income is that the opportunity cost of leisure time is lower for those of low socioeconomic status (SES) than for those of high SES.

In their cross-country research on patterns of income and the digital divide, Martin and Robinson (2007) examined cross-national differences among European countries and the United States (US). In the two time periods for which data were analyzed, 1997 and 2003, the odds ratios for the US and European samples indicate that the low-income group has lower internet usage compared to the high-income group. Compared to the European countries, the US has more internet users at all income levels; however, an increase in internet users is evident for all

countries in the more recent time period. Also for the more recent time period, the income inequality gap of internet users in the US increased but decreased in Europe.

Education

With some exceptions, results for the influence of education on the digital divide regularly map those of income, potentially because income and education are highly correlated (Blaug, 1972; White, 1982). According to Robinson, Dimaggio, and Hargittai (2003), education is considered to be the primary factor that predicts internet access.

Education is essential in technology adoption but the role of education in the use of technology is less clear. Sipior et al. (2011) find support for their hypothesis that education is negatively associated with internet access barriers. In the same study that investigates the influence of income on the digital divide, Goldfarb and Prince (2008) find that education is positively related to internet adoption. Although individuals with higher education are more likely to adopt the internet than those with lower education, they are also less likely to utilize the internet compared to individuals of lower SES who do have access to the medium (Goldfarb and Prince, 2008).

Besides their ability to earn more income, college-educated individuals have advantages that lead to greater adoption and use of the internet when compared to non-college-educated individuals. Those who are college educated generally have greater autonomy in their ability to access and use the internet, pronounced internet navigational skills, and a better understanding of the variety of website types and their uses (hedonic or utilitarian; Robinson, Dimaggio, and Hargittai, 2003).

Age

Age is a factor that predicts the access to and utilization of ICTs. Recognizing that younger adults are more likely to use the internet, Hargittai and Hinnant (2008) investigate self-reported skill and website use of a younger population. They find young adults with college degrees, high autonomy, and more practice with the medium have higher self-reported skill compared to young adults with a high school education, less autonomy, and less experience with the medium. In addition, the authors find that high self-reported skill and education are more likely to result in visits to capital-enhancing websites (e.g. news, health, and product information) and younger internet users' abilities to find specific information online differ from older users. In similar studies, Hargittai and Shafer (2006) find that age is a statistically significant predictor in successfully searching for specific content online, and Akhter (2003) provides evidence that younger people are more likely to make purchases online than older people. Korupp and Szydlik (2005) focused on the family context in digital divide and find that parents were more likely to use internet and PCs as teenagers and young adults were residing in a family household.

Gender

Research that uses gender as a predictor of access and use of the internet provides mixed results. In support of gender as a contributing factor to the digital divide, Bimber (2000) finds considerable differences in internet use but no difference in internet access between men and women. More specifically, men are likely to be frequent internet users and women are likely to be infrequent users of the internet. Similarly, in a study on the intentions to use e-government applications, gender was a significant predictor of use intentions but not a significant predictor of internet access (Belanger and Carter, 2009). In an online purchase intention study, Akhter (2003) also finds significant results for gender differences in internet use in support of his

hypothesis that males are more likely than females to engage in business transactions over the internet. Finally, within a sample of students in secondary education, Wei et al. (2011) find that compared to males, females have lower computer self-efficacy and home computer use for studying and leisure.

Based on a review of empirical studies that incorporate gender as either a predictor or control variable of any ICT digital divide, the majority of studies are based on individual-level analysis, the exception to which is Chen and Wellman's (2004) aggregate descriptive study of the digital divide in several countries. The literature review reveals that much of the empirical research consists of one-country studies that employ US samples; exceptions have been contributed by Broos (2005); Martin and Robinson (2007); Korupp and Szydlik (2005); Wei et al. (2011); Kennedy, Wellman, and Klement (2003); and Ono and Zavodny (2005). While the majority of studies find gender to be a statistically significant variable in explaining digital divides, these studies have not been theoretically grounded or justified. Research shows that women are less likely than men to have internet access, be frequent internet users, and make purchases online (e.g. Loges and Jung, 2001; Wasserman and Richmond-Abbot, 2005; and Akhter, 2003). Similarly, females have been found to have greater computer anxiety and lower computer self-efficacy compared to their male counterparts (e.g. Broos, 2005 and Hsieh, Rai, and Keil, 2008). The remaining portion of this section details important digital divide studies that illustrate different approaches taken to relate gender to the digital divide.

Cooper (2006) extensively studies the role of gender in the digital divide and articulates why females are disadvantaged compared to males in adopting and using ICTs. Citing various studies that show a similar phenomenon, the author asserts that gender gaps in ICT adoption and use exist across international borders and are a function of social construction that results in

computer anxiety for females and conscious or non-conscious gender stereotypes that discourage female adoption and use of technology. To test his assertion, Cooper (2006) conducted an experimental study on the effects of identity and stereotypes on computer performance. Results indicated that females in an excellent high school who were primed and identified as a group of 'girls' (versus identified as students) did not perform as well as a females who were primarily identified as 'students'.

In a study that examines gender ICT divide in Belgium, Broos (2005) found that women have more negative attitudes and more anxiety than men in relation to computers and the internet. Moreover, computer experience was found to have an influence on reducing computer anxiety and increasing "ICT-liking" for men but no impact on women. The author suggests more investigation into the reasons for different effects of self-efficacy on computer anxiety for males and females.

Shashaani and Khalili (2001) studied the attitudes toward computers of males and females using questions regarding computer confidence, self-perceived stereotypical views, including those of their parents and friends, and parents' SES. The results of their study reveal gender differences in stereotypical views of the participants; women believed they are equally competent in using computers, while males identified computers as a male domain. Female respondents did, however, indicate that they personally felt deficient in their computer abilities and apprehensive when using computers. Stereotypical views of parents and friends were found to impact the stereotypical views of participants as well as their computer interest and confidence in computer use. Lastly, in terms of SES, the education of participants' parents had a greater impact than their income on participants' attitude toward computers. Parental income was

similarly found to be a nonfactor in internet use for participants in a study by Odell, Korgen, Schumacher, and Delucchi (2000).

In their research on gender and the internet, Ono and Zavondy (2003) analyzed several data sources between 1997-2001 to comprehend the extent of gender gaps in internet access and use within the United States. While controlling for socioeconomic and demographic factors, the researchers found gender gaps for internet access existed in the earlier time periods but dissipated in the later time periods, leading them to conclude that a gender gap in access no longer exists. Ono and Zavondy (2003) also found evidence of gender differences in the frequency and intensity of internet use.

Ono and Zavondy (2005) conducted an individual-level, cross country comparison study between Japan and the United States. Using the same time periods (1997-2001) explored in their 2003 study, and controlling for socioeconomic and demographic variables, Ono and Zavondy investigate the role of employment, particularly nonstandard and standard jobs. Standard employment are jobs that are full time and require a considerable amount of human capital investment, while nonstandard employment are often part-time or self-employed jobs that require less investment of human capital. Their research found that women in the United States in both nonstandard and standard jobs have more computer skills and use IT more than women in similar jobs in Japan. Overall, the evidence points to few gender differences in IT adoption and use in the United States, which contrasts to Japan where gender inequality in the labor workforce seems to be contribute to a gender digital divide.

Gender in Technology Adoption Models

Gefen and Straub (1997) are some of the first researchers to incorporate the role of gender in IT diffusion and adoption research. The authors study one country from each of three

continents—the United Stated from North America, Switzerland from Europe, and Japan from Asia. Using the technology acceptance model (TAM), significant gender differences were evident within each of the three country samples. Women placed higher value than men on perceived social presence and perceived usefulness of the technology (except in Switzerland). Men perceived the technology to be easier to use than women; however, gender difference in the actual use of the technology was not found.

In a similar study on technology adoption, Venkatesh and Morris (2000) extend the TAM by incorporating factors of subjective norms, experience, and gender. Their research concluded that men and women weigh TAM factors differently; perceived ease of use and subjective norms were more important factors for women while perceived usefulness was more important for men. In related research, Venkatesh, Morris, and Ackerman (2000) used the theory of planned behavior to explain technology adoption between males and females. The authors found for those adopting new technology, subjective norms and perceived behavioral control to have greater influence on women and attitudes toward the technology to have greater influence on men. Both studies suggest that when considering the adoption of new technology, men focus on the instrumental factors (e.g., usefulness of the technology) while women are motivated by the process (e.g., ease of use, subjective norms, perceived behavioral control).

In summary of the literature, socioeconomic and demographic variables are important factors that predict digital divides. While there are clear and common factors in digital divide stream of research, there remains a lack of attention to potentially relevant predictors of the digital divide. One example is traditional media systems, which continue to be widely utilized and may play a considerable role in the adoption and use of newer technologies—this is

discussed in Chapter 2. Subsequently, Chapter 3 details the role of human values in the digital divide, followed by Chapter 4, an in-depth investigation of gender gap in PC use.

Chapter 2

The Digital Divide: A Knowledge Gap and Displacement Hypotheses Perspective

The inequality of information acquirement from traditional mediums such as newspapers and radio (Tichenor, Donohue, and Olien, 1970) has been replicated with the internet (Bonfadelli, 2002). This phenomena is reasonable given that, compared to traditional media, the internet is a dynamic medium for information exchange, communication, and commerce. Given the dynamic nature of the internet, greater skill is required to extract information from this source compared to traditional media sources. Differences in users' skills can lead to disparate extraction of information from the internet; however differences in information acquirement from the internet may also be due to dissimilarities in access and use of the internet to begin with. Disparities in internet access and use are example of digital divides.

The *digital divide* is generally defined as the gap between those who can access and use digital technologies and those who cannot (e.g., Korupp and Szydlik, 2005). The internet digital divide is typically measured by the inequality of internet access and internet use, classified as first-level effects and second-level effects (Hargittai, 2002; Dewan and Riggins, 2005), respectively. In the European region, 58.3% of population utilizes the internet compared to 78.3% in North America[1] and the growth of internet use penetration from 2000 to 2011 has increased 353.3% for Europe and 151.7% in North America. Even while technology penetration rates have exponentially increased, there remains an evident divide between citizens who use the internet and those who do not.

[1] http://www.internetworldstats.com/stats.htm - Internet user percentage was last updated March 2011.

The digital divide phenomenon manifests both within and between developed and less-developed countries. The divide naturally categorizes citizens into either the advantaged or disadvantaged side of the divide, where those on the disadvantaged side of the digital divide are those who do not access or use the internet. These individuals tend to be of lower socioeconomic status and, while the price of information and communications technologies (ICTs) is generally decreasing, improvement in the rates of access to certain technologies, such as the internet, remains non-uniform. For example, internet use (per 100 people) continues to vary widely within and between nations.

Bonfadelli (2002) proposes that the knowledge gap hypothesis can be used to explain differences in internet access and internet use. Originated in the 1970s, the knowledge gap hypothesis explains how information acquirement inequalities relate to the traditional sources of information (newspapers, radio, and television) and socioeconomic status (SES). While this theory can be used to explain gaps in access to and use of both the traditional and more modern sources (internet) of information, the effects of traditional media systems on the internet digital divide need to be further investigated.

Despite the diffusion of modern ICTs, information delivery sources such as newspapers, radio, and television continue to be utilized by citizens, which may have displacement or supplemental effects on the adoption of newer ICTs (Robinson, Barth, and Kohut, 1997; Venkatesh, and Brown, 2001). A supplemental effect occurs when the use of traditional media drives individuals to use the internet, to acquire additional information they could not find in the traditional media source, for example. Contrary to this supplemental effect, a functional displacement effect may arise as new technological developments lessen the use of earlier technologies (Katzman, 1974), by which more time is spent using the newer technology in place

of the older (Mutz, Roberts, and van Vuuren, 1993). It is possible that individuals do not completely displace traditional media systems for newer mediums like the internet, but instead rely on traditional media systems as a functional alternative. This displacement behavior ultimately creates or prolongs digital divides. These idea of supplemental and displacement effects playing a role in the digital divide is tested in the present research that focuses on individual-level internet inequalities within a number of countries across multiple time periods; accordingly, the factors that are common to the digital divide in past studies are elaborated below. Borrowing from the mass communication literature, I begin by reviewed the displacement hypothesis and knowledge gap hypothesis.

THEORETICAL BACKGROUND

Displacement Hypothesis

Research on displacement dates back as early as the 1940's when scholars in the communication field investigated the effect of radio on reading print media (Lazarsfeld, 1941) and books (Lazarsfeld and Kendall, 1948). Soon after, other researchers investigated the decline of newspaper purchases and the change in the function of the radio at the same time televisions sets were being rapidly adopted in homes (Belson, 1961; Parker, 1961). Decades later, ongoing research on displacement continues to explore the role of new ICTs (e.g., personal computers and internet) as they are introduced. A review of this literature is presented below.

Researchers have examined several forms of displacement. The first is time displacement, which occurs when excessive use of a specific medium or involvement in an activity adverts time spent engaged with/in alternatives (Mutz, Roberts, and van Vuuren, 1993; Robinson and Kestnbaum, 1999; Cai, 2005). A second form of displacement is functional displacement. Robinson and Martin (2009) refer to functional displacement as *functional*

equivalence and in its definition assert that "a new technology will replace those activities that most closely perform the same functions for users as did the older technologies" (p.16). Similarly, Ferguson and Perse (2000) label functional displacement *functional alternative*, and describe it as new media that can displace older media provided it can be used to achieve existing goals. Finally, Kayany and Yelsma (2000) distinguish functional displacement as the replacement of existing resources with a new resource(s) that functions as the *primary* means of meeting a population's need(s). From the overlapping conceptions of the phenomena described above, *functional displacement* can be understood as the replacement of a technology or activity with one that is similar and, because of its superior effectiveness and efficiency, becomes the primary outlet for meeting the needs of an individual or population.

Previous research has investigated internet use and displacement effects. In comparisons by gender and generation, Kayany and Yelsma (2000) find time displacement is significantly different for adults and children (children displace more time spent viewing television and engaging in telephone and domestic conversations with internet use) but not for males and females. In relation to youth's functional displacement of traditional media, Lee and Kuo (2002) found support with a Singaporese sample for the displacement of television with the internet but an increase in the use of radio listening and newspaper reading accompanied by internet use. Ferguson and Perse (2000) found the opposite effect with a sample of college students, that the World Wide Web and television are functionally dissimilar and, therefore, internet use does not displace television viewing. Through experimental research, Cai (2005) investigated time displacement effects by having participants deprive themselves from the use of computers. For both heavy and light users of the computer, there was no support for the premise that time spent with other media such as television, radio, and newspapers will increase as computer use is

restricted. Some support, however, was found for the use of traditional media remaining unchanged.

Other studies have evidenced an opposite (supplemental) effect of time displacement with adult samples. Robinson and Kestnbaum (1999) evaluated time displacement of personal computer users and nonusers in relation to leisure activities and participation in social events. Their results show that average users and heavy users of personal computers are more likely to participate in leisure activities or social events than nonusers, concluding that personal computer use supplements other activities rather than displaces them. A later study by Robinson, Kestnabaum, Neustadtl and Alvarez (2000) makes evident similar supplemental effects of internet use on social activities and the use of traditional media.

Knowledge Gap Hypothesis

Knowledge acquirement requires the adoption of innovations, and the acquirement and use of such innovations are influenced by individuals' socioeconomic status. The prominent diffusion of innovations scholar, Everett Rogers, addresses the importance of SES in the adoption of innovations and states that the diffusion of innovations contributes to the gap between citizens of different socioeconomic status (Rogers, 1995:125). This gap exists between two segments—an advantaged group that adopts the innovation and a disadvantage group that is unable to adopt the innovation, at least as rapidly as the former. This inequality of innovation diffusion in a social system as a consequence of the differences in SES is related to the diffusion of knowledge among individuals in two ways. Information is required for individuals to adopt innovations and the diffusion of information occurs through innovations that have been adopted (Rogers, 2003). This relationship between knowledge and individual adoption of innovations is conventionally addressed in the diffusion research, yet similar concepts are included in the mass

communication literature, appearing as early as 1970. Phillip Tichenor and his associates (Tichenor, Donohue, and Olien, 1970) investigate the disparities of information attainment due to socioeconomic status. Decades later, Persaud (2001) related that, "knowledge comes from people with time and resources to discuss, think and experiment" (p.109) and found that the gap in knowledge between countries is ten times as large as the gap in income.

Tichenor, Donohue, and Olien (1970) introduce the knowledge gap hypothesis that states as information is diffused by mass media systems across groups of citizens in a social system, the acquirement of this information by these citizens will be differential or unequal based on their SES. A knowledge gap can occur whenever there is a significant difference in knowledge acquirement by individuals; therefore, knowledge gaps can manifest in greater or lesser degrees and vary across topics. This occurs because citizens with higher SES have the advantage that they acquire information at a faster rate than citizens of lower SES. This is not to say that the disadvantaged segment do not eventually acquire the information, they just may do so at a later time period. As stated by Tichenor et al. (1970):

> "As the infusion of mass media information into a social system increases, segments of the population with higher socioeconomic status tend to acquire this information at a faster rate than the lower status segments, so that the gap in knowledge between these segments tends to increase rather than decrease" (p. 159–60).

Tichenor et al. (1970) operationalize SES as educational attainment and provide five reasons to explain why the knowledge gap can be attributed to formal education. The first contributing factor of the knowledge gap is *communication skill*, which provides an individual the valuable reading and comprehension skills necessary to acquire information. The second factor, *stored*

knowledge, entails prior knowledge from previous exposure to the topic that leads to a better understanding of information in the future. The third reason is the *relevant social contacts,* which are interpersonal connections that represent a network of people with whom an individual can discuss information. The fourth factor, *selective exposure, acceptance, and retention of information,* is the idea that information being acquired is largely dependent on that which is relatively consistent with existing attitudes, beliefs, values, all of which are influenced by individuals' education. The final contributing factor is the *nature of mass media system,* explained as sources of information acquirement, such as print media—often utilized by educated or "higher-status persons" (Tichenor et al., 1970).

Aiming to understand knowledge gaps in local communities, especially those related to specific local issues, Donohue et al. (1975) considered as additional causes of inequality in information attainment—community concern and conflict, community structure, and the repetition of media content on public affairs. The authors found that the knowledge gap may decrease and equalization of knowledge can occur when the information diffused is of general concern to the community, rather than to a specialized group. Results also provide evidence that a knowledge gap is less profound when the perceived conflict over an issue is high because such conflict inspires interpersonal communication or personal discussion that increases the exchange of relevant information. Furthermore, the authors found knowledge gaps increase in communities that are heterogeneous in employment, government, religion, and other social institutions compared to communities that are more similar in nature. Finally, no support was found for the contention that message redundancy, or increased media attention, will decrease the size of knowledge gaps.

Gaziano (1983) has also contributed considerably to the literature with her examination of 58 studies related to knowledge gaps that thoroughly investigates their methodologies, samples, and findings. The author finds that "knowledge gap" was defined and explored in two different ways across studies. First, the knowledge gap was conceptualized as a gap that refers "only to the relationship between education and knowledge without reference to media" (Gaziano, 1983:449). Second, and consistent with the knowledge gap hypothesis as defined by Tichenor et al. (1970), the knowledge gap was defined as a gap that is "an outcome dependent on media treatment or media exposure" (Gaziano, 1983:449). Overall, results of the latter studies indicate that both one-time and time-trend studies are influenced by media publicity; however, other factors may contribute to decreasing gaps. In addition, knowledge gaps are topic-specific and smaller gaps are more prevalent for local topics than for international topics and those related to class or textbook information.

From the above review, it is apparent that there is considerable overlap in the knowledge gap and digital divide streams of research. In the following section I explain how the knowledge gap hypothesis can be used to explain digital divides and update the knowledge gap hypothesis framework to accommodate ICTs.

THEORY DEVELOPMENT

There is inconsistency in the literature with how the knowledge gap has been defined and tested. Tichenor et al. (1970) and Donohue et al. (1975) investigated the knowledge gap arising from information attained by reading newspapers. Although Donohue et al. (1975) operationalized mass media as newspapers, they tested the knowledge of participants by asking respondents whether they have read or heard anything about a particular topic in recent months. This is problematic to the extent that asking participants what if anything they 'have heard,'

researchers may have inadvertently generated responses based in other information delivery sources (e.g., word-of-mouth through social contacts, television, or radio).

Knowledge gap research conducted on the use of a single medium (like newspapers) or on traditional media alone, limits the generalizability of findings because the nature of mass media is one factor that contributes to the knowledge gap (Tichenor et al., 1970). By the same reasoning, studying internet use separate from the use of other media similarly limits generalizability of findings, especially because mass media systems, including the internet, are utilized dissimilarly by different status groups. As evidenced by Tichenor et al. (1970), higher status groups traditionally use print media sources more than lower status groups, an outcome that is likely owed to the reading and comprehension skills learned from formal education and the common use of the medium by their relevant social contacts. Other information delivery sources that do not require as much skill, like television, may be utilized by lower-status individuals in place of reading print media (Neuman, Just, and Crigler, 1992). Comparatively, the internet is a newer information source that requires technical knowledge and skills for effective utility of the medium.

Technical knowledge and skills as a contributing factor to information acquirement has rarely been incorporated into research on the knowledge gap and the digital divide even though the importance of technical knowledge and skill to communication was recognized decades ago by Katzman (1974), who proposed the impact of new communication technology on acquiring knowledge and stated, "A certain degree of ability to use new technology can probably be called 'innate' but it is important to note that much acquired knowledge and skill is directly related to the ability to acquire more information. In some cases the key is technical knowledge (p. 51)" Exception to the lack of research assigning the importance of technical knowledge and skill to

knowledge gaps are Hargittai and Hinnant (2008) and DiMaggio Hargittai, Celeste and Shafer (2004). First, DiMaggio et al. (2004) found that low technical skills contribute to individuals' cost to use the internet compared to the cost to use traditional media. Subsequently, Hargittai and Hinnant (2008) stated that individual skills contribute to the knowledge gap and sampled individuals of high SES to test their hypothesis that online skill and types of website visits contributes to knowledge gaps. The authors found that higher education led to more visits to capital-enhanced websites, that men more than women claimed higher digital literacy (e.g., knowledge of internet terms and features), and that less frequent internet users are less knowledgeable about the web.

Addressing individual knowledge and skills, Bonfadelli (2002) has integrated the knowledge gap perspective with the internet digital divide by focusing on the differences in information acquirement between traditional mediums and the internet and the impact of internet access and use on the knowledge gap. Bonfadelli has proposed that, in order to meaningfully use the internet, individuals need to acquire the skills traditionally possessed by journalist for retrieving information. For example, internet users need to follow purposeful searching strategies and assess the credibility of sources. While the internet presents some challenges to users, there is great advantage in its potential to provide unlimited information and, compared to traditional media, its wide availability, superior ability to informs users of politics, and its less biased nature due to information not being composed solely by journalists (Bonfadelli, 2002; Hargittai, 2008).

Drawing from the research of Bonfadelli (2002), and given the similarity in predictors of the knowledge gap and digital divide, I propose that the framework embodied by the knowledge gap hypothesis can be used to explain the digital divide. The knowledge gap is a phenomenon

that results from varied use of multiple media systems and the digital divide results from varied adoption and use of a single technology (e.g., the internet). While the focus of the digital divide has been singular technologies (either computer or the internet), I propose that internet adoption and use, and thus the digital divide, may also be a function of time and functional displacement of traditional media. Therefore, the knowledge gap hypothesis framework, which by its nature incorporates multiple media systems, seems appropriate for theoretically understanding the digital divide when it is studied in a context that incorporates traditional media alternatives. In addition, the knowledge gap and the digital divide already share common predictors that have been consistently supported by empirical evidence, including SES, demographics, and individuals' skills.

An update to the knowledge gap framework that is necessary to study the digital divide is the a) addition of technical knowledge and skills as a contributor to the divide, b) investigation of the internet as one of multiple media systems alternatives, and c) incorporation of time and functional displacement. Figure 1 illustrates an integration of the knowledge-gap and time displacement with the digital divide. Individuals' demographics, SES—inclusive of income and education—and motivation are antecedents of skills which can predict selection of the media system individuals primarily use and how much time they spend with that and other mediums. These differences between those with and without the ability and/or willingness to access or use the internet results in a digital divide. Finally, the digital divide and knowledge gap perpetuate one another since a lack of knowledge leads to slower adoption and limited use of innovations and the failure to adopt or utilize innovations, like the internet. This in turn can result in less access to, and acquirement of information and, consequently, reduced knowledge.

The digital divide exists on multiples levels (Dewan and Riggins, 2005). The first level is the adoption of the internet. This divide is associated with technology infrastructure and the characteristics of adopters and nonadopters. Citizens in communities that lack the physical infrastructure to support internet use are automatically on the disadvantaged side of the digital divide. Assuming the presence of internet technology infrastructure, individuals' income largely predicts whether or not they have access to the internet. The second-level of the internet digital divide addresses a) different ways people use the internet, or the purpose(s) of use (e.g., e-commerce or gaming), and b) their frequency of internet use. Demographics, SES, and technical (computer) skills are all predictors of variations in internet use.

I introduce a third level of the digital divide into the conceptual model—internet as the primary source of information—and suggest that this construct manifests from time and functional displacement of traditional media with use of the internet. This third level is distinct from Wei, Teo, Chan, and Tan's (2011) proposed third level of the digital divide, termed the "digital outcome divide", which is not a level of the digital divide, per se, but actually a component of the knowledge gap. The third level of the digital divide I am proposing can persist as a function of media system choice and the time spent using each medium. More specifically, a gap will form between those whose primary media source is the internet and those whose primary media source is a traditional one (or several combined). Traditional media can be displaced by the internet but will remain the primary media source as long as the time spent using this media is more than the time spent using the internet. However, when the time spent using the internet becomes greater than the time spent with other media, the internet functionally displaces traditional media systems as the primary media source, and lessens the digital divide

and, potentially, the knowledge gap as well. These relationships are presented in the model below and further described in the following section.

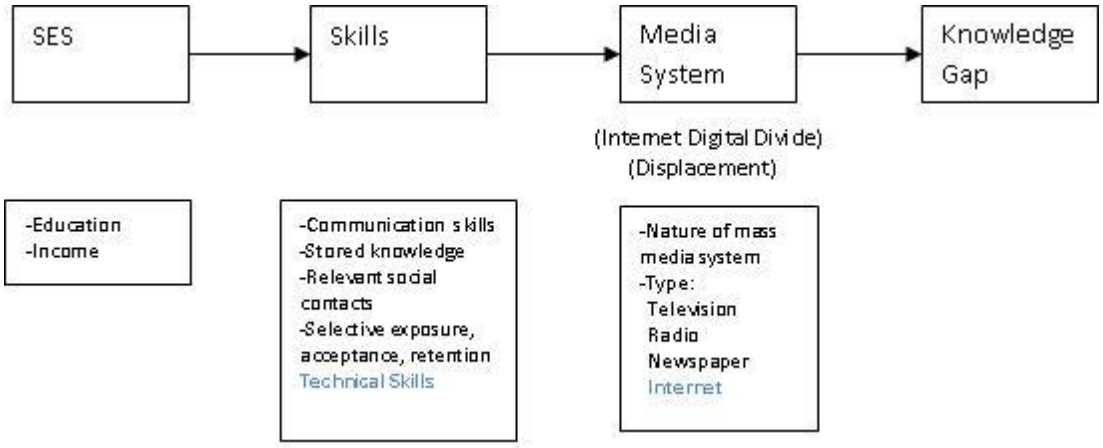


Figure 1: Digital Divide Synthesized with Knowledge Gap and Displacement Hypotheses

HYPOTHESES

Regardless of the environment, Katzman (1974) suggests that the ability to access information must be present to gain knowledge. Media outlets are sources of information and access to them is dependent on factors of demographics, SESs, and media system choice. The ability to access information via media is an antecedent to the use of media sources, making the use of media channels dependent on the same factors. The following sections provide hypotheses related to these proposed relationships.

Socioeconomic Status – Education and Income

Socioeconomic status is an essential factor in the adoption and use of ICTs. That the internet is accessed and utilized more by individuals with higher SES than those with lower SES, is a pattern that has been studied extensively by researchers of the digital divide (Chinn and Fairlie, 2007; Billon, and Lera-Lopez, 2009; Goldfarb and Prince, 2008; Kurupp and Szydlik,

2005). Research that evidences this pattern is in line with the knowledge gap hypothesis that predicts individuals of higher SES, as indicated by education, will acquire information faster than lower SES individuals (e.g., Tichenor et al., 1970 and Donohue et al., 1975). Kwak (1999) revisits the knowledge gap theory and examines additional variables (i.e., motivation and media use) besides education to explain gaps in knowledge acquisition between individuals of different SES. Education, the main variable that constitutes the SES-based knowledge gap in the seminal work by Tichenor and his associates, continues to be the driver for differences in knowledge attainment. According to Tichenor et al. (1970), education assists in media being utilized and the newspaper medium is more utilized by the high SES group than the low SES group. This is attributed to the skill background an individual received during his/her education. Television, however, a medium preferred more by low-cognitive individuals (Neuman et al., 1992) for information acquirement, can hinder the use of media systems that require skills to effectively function it.

Digital inequality research has typically defined SES by both education and income, where individuals with low income are less likely to access and use the internet than individuals with high income (e.g, Bucy, 2000; Goldfarb and Prince, 2008). For example, Hsieh et al. (2008) use income and education to group individuals as either socio-economically advantaged or disadvantaged in order to test the combined influence of income and education on the continued use of technology. Other studies that address income in the digital divide have evidenced significant positive effects on internet access and internet use (e.g., Chinn and Fairlie, 2007; Hargittai, 1999). In fact, the facilitating role of income in access to and use of the internet makes it the largest contributing factor of the digital divide (Chinn and Fairlie, 2007).

To understand how education can influence the digital divide it is necessary to begin with the role of SES in the use of traditional media sources, like print media, and its influence on individuals' knowledge. Knowledge gap researchers initially used education as a proxy for SES (e.g., Tichenor et al., 1970; Donohue et al., 1975; Ettema and Kline, 1977), but later included income as a second factor of SES associated with media use and knowledge acquired therefrom (e.g., Lovrich and Pierce, 1984). In the investigation of the knowledge gap theory, higher SES persons are assumed to have an advantageous position related to factors that influence media access and use and, thus, knowledge acquisition. These factors include communication skills, prior knowledge, relevant social contacts, selective use and exposure, and structure of the media systems.

Newspapers are considered a media system that higher SES individuals can make more effective use of because of the enhanced educational background they possess; an argument made for several reasons by Tichenor et al. (1970) and others. First, the structure of the media system allows higher SES individuals to make better use and interpret information more effectively because of their communication skills and prior knowledge, both of which are a result of their education and income. As a result, the knowledge of higher SES individuals is greater compared to that of their lower SES counterparts. Second, the occurrence of social influence from individuals in networks related to individuals' educational experiences is likely and provides high SES persons with an additional interpersonal source of information (Bonfadelli 2002). Third, individuals with a formal education are generally more informed and continuously search for more information and have more topic interests and information storage skills associated with high SES.

For end users, the internet may be considered a more complex source of information than traditional media systems (Bonfadelli, 2002) because it enhances the relevance of education to accessing and using the internet compared to print media. Both print media and the internet, however, are information rich media systems with different selective exposure types (Wei and Hindman, 2011). For example, the internet contains diverse information that is controlled by individual users of the medium in contrast to traditional media systems where information is controlled and exposed by media companies and journalists. Therefore, due to the difference in selective exposure and the nature of the media systems, individuals must necessarily possess skills to effectively utilize newer, advanced media systems, like the internet. More specifically, communication skills and prior knowledge are imperative to the effective use of the internet. Bonfadelli, (2002) argues that higher SES people, "are better able to manage communication in general and to use and interpret specific media information than less educated people" (p. 68). Moreover, the prior knowledge obtained by higher SES individuals allows them to effectively recognize and acquire subsequent information. Personal network exposure, or relevant social contacts, is a factor that Hsieh et al. (2008) and Tichenor et al. (1970) argue is important to the continued use of the internet as well as the knowledge gap. High SES individuals are assumed to have more social influences that can function as an additional information source and contribute to their continued use of the internet (Tichenor et al., 1970; Hsieh et al., 2008).

In the same way that individuals with higher SES gain more knowledge from media sources than those with lower SES, I argue that the five factors that contribute to the knowledge gap (i.e., communication skills, prior knowledge, relevant social contacts, selective exposure, and structure of the media systems) will allow higher SES individuals to effectively use the internet and will, therefore, add to the likelihood that they more frequently use the internet than

individuals with low SES. This argument is consistent with that of Wei and Hindman (2011), who state that individuals with higher SES are not only likely to have more knowledge than individuals with lower SES, but that they will also access and use newer media systems at a faster rate than those with lower SES. Taken together, as theorized by the knowledge gap hypothesis and supported by empirical research (e.g., Bonfadelli, 2002; Wei and Hindman, 2011), I posit that individuals with higher SES—formal education and income—will access and use the internet more than individuals with lower SES. This idea is captured by the following four hypotheses.

H1a: Education will be positively associated with internet access.

H1b: Education will be positively associated with internet use.

H2a: Income will be positively associated with internet access.

H2b: Income will be positively associated with internet use.

In addition to formal education, individuals' completion of secondary courses and/or lectures designed to improve knowledge and skills may have an influence on newer media use. This may occur because technical skills are required to effectively use newer communication technology (Katzman, 1974) along with the communication skills needed to acquire information from media systems (Tichenor et al., 1970). Drawing from the same arguments articulated for the above hypotheses that relate formal education to internet use and access, I argue that formal training through courses, lectures, and/or conferences will be positively associated with internet use and access. Thus, I posit that individuals who receive these types of formal training will adopt and use the internet more than those who do not receive such formal training.

H3a: Knowledge and skills training will be positively associated with internet access.

H3b: Knowledge and skills training will be positively associated with internet use.

Displacement of Media Channels

The traditional sources of communication technologies such as newspapers, radio, and television are mediums that have provided citizens with information for decades. Information and communication technologies have evolved from these one-way communication channels to two-way communication outlets (e.g., telephone and internet), and while newer ICTs contain similar functionalities of traditional mediums, the long-established information sources continue to be used. This continued use of traditional media may consequently impact the adoption and/or use of newer technologies (Cai, 2005).

New mediums or activities that are functionally similar and more effective have a greater chance of displacing mediums or activities that are traditionally used (Neuman, 1991). For example, Lee and Kuo (2002) state that internet use and watching television both provide the same gratifications and satisfactions and require a great deal of attention in their effective use. As such, the internet provides individuals with interaction and personalization opportunities, making the medium more effective and likely to displace television. A study conducted by Bucy (2000), who looks at how media use effects internet use, found that time spent watching television had a negative correlation with activities conducted online. This effect is evident in a preliminary study on internet and society by Nie and Ebring (2000) who find that the time individuals spend using the internet is expensed by their television time, an example of time displacement (Mutz et al., 1993). Thus, it can be assumed that those who have access to and use TV as their primary media source will less likely pursue access to the internet. Consistent with the displacement hypothesis and empirical evidence, I posit that the amount of time watching television will be associated with access to and use of the internet.

H4b: The amount of time spent watching television will be negatively associated with internet access.

H4b: The amount of time spent watching television will be negatively associated with internet use.

Those with more education are more likely to read newspapers and to have access to and use the internet (Bonfadelli, 2002; Goldfarb and Prince, 2008; Tichenor et al., 1970). Therefore, one can assume that among the educated who have the choice of both media, the accessibility of the internet as a source of information will lead to the displacement of traditional information sources such as newspapers. However, the accessibility and use of the internet may not hinder newspaper use. According to Lee and Kuo (2002), the main functions of newspaper and radio are unequivocal to the internet because newspapers function mainly as an information source and the radio acts as an entertainment source that can be used in the background, simultaneously with other activities. Research from Nie and Ebring (2000) find that time spent reading newspapers is expensed less than time spent watching television.

Research shows a positive association between use of newer ICTs and newspaper reading (Robinson et al., 1997; Robinson, et al., 2000). Possible reasons for this association are that individuals verify information from one media source with another or that information not found in one source is sought out in another. I argue that newspaper reading can increases the likelihood of internet access and internet use because printed media can drive users to a number of websites, including newspapers' corresponding website, sites linked to stories appearing in the newspapers, and sites associated with newspaper advertisements. Therefore, I hypothesize that:

H5a: The amount of time spent reading the newspaper will be positively associated with internet access.

H5b: The amount of time spent reading the newspaper will be positively associated with internet use.

Similar to the hypothesized relationship between reading newspapers and internet use, listening to the radio can increase internet use because radio messages can drive users to a number of websites, including radio stations' corresponding website, sites linked to stories and people featured on the radio, and websites associated with radio advertisements. Bucy (2000) found a positive association between radio listening and internet use. As its main functions are utilized for hedonic purposes (e.g., listening to music), radio is a secondary activity that can be run in the background and not affect other activities (Luo and Kuo, 2002). Therefore, based in empirical research that supports the displacement hypothesis, I hypothesize:

> *H6a: The amount of time spent listening to the radio will be positively associated with internet access.*
>
> *H6b: The amount of time spent listening to the radio will be positively associated with internet use.*

Age and Gender as Demographic Predictors for Internet Access and Internet Use

Research that includes age as a predictor of internet adoption and use broadly supports younger people adopting and using the technology more than older people (e.g., Broos and Roe, 2006; Goldfarb and Prince, 2008; Ono and Zavondy, 2007). Research on the behavior of individuals following their internet adoption indicates younger people are more likely to make purchases over the internet (Akhter, 2003) and more accurately search for content online (Hargittai and Shafer, 2006). In a study that investigates technology adoption in the workplace, Morris and Venkatesh (2000) suggest that the differences in technology adoption between younger and older adults may be due to disparate exposure of information technology in education, which leads older adults to rely more on traditional sources to complete tasks than their younger counterparts. Consistent with the aforementioned empirical research, I assert that

age influences digital inequality in the sense that older individuals are less likely to adopt the internet and, moreover, to use the internet than younger people.

H7a: Age will be negatively associated with internet access.

H7b: Age will be negatively associated with internet use.

Studies that investigate gender inequality of ICT access and use have returned mixed results. Although differences in computer use exist between males and females, both perceive the medium as useful for themselves and society (Shashaani and Khalili, 2001). Research focusing on perceptions and attitudes of technology adoption and use indicates males are more accepting of technology. With a focus primarily on gender and ICT attitudes, Broos (2005) also finds significant gender differences in computer anxiety, computer-liking, and internet attitudes, all of which favor males because they are less anxious and hold more positive attitudes towards new technologies. Similarly, Wei et al. (2011) find females have lower computer self-efficacy and use computers less for both utilitarian and hedonic purposes. Other research indicates no significant gender differences in internet access but significant inequalities in frequency of internet use (e.g. Belanger and Carter, 2009; Goldfarb and Prince, 2008). Similar observations have been made by Bimber (2000) and Wasserman and Richmond-Abbott (2005), who find that men are more likely than women to be frequent internet users. Busselle, Reagan, Pinkleton, and Jackson, (1999) state the role of demographics, such as gender, varies based on the stage of diffusion of that innovation. Thus, one should expect the role of gender in ICT adoption and use to decrease over time. In line with the extant research that treats gender as a demographic influence of digital divide, the present study posits there will be no gender gap in internet access but a significant difference in the frequency of internet use, where males are more frequent users of the internet than females.

H8a: Males will have internet access more than females, but the difference will decrease across time periods.

H8b: Males will use the internet more frequently than females, but the difference will decrease across time periods.

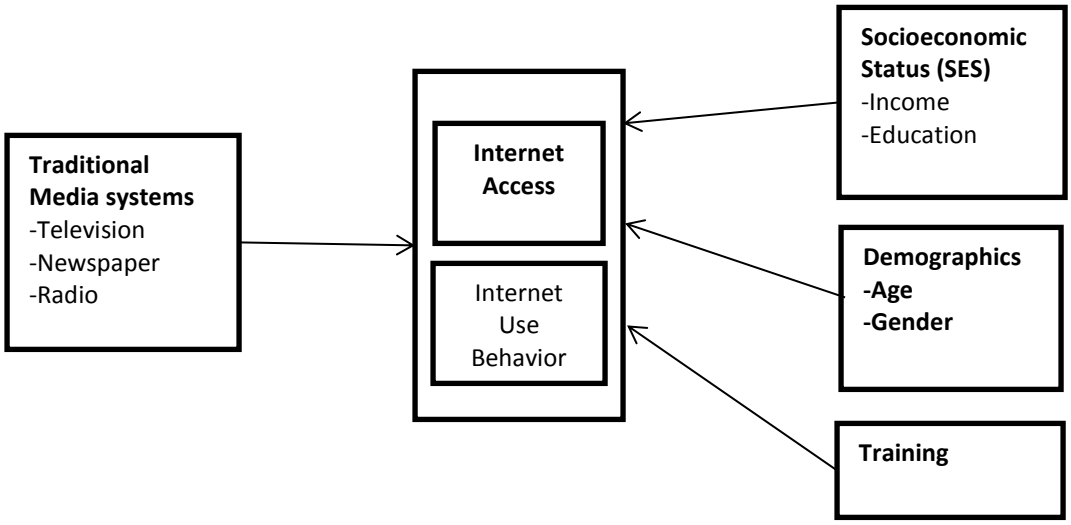


Figure 2: Conceptual Model for Hypotheses 1a – 8b

Perpetuation of the Knowledge Gap Hypothesis through Displacement

Use of personal computers and the internet require a great deal of understanding compared to traditional media. In particular, individuals must comprehend the potential uses of computers and the internet as well as how they function. The learning process required to use a personal computer differs from that necessary to operate a television, for example. The latter involves less literacy compared to that for personal computers, which requires individuals to learn packages of software. Given the skill requirement of newer ICTs, high SES individuals are assumed to possess the ability to utilize these technologies. This contrasts to low SES individuals, who may continue to rely more on less skill-based technologies for information.

The underlying factors that account for the knowledge gap hypothesis do not focus on difference in use of various information sources. For example, that knowledge of an event can be attributed to information gained from one or more sources (e.g., radio, print, TV and/or the internet). In his study on the knowledge gap hypothesis and the internet, Bonfadelli (2002) states

that the knowledge gap that results from the internet is a function of inequality of internet access, internet use, and skills. This knowledge gap the author contrasts to the knowledge gap that results from traditional media (television and press), which is a consequence of differences in education and motivation. This framework is a comparison of the knowledge gap within media types and does not incorporate the knowledge gap that results from media choice, which is the knowledge gap that results from differences in information attainment *between* media sources. More generally, the original knowledge gap hypothesis worked under the assumption that knowledge of citizens in a social system results only from varying levels of newspaper coverage, rather than varying levels of other media source access and use. For example, newspapers reading would result in knowledge gaps between high and low SES groups as the high SES individuals benefit from knowledge acquirement. The low SES group, however, can level out the knowledge differences if other media (e.g., television) is utilized. Fortunately, the use of other media sources by the disadvantaged group may result as a knowledge lever (Tichenor et al., 1970), but a review of the research has found mixed support for that idea (Kwak, 1999).

The present research argues that the choice of information sources contributes to the knowledge gap to the extent that different mediums provide different levels of quality and quantity of information based on different time lines (e.g., reading news from the internet is more current compared to reading from a print source). Therefore, given those factors associated with lower SES, such as limited income, education and skills, lower SES individuals are more likely to use traditional media sources compared to high SES individuals who are more likely to use newer mediums that require advanced skills. Though research on media and cognitive skills find that low-cognitive individuals prefer television as their news source compared to high-cognitive individuals who prefer newspapers (Neuman, et al., 1992), the comparison of newspaper and the

internet differs—the former medium does not require as many skills compared to the latter (Bonfadelli, 2002; Wei and Hindman, 2011). In addition, since skill level is positively related to seeking and gaining information faster from media sources (Tichenor et al., 1970, Katzman, 1974), even when individuals of lower SES use newer ICTs, skill limitations may lead to less effective use of these sources. As related to the digital divide, I argue that such a limitation in the effective use of newer ICTs by those with lower SES individuals may lead to them using media systems that are less skill-based, therefore, continuing their reliance on more traditional media systems, and ultimately perpetuating the knowledge gap. By applying the knowledge gap and displacement hypotheses to the digital divide, I posit that SES will predict a divide in the use of information media through a time displacement effect.

H9: Frequent users of the internet will spend less time using traditional media systems:
a) Television
b) Newspaper
c) Radio

Research on the displacement hypothesis has indicated age has a negative association with the use of newer media due to individuals' time being displaced with traditional mediums (e.g., Kayany and Yelsma, 2000; Robinson and Martin, 2009). As Robinson and Kestnbaum (1999) note, younger individuals are more likely to engage in "novel behavior" and are open to new experiences (in the context of media usage). Similarly, Kayany and Yelsma (2000) state that younger individuals "take to the new technology faster than adults" (p. 223). In addition, other studies find older individuals tend to spend time reading newspapers and watching television more than younger individuals (e.g., Moy, Scheufele, and Holbert, 1999). Therefore, the expectation is that older individuals will spend more of their time using traditional mediums and not utilizing newer ones.

H10: Age is positively associated with the likelihood of being a frequent user of traditional media systems:

a) Television
b) Newspaper
c) Radio

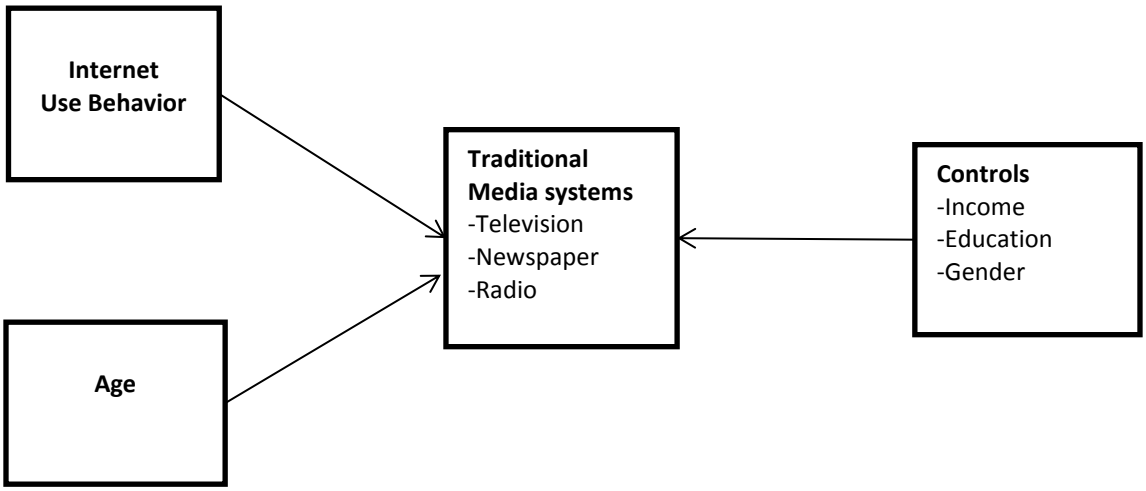


Figure 3: Conceptual Model for Hypotheses 9a – 10c

METHODOLOGY

Sample and Data

Data from the European Social Survey (ESS) was used in the present study. The ESS appraises a wide range of individual attitudes, beliefs, and behavioral patterns across 30 European nations. European countries were chosen to study the digital divide in internet access and use because, according to the Global IT Report (2011), "Both in fixed and mobile broadband, the European Union continues to be the largest broadband market in the world."

Given this trend, the present research analyzes member and non-member countries of the European Union to provide insight into ICT adoption and use patterns in Europe.

The ESS contains a total of five data collection waves where individuals surveyed varies across time periods. Data were collected by survey in time periods lasting two years; the first time period is 2002-2003 and the most recent is 2010-2011. The present study makes use of all five waves to analyze ICT adoption and use patterns across countries. There were at least 1000 observations for each country in each cross-sectional time period. See Table 1 below for a sample of descriptive statistics.

Measures

Dependent Variables

The dependent variables for hypotheses 1a to 8b were internet access and internet use. *Internet access* refers to having internet access at home or work. Internet access was coded as 1 for access and 0 otherwise. *Internet use* was measured by frequency. Respondents answered the question, "How often do you use the internet, the World Wide Web or e-mail – whether at home or at work." For this variable, individuals were categorized dichotomously as either high-intensity users or low-intensity users. High-intensity users were coded as 1 and low intensity users as 0.

The dependent variables for hypotheses 9 and 10 are the time spend using each of the traditional media systems—television, newspaper, and radio. For example, respondents answered the question, "On an average weekday, how much time, in total, do you spend watching television?" This question is answered using a 7-point likert scale with where 1 = *less than half an hour* and 7 = *more than three hours*.

Independent Variables

Demographics. The demographic variables of age and gender were utilized as independent variables. *Age* was entered as a continuous variable. *Gender* was coded as a dummy variable, where male = 1 and female = 0. Gender and age variables were all the estimated models.

Socioeconomic status. Socioeconomic status is inclusive of education and income. Education was measured as formal schooling of individuals. Education was coded using six categorical variables that represent increasing levels of educational achievement. Income was coded categorically based on income ranges established as lower income (1), middle income (2), and higher income (3). Income variables were included in all the estimated models.

Skills. The skills variable was operationalized as recent formal training (received in the last 12 months) such as that received through coursework, lecture, or a conference. This variable was coded as a dummy variable, where received training = 1 and 0 otherwise. This variable was included to test hypotheses 1a to 8b.

Media systems. Media systems refer to both the choice of traditional media systems—newspapers, radio, and television—and their frequency of use. These variables were measured by the total time on an average weekday that the media were used. The frequency of use of these media is coded continuously while no time at all spent with a medium is coded as 0. These variables were included to test hypotheses 1a to 8b.

Internet Use. This variable was categorized dichotomously as either high-intensity users or low-intensity users. High-intensity users were coded as 1 and low intensity users were coded as 0. The variable is included in the model that tests hypotheses 9 and 10.

Countries. Dummy variables were assigned to each country so that the country in which an individual resides was coded as 1 and all other countries were coded as 0. The country dummy variables were used in the pooled analysis.

Waves. Dummy variables were assigned to each wave (time period) so that the wave in which an individual responded was coded as 1 and all other time periods were coded as 0. The wave dummy variables were used in the pooled analysis.

Statistical Analyses

To test the first set of hypotheses (H1a-H8b), which investigates internet access and use with predictors of demographics, socioeconomic status, and traditional media systems, a series of logistic regressions were performed. First, I performed a pooled logistic regression for two estimated models—internet access and internet use—that combines the data from all 30 countries and five time periods. Dummy variables were included that controlled for country and time effects. Next, eleven countries were selected based on the data availability across three time periods (2002, 2006, and 2010). I performed a logistic regression for each country in each time period for the two estimated models.

The next set of hypotheses (H9a-10c) was tested using a multivariate analysis that included two independent variables, internet use and age, and three dependent variables: frequency of use television, newspaper, and radio. Control variables of gender, education, and income were also included in these models. Similar to the first set of hypotheses, a pooled linear regression was run, which included data from all the countries and the five time periods. Dummy variables were included that controlled for country and time effects. Subsequently, the regression analysis was performed for each country in each time period for three estimated models—television, newspaper, and radio.

Table 1: Sample Descriptive Statistics from Data Collected in 2010

Descriptive Statistics							Descriptive Statistics					
Countries	**Variables**	**Min.**	**Max.**	**Mean**	**s.d.**		**Countries**	**Variables**	**Min.**	**Max.**	**Mean**	**s.d.**
Belgium	Age	15	94	46.76	18.86		Slovenia	Age	15	93	47.40	18.50
	Gender (male = 0)	0.00	1.00	0.48	0.50			Gender (male = 0)	0.00	1.00	0.46	0.50
	Education Years	1	45	12.68	3.74			Education Years	0	35	11.88	3.68
	Household Income	1	10	5.94	2.42			Household Income	1	10	4.69	2.69
	n = 1431							n = 1057				
Denmark	Age	15	94	48.48	18.47		Spain	Age	15	94	45.85	18.26
	Gender (male = 0)	0.00	1.00	0.51	0.50			Gender (male = 0)	0.00	1.00	0.49	0.50
	Education Years	0	40	13.30	5.30			Education Years	0	40	12.43	5.50
	Household Income	1	10	6.06	2.92			Household Income	1	10	5.28	2.75
	n = 1354							n = 1444				
Finland	Age	15	95	48.83	19.25		Sweden	Age	15	95	48.60	19.24
	Gender (male = 0)	0.00	1.00	0.49	0.50			Gender (male = 0)	0.00	1.00	0.48	0.50
	Education Years	0	50	12.94	4.37			Education Years	0	30	12.64	3.61
	Household Income	1	10	5.57	2.74			Household Income	1	10	6.12	3.00
	n = 1715							n = 1398				
Netherlands	Age	15	96	50.42	17.49		Switzerland	Age	15	96	47.81	18.75
	Gender (male = 0)	0.00	1.00	0.46	0.50			Gender (male = 0)	0.00	1.00	0.51	0.50
	Education Years	1	35	13.37	4.29			Education Years	5	28	11.38	3.33
	Household Income	1	10	5.63	2.70			Household Income	1	10	5.75	2.61
	n = 1466							n = 1230				
Norway	Age	15	99	46.38	18.50		UK	Age	15	98	50.00	18.98
	Gender (male = 0)	0.00	1.00	0.52	0.50			Gender (male = 0)	0.00	1.00	0.44	0.50
	Education Years	1	33	13.57	3.73			Education Years	0	42	13.06	3.74
	Household Income	1	10	5.05	2.67			Household Income	1	10	4.95	2.97
	n = 1474							n = 1893				
Poland	Age	15	96	44.40	18.91							
	Gender (male = 0)	0.00	1.00	0.48	0.50							
	Education Years	0	25	12.44	3.53							
	Household Income	1	10	5.23	2.74							
	n = 1314											

*Education Years refers to the number years of completed education.
*Household income is a ten point scale presented in ranges:1 is the lowest income range 10 highest income range.

RESULTS

The Impact of Socioeconomic, Demographic, and Traditional Media Systems on Internet Access and Internet Use

Internet Access and Internet Use, Pooled Analyses

Table 2 shows the results for the two pooled logistic regression models. The independent variables for the two models—internet access (IA) and internet use (IU)—are listed in the first column. The second and third columns contain the results for the IA model and the IU model, respectively. The waves and countries dummies are significant in the two models and together explain about a third of the total variance prior to adding the remaining variables. Moreover, all the socio-demographic and traditional media systems variables are significant in their hypothesized directions.

A unique variable that represents knowledge and skills training that has not been previously been empirically investigated was significant and positively associated with both IA and IU. With regards to the traditional media systems (newspaper, radio, and television), the results reveal time spent watching television is negatively associated with IA and IU, while time spent reading newspapers and listening to the radio are positively associated with IA and IU. The gender variable is positively association in both models indicating that males are more likely than females to have access to the internet and be frequent users of it.

Table 2: Pool Logistic Regression Results

	Internet Access		Internet Use	
Education	.236	***	.234	***
Training	1.048	***	.873	***
Income	.497	***	.316	***
Age	-.069	***	-.074	***
Gender	.233	***	.426	***
Newspaper	.096	***	.054	***
Radio	.016	***	.013	***
Television	-.094	***	-.042	***
Pseudo R^2	.625		.575	

Note: A total of 30 countries dummies were included in the analysis. Reference to Poland.
-Sample of countries used in Study 1's pooled analysis: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Russia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom
-Five time periods (2002, 2004, 2006, 2008, 2010) were included in the analysis. Each time/wave is given a value of 1 and 0 otherwise. Reference point is 2006.
-Number of observations: 185, 684
* p <.10, **p <.05, ***p <.001

In the next set of analyses, a series of logistic regression models for IA and IU were conducted for each country in three different time periods to assess the patterns of the independent variables. The time periods are 2002, 2006, and 2010. Due to the inconsistencies of the available data throughout the different time periods, the number of countries was reduced to eleven—Belgium, Denmark, Finland, Netherlands, Norway, Poland, Slovenia, Spain, Sweden, Switzerland, and United Kingdom. A total of 66 binary regressions were run (i.e., eleven countries, two models—IA and IU, and three time periods—2002, 2006, and 2010).

Internet Access, per Country Analyses

The results for the internet access model are presented in Table 3 and Figure 4, which summarize the total frequency of significant independent variables across countries and over all time periods. The results in Table 3 reveal statistical significance in the expected direction for education (H1a), income (H2a), and age (H7a), across the three time periods for all eleven nations. Thus, the hypotheses (H1a, H2a, and H7a) are supported. Younger individuals with high education and income were more likely to have internet access than older citizens with low

education, and income. With the exception of the Netherlands in 2010, the training variable was significant across countries and time periods. These results support hypothesis 3a that posits knowledge and skills training will be positively associated with internet access.

Regarding gender, the results in 2002 indicate that males were more likely than females to access the internet in six of the eleven countries. In 2006, the male-advantage in internet access was apparent for the United Kingdom, although gender was not significant for the UK in 2002. In 2010, the male-advantage disappeared, and in Sweden the advantage was reversed, meaning females were more likely than males to access the internet there. The expectation represented by hypothesis 8a is that the gender access divide will decrease over time, which is supported by the results.

The associations of traditional media systems with internet access show a similar pattern as gender, that is, a decrease across time periods. In 2002, nine countries had a negative and statistically significant association between time watching television and IA. The number of countries that showed statistical significance for this variable dropped to seven in 2006 and four in 2010. Overall, hypothesis 4a that predicts time watching television to be negatively associated with internet access is supported.

The number of countries that reveal an association between time reading newspapers and IA also decreased across the time periods. Eight of the eleven countries had a positive association between time spent reading the newspaper and IA; however, only Spain continued with this pattern in 2010. The latest time period also reveals an inverse relationship in Slovenia and the United Kingdom where both countries had a positive association between newspaper time and IA in 2002 and 2006. In general, the hypothesis 5a is supported; however, newspaper time as a predictor of IA decreased across countries over later time periods.

As with reading newspapers, hypothesis 6a posits that a citizens' time spent listening to the radio will be positively associated with IA. Until 2006 there was no evidence of this association, and in 2002 three countries (Belgium, Norway, and Sweden) indicated a negative association. In 2006, there was a positive association between radio and IA for Slovenia and the United Kingdom, and in 2010 for Belgium, Slovenia, and Spain. Although the results in 2002 do not support hypothesis 6a there is some support for the hypothesis in 2006 and 2010.

Table 3: Logistic Regression Results per Country for 2002, 2006, and 2010 – Dependent Variable: Internet Access

Year: 2002

	Belgium		Denmark		Finland		Netherlands		Norway		Poland		Slovenia		Spain		Sweden		Switzerland		UK	
Education	.189	***	.234	***	.183	***	.138	***	.219	***	.306	***	.275	***	.179	***	.236	***	.149	***	.198	***
Income	.290	***	.235	***	.268	***	.186	***	.261	***	.288	***	.466	***	.313	***	.423	***	.269	***	.382	***
Training	1.010	***	.749	***	1.142	***	.822	***	.933	***	.771	***	.790	***	.997	***	.940	***	1.055	***	1.212	***
TV	-.171	***	-.087	*	-.098	**	-.086	**	-.166	***	-.092	**	-.060		-.163	**	-.090	**	-.042		-.128	**
Newspaper	.154	**	.221	**	.216	**	.127	**	.044		.433	***	.470	***	.245	**	.118		.017		.090	*
Radio	-.054	*	-.029		.022		-.029		-.085	**	.020		-.015		-.015		-.069	**	-.039		-.030	
Age	-.050	***	-.066	***	-.076	***	-.059	***	-.060	***	-.093	***	-.069	***	-.051	***	-.070	***	-.066	***	-.043	***
Gender	.284	*	.157		-.083		.310	**	.301	**	.234		-.146		.586	**	.324	*	.441	**	.227	
Pseudo R^2	.537		.513		.581		.459		.559		.553		.581		.554		.631		.498		.593	

Note: The coefficients represent betas
* p <.10, **p <.05, ***p <.001

Year: 2006

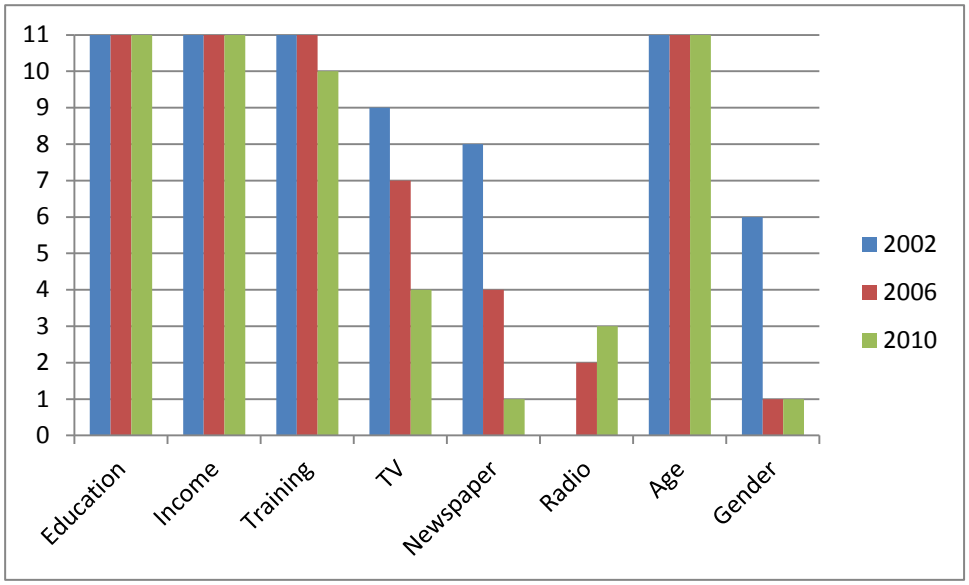
	Belgium		Denmark		Finland		Netherlands		Norway		Poland		Slovenia		Spain		Sweden		Switzerland		UK	
Education	.182	***	.114	***	.160	***	.130	***	.248	***	.362	***	.324	***	.251	***	.186	***	.206	***	.172	***
Income	.261	***	.244	***	.331	***	.353	***	.204	***	.474	***	.411	***	.183	**	.403	***	.359	***	.346	***
Training	1.427	***	1.047	***	1.036	***	1.303	***	1.292	***	1.050	***	1.201	***	1.161	***	.481	**	1.161	***	.711	***
TV	-.033		-.109	*	-.175	**	-.120	**	-.177	**	-.077	*	-.013		-.094		-.128	**	-.066		-.080	**
Newspaper	.096		.251	**	.028		.083		.045		.159	**	.125		.209	*	.147		.180	**	.049	
Radio	.011		-.036		-.044		.032		.020		-.013		.121	**	.036		.025		.051		.078	**
Age	-.062	***	-.084	***	-.077	***	-.080	***	-.082	***	-.057	***	-.102	***	-.049	***	-.085	***	-.080	***	-.053	**
Gender	.230		-.007		-.083		.053		.132		.051		.217		.285		.183		.216		.371	**
Pseudo R^2	.566		.561		.620		.565		.618		.579		.678		.632		.596		.599		.539	

Note: The coefficients represent betas
* p <.10, **p <.05, ***p <.001

Year: 2010

	Belgium		Denmark		Finland		Netherlands		Norway		Poland		Slovenia		Spain		Sweden		Switzerland		UK	
Education	.171	***	.085	**	.253	***	.178	***	.209	***	.339	***	.315	***	.223	***	.172	***	.169	***	.134	***
Income	.280	***	.361	***	.350	***	.181	**	.189	**	.331	***	.334	***	.268	***	.371	***	.286	***	.406	***
Training	.949	**	1.267	**	.609	**	.326		1.105	**	1.404	**	1.485	**	.586	*	1.244	**	.771	**	1.025	***
TV	-.042		-.115		-.046		-.012		-.063		-.099	*	.048		-.050		-.195	**	-.091	*	-.112	**
Newspaper	-.082		.021		.056		.048		.069		.084		-.357	**	.442	***	.172		.084		-.129	**
Radio	.061	*	.044		.049		.058		-.043		.030		.101	**	.151	***	.011		.024		.023	
Age	-.065	***	-.087	***	-.105	***	-.113	***	-.108	***	-.086	***	-.120	***	-.072	***	-.112	***	-.084	***	-.057	***
Gender	-.275		-.072		.358		.046		.236		-.036		.010		-.343		-.574	**	.206		-.089	
Pseudo R^2	.515		.567		.650		.470		.574		.689		.705		.656		.650		.536		.546	

Note: The coefficients represent betas
* p <.10, **p <.05, ***p <.001



Note: This figure illustrates total number of countries that show significance for each variable in the hypothesized direction.

Figure 4: Frequency of Significant Variables Across Countries and Time Periods, Dependent Variable: Internet Access

Internet Use, per Country Analyses

This subsection focuses on the impact of the aforementioned factors on internet use. As shown in Table 4 and Figure 5, income, education, training, and age are significant variables for the majority of countries and time periods. In other words, individuals who frequently use the internet are younger, educated, and skilled citizens with high income. In general, the results support the hypotheses that correspond to education (H1b), income (H2b), training (H3b), and age (H7b).

Concerning gender, in 2002 and 2006 males were more likely than females to be frequent users of the internet across countries. By 2010, citizens in three of the eleven countries (Belgium, Norway, and Switzerland) continued maintained this pattern. Contrary to expectations, results from 2010 reveal that females in Sweden were more frequent internet users

than males. Thus, the gender hypothesis (H8b) is partially supported across time periods, and partially refuted in 2010.

The number of countries that show an association between the time spent using traditional media systems and IU is minimal when compared to the socioeconomic and demographic variables. The present research hypothesizes (H4b) that citizens who spend less time watching television are more likely to use the internet frequently. In the three time periods, the countries for which this association is significant are Norway, Poland, and Spain in 2002; Denmark and the United Kingdom in 2006; and the United Kingdom in 2010. Overall, hypothesis 4b is partially supported.

With regard to newspaper use, it is hypothesized that an individual's time spent reading the newspaper will have a positive association with IU. This hypothesis (H5b) is mostly supported in 2002 and 2006 and partially supported in 2010. Those countries for which this variable is significant are Denmark, Finland, Slovenia, and Sweden in 2002; Belgium, Denmark, Netherlands, and Spain in 2006; and Netherlands, Spain, and Sweden in 2010.

The association between radio use and internet use was infrequently significant across countries and time periods. Hypothesis 6b posited that the amount of time spent listening to the radio will be positively associated with internet use. The 2010 time period is the only wave during which the hypothesized association is apparent, and only for the Netherlands and Spain. Thus, hypothesis 6b is not supported in 2002 and 2006 but partially supported in 2010.

Table 4: Logistic Regression Results per Country for 2002, 2006, and 2010 – Dependent Variable: Internet Use

Year: 2002

	Belgium		Denmark		Finland		Netherlands		Norway		Poland		Slovenia		Spain		Sweden		Switzerland		UK	
Education	.184	***	.157	***	.239	***	.119	***	.221	***	.423	***	.337	***	.137	**	.296	***	.196	***	.163	***
Income	.207	***	.121	**	.189	***	.131	**	.034		.229	**	.327	***	.135		.081		.088	*	.157	***
Training	.958	***	.703	**	1.383	***	.719	***	.743	***	.579	*	1.283	***	1.105	**	.256		.844	***	.547	**
TV	-.030		-.040		-.028		-.067		-.089	*	-.152	**	-.050		-.192	**	-.042		.011		-.040	
Newspaper	.004		.208	**	.233	**	-.012		.128		.159		.228	**	.032		.196	*	.023		.066	
Radio	-.033		-.043		.006		.002		-.071	*	.029		-.033		-.032		-.002		-.019		-.002	
Age	-.066	***	-.070	***	-.079	***	-.043	***	-.062	***	-.103	***	-.084	***	-.072	***	-.063	***	-.058	***	-.044	***
Gender	.911	***	.797	***	.015		.807	***	1.056	***	.337		.429	*	.924	**	.952	***	1.039	***	.309	*
Pseudo R^2	.496		.381		.614		.621		.397		.648		.631		.508		.406		.370		.285	

Note: The coefficients represent betas
* p <.10, **p <.05, ***p <.001

Year: 2006

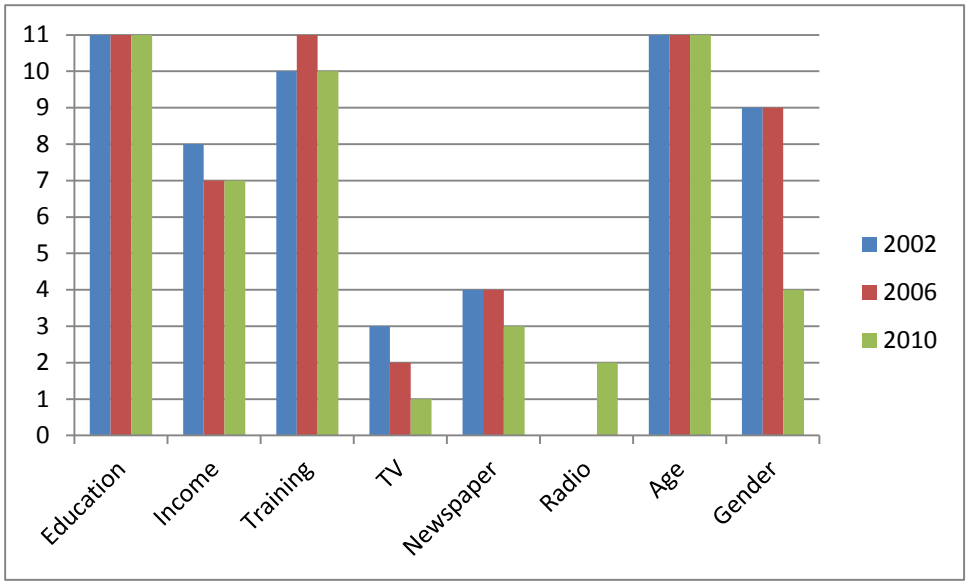
	Belgium		Denmark		Finland		Netherlands		Norway		Poland		Slovenia		Spain		Sweden		Switzerland		UK	
Education	.185	***	.091	***	.272	***	.154	***	.214	***	.370	***	.318	***	.237	***	.220	***	.251	***	.171	***
Income	.161	**	.117	**	.133	**	.146	**	.039		.358	***	.370	***	-.052		.008		.018		.205	***
Training	1.046	***	.872	**	1.067	***	.633	**	.736	**	.819	**	.886	***	1.075	***	.712	**	.626	**	.937	***
TV	-.040		-.135	**	-.017		-.059		-.069		-.020		.002		.038		-.040		-.002		-.126	**
Newspaper	.160	*	.162	*	-.031		.268	**	.075		.111		.050		.576	***	.097		.119		.019	
Radio	.060		-.040		-.034		.036		-.059		-.028		.048		-.036		-.041		.056		.004	
Age	-.078	***	-.076	***	-.088	***	-.076	***	-.087	***	-.097	***	-.097	***	-.069	***	-.061	***	-.070	***	-.048	***
Gender	.613	**	.442	*	.516	**	.579	**	.884	***	.428	*	.204		.292		.823	**	.867	***	.420	**
Pseudo R^2	.507		.381		.656		.394		.449		.657		.689		.590		.319		.342		.448	

Note: The coefficients represent betas
* p <.10, **p <.05, ***p <.001

Year: 2010

	Belgium		Denmark		Finland		Netherlands		Norway		Poland		Slovenia		Spain		Sweden		Switzerland		UK	
Education	.184	***	.127	***	.190	***	.168	***	.217	***	.385	***	.263	***	.273	***	.256	***	.202	***	.115	***
Income	.104	**	.052		.227	***	.080		.055		.286	***	.213	***	.126	**	.052		.173	**	.122	**
Training	1.346	***	.852	**	.837	**	.902	**	.909	**	.893	**	1.093	**	1.157	**	.305		1.165	**	1.460	***
TV	-.029		.001		-.042		-.059		-.014		-.099		-.011		.074		-.091		-.018		-.104	*
Newspaper	.026		-.008		.008		.192	**	-.026		-.051		.121		.389	**	.381	**	.203		-.015	
Radio	.000		-.061		-.004		.122	**	.004		-.028		.026		.073	*	-.043		.062		.028	
Age	-.049	***	-.072	***	-.108	***	-.074	***	-.070	***	-.128	***	-.119	***	-.083	***	-.085	***	-.061	***	-.053	***
Gender	.483	**	-.156		.243		.042		.889	**	-.197		.064		.279		-.561	*	.441	*	-.024	
Pseudo R^2	.342		.322		.623		.367		.369		.700		.675		.633		.407		.320		.331	

Note: The coefficients represent betas
* p <.10, **p <.05, ***p <.001



Note: This figure illustrates total number of countries that show significance for each variable in the hypothesized direction.

Figure 5: Frequency of Significant Variables Across Countries and Time Periods, Dependent Variable: Internet Use

The Impact of Internet Use and Age on the Use Traditional Media Systems

After running a series of logit regressions to examine the effect of socio-demographic and traditional media system variables on internet use, 99 linear regressions were run to assess the impact of internet use on traditional media systems (three dependent variables: television, newspaper, and radio; three time periods: 2002, 2006, 2010; and one independent variable: internet use). Prior to running these analyses, three pooled regression were conducted that include time and country independent variables.

The results from the pooled regression models that assess the association of internet use with the use of three traditional media systems—television, newspaper, and radio—are presented in Table 5. All the time periods and most of the countries were significant for each model. Internet use has a negative association with time spent watching television and positive

associations with time spent reading the newspaper and time spent listening to the radio. The explained variance for each model is 10.7%, 11.6%, and 4.5% for television, newspaper, and radio, respectively.

Table 5: Pool Regression Results for Television, Newspaper, and Radio – Internet Use

	Television		Newspaper		Radio	
Education	-.138	***	.100	***	-.023	***
Income	-.051	***	.076	***	.023	***
Age	.106	***	.228	***	.051	***
Gender	-.002		.067	***	.008	**
Internet Use	-.050	***	.022	***	.030	***
R^2	.107		.116		.045	

Note: A total of 30 countries dummies were included in the analysis. Reference to Poland.
-Sample of countries used in Study 1's pooled analysis: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Russia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom
-Five time periods (2002, 2004, 2006, 2008, 2010) were included in the analysis. Each time period is given a value of 1 and 0 otherwise. Reference point is 2006.
-Number of observations: 125, 957
-The coefficients represent standardized betas
- F-static for all models are significant at $p < .01$
* p <.10, **p <.05, ***p <.001

A split sample linear regression analysis was conducted to assess the association of internet use on television, newspaper, and radio for each country in 2002, 2006, and 2010—refer to Table 6 and Figure 6 for a summary of results (Appendix A includes the results with control variables). The present research asserts that individuals who frequently use the internet will less frequently use traditional media systems, as presented by hypotheses 9a-c. There was some support for the negative association between internet use (H9a) and time spent watching television in Belgium, Netherlands, Norway, Poland, Slovenia, and Spain in 2002; Belgium, Denmark, Finland, and the United Kingdom in 2006; and the United Kingdom in 2010.

Hypothesis 9b is refuted as results for internet use is positively associated with the time spent reading newspapers for Denmark and Finland in 2002; Belgium, the Netherlands, and

Spain in 2006; and the Netherlands and Spain in 2010. Hypothesis 9c predicts a negative association between internet use and the time spent listening to the radio. Only Norway in 2002 shows support for the premise as the result was significant and in the hypothesized direction. In contrast, Belgium and Switzerland in 2006 and the Netherlands, Spain, and United Kingdom in 2010 revealed a positive association, partially refuting hypothesis 9c. Results for hypotheses H10a-c are supported as results reveal a positive association between age and the time spent using traditional media systems (see Table 6 and Figure 7). The number of countries that reveal a significant and positive association between age and the use traditional media systems increased across time periods.

Table 6: Linear Regression Results – Effect of Internet Use on Traditional media Systems (Television, Newspaper, and Radio)

Television

Year	Variables	Belgium	Denmark	Finland	Netherlands	Norway	Poland	Slovenia	Spain	Sweden	Switzerland	UK
2002	Age	.036	.075 **	.098 **	.008	-.001	-.008	.131 **	.001	.033	.144 ***	.104 **
	Internet Use	-.077 *	-.043	-.034	-.078 **	-.095 **	-.183 **	-.083 *	-.140 *	-.034	-.028	-.042
	R^2	.114	.053	.088	.071	.052	.077	.041	.051	.046	.067	.080
2006	Age	.177 ***	.172 ***	.162 ***	.066 **	-.012	.179 ***	.091 **	.194 ***	.083 **	.129 ***	.048
	Internet Use	-.075 **	-.110 **	-.070 *	-.046	-.040	-.051	-.031	.016	-.044	-.051	-.109 **
	R^2	.160	.095	.108	.061	.041	.078	.034	.131	.053	.125	.093
2010	Age	.203 ***	.224 ***	.274 ***	.182 ***	.096 **	.172 ***	.204 ***	.138 ***	.144 ***	.174 ***	.103 ***
	Internet Use	-.036	-.003	-.040	-.024	-.007	-.070	-.052	.055	-.028	-.038	-.052 **
	R^2	.108	.087	.107	.092	.056	.091	.073	.077	.096	.078	.078

Note: The coefficients represent standardized betas
* p <.10, **p <.05, ***p <.001
F-static values for all models are significant at p < .01

Newspaper

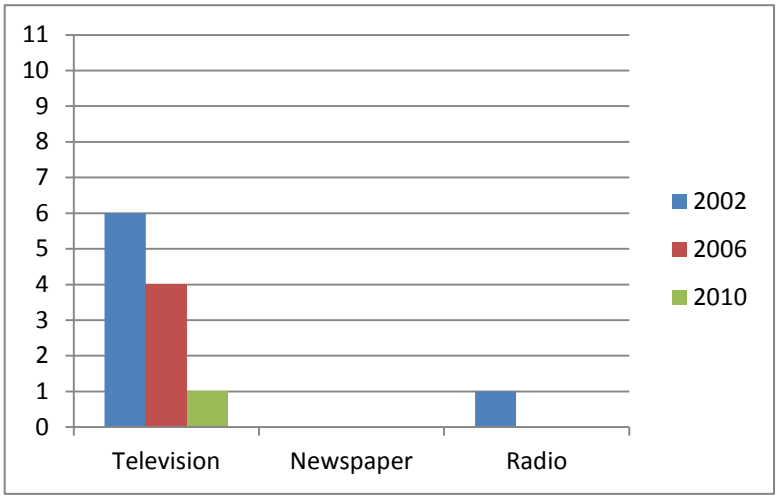
Year	Variables	Belgium		Denmark		Finland		Netherlands		Norway		Poland		Slovenia		Spain		Sweden		Switzerland		UK	
2002	Age	.250	***	.427	***	.452	***	.382	***	.318	***	.074		.216	***	.072		.342	***	.257	***	.157	***
	Internet Use	.021		.071	*	.098	**	-.005		.030		.042		.060		.024		.046		.023		.032	
	R^2	.077		.182		.139		.141		.093		.022		.046		.029		.112		.061		.018	
2006	Age	.245	***	.428	***	.408	***	.314	***	.274	***	.087	*	.374	***	.272	***	.340	***	.319	***	.171	***
	Internet Use	.068	*	.042		-.020		.110	***	.006		.049		.020		.202	***	-.003		.035		-.008	
	R^2	.075		.197		.158		.097		.086		.021		.111		.143		.113		.102		.036	
2010	Age	.188	***	.395	***	.408	***	.384	***	.246	***	.188	***	.311	***	.226	***	.313	***	.283	***	.151	***
	Internet Use	.022		-.019		-.011		.081	**	-.022		.005		.035		.138	**	.033		.033		-.013	
	R^2	.042		.182		.160		.153		.088		.054		.074		.110		.092		.098		.026	

Note: The coefficients represent standardized betas
* p <.10, **p <.05, ***p <.001
F-static values for all models are significant at p < .01

Radio

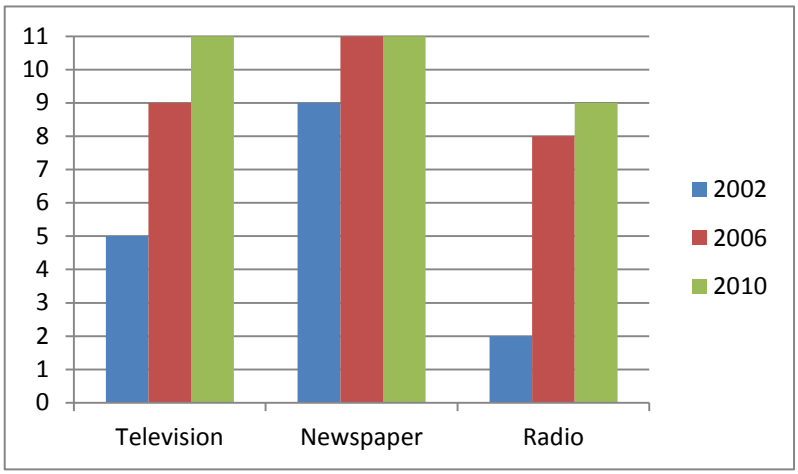
Year	Variables	Belgium	Denmark	Finland	Netherlands	Norway	Poland	Slovenia	Spain	Sweden	Switzerland	UK
2002	Age	-.062	.047	.013	-.033	.116 ***	-.165 **	-.077 *	-.037	.079 **	-.041	.014
	Internet Use	-.057	-.046	-.003	.002	-.069 **	.060	-.036	-.024	.015	.013	.008
	R^2	.077	.182	.139	.141	.093	.022	.046	.029	.112	.061	.019
2006	Age	.098 **	.042	.067 **	.059 *	.116 ***	-.088 *	.110 **	-.019	.141 ***	.087 **	.037
	Internet Use	.078 *	-.025	-.016	.049	-.024	-.037	.030	-.010	-.039	.064 *	.031
	R^2	.006	.015	.015	.000	.019	.017	.018	-.001	.032	.017	.016
2010	Age	.058 *	.121 ***	.134 ***	.077 **	.149 ***	.026	.116 **	.044	.163 ***	.087 **	.076 **
	Internet Use	.027	-.020	.017	.111 ***	.002	.012	.076	.087 **	-.021	.049	.064 **
	R^2	.003	.026	.044	.024	.041	.001	.006	.009	.029	.026	.015

Note: The coefficients represent standardized betas
* p <.10, **p <.05, ***p <.001
F-static values for all models are significant at p < .01



Note: Y-axis represents the number of countries.
-The figure shows the number of countries that show internet use to be significant in the hypothesized direction.

Figure 6: Frequency of Countries and Significant Variables Across Time Periods – Internet Use on Traditional Media Systems



Note: Y-axis represents the number of countries.
-The figure shows the number of countries that show significance between age and traditional media systems in the hypothesized direction

Figure 7: Frequency of Countries and Significant Variables Across Time Periods – Age on Traditional Media Systems

Table 7a: Summary of Results (Part 1)

	Hypotheses	2010			2006			2002		
		Sig.	**Inverse**	**Support**	**Sig.**	**Inverse**	**Support**	**Sig.**	**Inverse**	**Support**
H1a	Education will be positively associated with internet access.	11		Strong	11		Strong	11		Strong
H1b	Education will be positively associated with internet use.	11		Strong	11		Strong	11		Strong
H2a	Income will be positively associated with internet access.	11		Strong	11		Strong	11		Strong
H2b	Income will be positively associated with internet use.	7		Strong	7		Strong	8		Strong
H3a	Knowledge and skills training will be positively associated with internet access.	11		Strong	11		Strong	11		Strong
H3b	Knowledge and skills training will be positively associated with internet use.	10		Strong	11		Strong	10		Strong
H4a	The amount of time spent watching television will be negatively associated with internet access	5		Moderate	10		Strong	10		Strong
H4b	The amount of time spent watching television will be negatively associated with internet use.	1		Weak	2		Weak	3		Weak
H5a	The amount of time spent reading the newspaper will be positively associated with internet access	1	2	Weak	4		Moderate	8		Strong
H5b	The amount of time spent reading the newspaper will be positively associated with internet use.	3		Weak	4		Moderate	4		Moderate

Notes: Maximum number of countries is 11.
*Sig. denotes the number of countries significant in the hypothesized direction (Alternative hypotheses).
*Inverse denotes the number of countries that show an inverse relationship to the expected hypotheses.
*No support denotes when 0 countries are significant in the hypothesized direction.
*Weak support denotes when 1 to 3 countries are significant in the hypothesized direction.
*Moderate support denotes when 4 to 6 countries are significant in the hypothesized direction.
*Strong support denotes when 7 to 11 countries are significant in the hypothesized direction.

Table 7b: Summary of Results (Part 2)

	Hypotheses	2010 Sig.	2010 Inverse	2010 Support	2006 Sig.	2006 Inverse	2006	2002 Sig.	2002 Inverse	2002 Support
H6a	The amount of time spent listening to the radio will be positively associated with internet access	3		Weak	2		Weak	0	3	No
H6b	The amount of time spent listening to the radio will be positively associated with internet use.	2		Weak	0		No	0	1	No
H7a	Age will be negatively associated with internet access.	11		Strong	11		Strong	11		Strong
H7b	Age will be negatively associated with internet use.	11		Strong	11		Strong	11		Strong
H8a	Males are more likely to have internet access more than females.	0	1	No	1		Weak	6		Strong
H8b	Males will use the internet more frequently than females.	3	1	Weak	9		Strong	9		Strong
H9a	Frequent users of the internet will spend less time using traditional media systems (Television).	1		Weak	4		Moderate	6		Strong
H9b	Frequent users of the internet will spend less time using traditional media systems (Newspaper)	0	2	No	0	3	No	0	2	No
H9c	Frequent users of the internet will spend less time using traditional media systems (Radio)	0	3	No	0	2	No	1	0	Weak
H10a	Age will be positively associated with the likelihood to be a frequent user of traditional media systems (Television).	11		Strong	9		Strong	5		Moderate
H10b	Age will be positively associated with the likelihood to be a frequent user of traditional media systems (Newspaper).	11		Strong	11		Strong	9		Strong
H10c	Age will be positively associated with the likelihood to be a frequent user of traditional media systems (Radio).	9		Strong	8	1	Strong	2	2	Weak

Notes: Maximum number of countries is 11.
*Sig. denotes the number of countries significant in the hypothesized direction (Alternative hypotheses).
*Inverse denotes the number of countries that show an inverse relationship to the expected hypotheses.
*No support denotes when 0 countries are significant in the hypothesized direction.
*Weak support denotes when 1 to 3 countries are significant in the hypothesized direction.
*Moderate support denotes when 4 to 6 countries are significant in the hypothesized direction.
*Strong support denotes when 7 to 11 countries are significant in the hypothesized direction.

DISCUSSION

The Impact of Socioeconomic, Demographic, and Traditional Media Systems' on Internet Access and Internet Use

Study 1 provides answers to the research question that asks whether the conventional socioeconomic and demographic predictors of the digital divide hold across multiple nation and time periods. The present study concludes that the socioeconomic and demographic variables predictors of the digital divide hold across multiple nations (see summary results Table 7). Moreover, most of the variables remain significant for the majority of countries in the three, cross-sectional time periods assessed in the analyses. Citizens with higher education and income are more likely to have internet access and frequently use the internet than those with lower education and income. These results corroborate previous studies (e.g., Goldfarb and Prince, 2008; Martin and Robinson, 2007).

Knowledge and skills training, which has not been considered in past research, seems to be as vital as income and education to the digital divide. As shown in the results for the majority of countries across time periods, citizens who in the last 12 months had participated in knowledge and skills training via courses, lectures, and/or conferences were more likely to have internet access and be frequent users of the internet. Thus, the provision of training sessions may assist citizens on the disadvantaged side of the divide. Though this is a unique and significant finding, an individual's training may be linked to their education and income. Results of post hoc analyses indicate that income and education have a significant and positive association with training.

In the past, when internet access was not common more males than females were likely to have internet access; however, the recent research has concluded that a gender access divide no

longer exists (e.g., Bimber, 2000; Belanger and Carter, 2009). Thus, the expectation of the present research was that the significance of gender to the access divide would decrease over time, a phenomenon that past research has not examined across countries. In line with the expectation, males were more likely to have internet access than females in earlier time periods but, as shown in the results on Table 3, the pattern eventually weakens. In fact, in the latest time period, the results for Sweden show females are *more* likely to have IA than males. These results support an agenda for increasing attention to the gender divide in ICT use rather than ICT access.

Regarding gender and internet use, males are more likely to be frequent users of the internet than females. The gendered pattern in internet use is evident for the majority of countries in 2002 and 2006, but held for only Belgium, Norway, and Switzerland in 2010. The findings that indicate males are more frequent users of the internet than females, are similar to those of Bimber (2000), Korupp and Szydlik (2005), and Wasserman and Richmond-Abbot (2005). However, as with gender and internet access in the latest time period, results for Sweden revealed that females were more likely than males to be frequent users of the internet. Overall, the number of countries evidencing a gender divide in frequency of internet use is decreasing over time periods. Further research will determine if the pattern revealed in Sweden takes hold elsewhere and leads to a male-disadvantaged gender divide.

Age continues to be a predictor of IA and IU. Younger citizens are more likely to access and use the internet than older citizens. In contrast to the gender effect, the effect of age on IU remains significant for all countries across all time periods. This result is consistent with past studies that find older adults reluctant to adopt newer ICTs (Busselle et al., 1999, Akhter, 2002; Goldfarb and Prince, 2008). As governments, banks, and other institutions move previously in-

house transactions and functions online, older citizens will become increasingly disadvantaged by not using the internet (Belanger and Carter, 2009).

The present research also hypothesizes that age will be positively associated with the likelihood to be a frequent user of traditional media systems. As posited, the results show that older citizens are more frequent users of television, newspaper, and radio. Over time, a greater number of countries exhibit this relationship, particularly for television and radio. The positive association of age with reading newspapers is significant for the majority of countries in all time periods. The patterns of the analyses show an increase across time periods of countries in which older citizens spent more using traditional media systems than younger citizens. This contrasts to the expectation of Loges and Jung (2001), who extensively examined age in the digital divide and expected the disparities to eventually change. Older citizens persistent use of traditional media systems is concerning because it is continuing into a time when younger individuals are utilizing newer ICTs that provide functions in a more effective and efficient manner than traditional media. Greater resources are needed to assist older citizens in the use of newer ICTs. One strategy is to encourage new technology use through training (Cody et al., 1999) or to encourage new uses of mediums older citizens already use. For example, new television sets that contain newer ICT capabilities, known as Smart TVs, may encourage older citizens to utilize the internet because it can be used via a familiar medium.

Study 1 also provides answers to the research question that seeks to understand the role of traditional media systems on the access and use of ICTs. Results offer evidence that access to and use of the internet are associated with use of traditional media systems (see Tables 2, 3 and 4). For instance, citizens who spend less time watching television are more likely to have internet access and use the internet than those who spend more time watching television. One

reason these associations may exist is because television and internet are functionally similar (e.g., Jeffres and Atkin, 1996); television and the internet both require an individual's undivided attention because audible and visual senses must be engaged for their effective use. The hindrance to citizens' IA and IU that correlates to television use is clearly evident in countries in earlier time periods, but dissipates in the later time periods. This result may be attributable to the internet becoming generally more prevalent over time, which may be making users less dependent on traditional television (as opposed to smart TVs).

This study revealed that those who spend time reading newspapers are likely to access and use the internet frequently. There are several potential explanations for this association. First, newspapers are a medium in which more-educated and higher-income citizens utilize (Tichenor et al 1970) and education and income are the same factors that predict IA and IU (e.g., Martin and Robinson, 2007; Goldfarb and Prince, 2008). Therefore, a possible justification is that the individuals in the social class that normally accesses and utilize newspaper are of the same group that has the luxury of accessing and using the internet. Second, those from a higher SES group are also likely to have more information and knowledge on how, when, where, and why to utilize the internet. Finally, many newspaper articles refer readers to associated websites where they can obtain additional information on a particular topic. That the association of internet access and reading newspapers is diminishing from 2002 to 2010 may be attributable to the internet becoming more prevalent, so that former newspaper readers may now rely more on the internet for news content, including from traditional news outlets that now operate online newspapers.

Exceptions to the trend of a positive association of newspaper reading with internet access is evident in Slovenia and United Kingdom, where there was a significant and negative

association in the latest time period. Individuals in these countries who spend more time reading the newspapers are *less* likely to have internet access. This is a pattern that emerged only in 2010, as both countries in previous years showed a significant and positive association between the two variables. It may be that individuals' newspaper time is more recently being displaced with internet as the latter provides users with a variety of information that is more up to date and convenient to consume.

The last traditional media system, radio, seems to have the least relevance to internet access and use. The expectation was that the more time an individual spends listening to the radio the more likely s/he will have internet access and use the internet. Results for the IA model in 2002 indicate an inverse association of time listening to the radio with internet access for Belgium, Norway, and Sweden; however, the association in the later time periods is consistent with expectations—Slovenia and the UK in 2006 and Belgium, Slovenia, and Spain in 2010. Similar to the results from the IA model, radio use was found in the IU model to have a negative association for Norway in 2002, but a positive association between radio use and internet use for the Netherlands and Spain in 2010. The contrasting results may be due to the lack of diffusion of technologies in the earlier time periods that were required to access and use the internet (e.g., personal computers and mobile technologies). Radio use and internet use being positively associated can be explained in several ways. First, the radio is a medium that can be utilized in the background, while conducting other activities, so that it should not significantly interfere with other activities (Pilotta et al., 2004), like using the internet. Second, radio stations often recommend their users to visit websites for more information, which drives radio listeners to the internet. Finally, the radio is a medium that is often accessed in cars (Albarran et al., 2007),

which makes a difference because those with higher income are both more likely to own cars and use the internet frequently.

The Impact of Internet Use and Age on the Use of Traditional Media Systems

The present research assessed the association of internet use and age on the amount of time spent using three traditional media systems. In 2002, frequent internet users spent less time watching television for the majority of countries; however, that association did not remain significant in the more recent time periods. It may be that television in its traditional form is becoming gradually less relevant. As internet protocol television (IPTV) diffuses, internet users are able to substitute watching programs on television at their aired time to with watching programs on demand using internet technology. This includes watching movies using online services like Netflix and streaming movies and programs online, from major television networks, for example. The blending of television and internet technologies make traditional questions about time spent watching television inadequate to capture time spent watching television that utilizes internet technology. Therefore, results should be interpreted with care.

The present research hypothesized that frequent internet use would decrease newspaper use but, contrary to this prediction, time spent using the internet does not appear to deter from time spent reading newspapers. Rather, internet use and newspaper use are positively associated for at least two countries in each time period. Presently, many newspaper outlets have an online presence but require a subscription for premium service (e.g., New York Times and Wall Street Journal). Frequent internet users may continue to spend significant time reading traditional newspapers because they can be picked up periodically without commitment to a subscription. Newspaper readers may also prefer traditional newspapers over reading content online or

through a digital device; this idea corroborates research that finds some people prefer reading hardcopy material rather than a digital display (see Baron, 2013).

Frequent internet use minimally contributes to use of the radio. Norway is the only country that showed this anticipated negative association in 2002, while Belgium and Switzerland in 2006 and the Netherlands, Spain, and UK in 2010 show that frequent internet users spend more time listening to the radio. One reason for the positive association between internet use and time spent listening to the radio may be that the radio can be run in the background as a secondary activity (Pilotta et al., 2004), either via a traditional radio or online "radio."

Overall, new and existing internet usage policies may deter the use of the internet and thus perpetuate the use of traditional media. For instance, a public library that provides patrons access to personal computers with internet access may have time restrictions that limit use of the technology because the demand for these computers is high. Separately, mobile carriers that provide internet service via smart phones or other mobile devices, as well as other internet service providers (e.g., ATT), have policies that limit one's use of internet through data capacity restrictions or limitations. The amount of internet capacity and time people have available to them may cause them to rely on more traditional media systems for hedonic and utilitarian uses that cannot be accomplished online. In this case, internet users will prioritize their online activity. The trend of internet service providers limiting the capacity for internet use of its customers is recently and increasingly emerging and will require future research to determine how regulated internet use and traditional media systems relate.

CONCLUSION

The knowledge gap hypothesis and displacement hypotheses were introduced and enunciated to examine the association of socioeconomic status, demographics, and use of traditional media systems with internet access and internet use across multiple countries and time periods (ranging from 2002 to 2010). A series of pooled logistic regressions were conducted that included 30 countries and five time periods. Of those 30 countries used in the pooled analysis, eleven countries were selected and individually analyzed across three different time periods (years: 2002, 2006, and 2010). Separately, the study also examined the role of internet use on traditional media systems using a series of linear regressions.

A few contributions are made with Study 1. In addition to van Dijk's (2006) suggestion that digital divide research should contain more theoretical and interdisciplinary perspectives, I also address Selwyn's (2004) call for research that suggests new research focus on original mitigating factors and circumstances that impact ICT use. Study 1 incorporated theories from the mass communications field to address how the digital divide is impacted by two novel variables—training and the use of traditional media systems—, as well as common socioeconomic and demographics variables.

In the majority of countries, the impact of traditional media system use—consisting of time spent watching television, reading newspapers, and listening to the radio—was evident. In general, the majority of countries across time periods revealed that the time spent watching television was negatively associated with internet access; however this pattern was not as strong when the dependent variable was frequency of use. With regard to time spent reading newspapers, the positive association between newspaper time and internet access was evident for most countries in 2002 but this result held for only a single country by 2010. There was a positive association between newspaper time and frequency of internet use for a marginal

number of countries across time periods. The number of countries that showed a positive association between radio use with the two dependent variables—internet access and frequency of internet use—were either not significant or relatively low in the later time periods.

The role of socioeconomic status in predicting internet access and frequency of use did not weaken; income and education were significant for the entire sample of countries in each time period. Similar results are evident with the age variable, as younger citizens were consistently more likely to access and frequently use the internet than old citizens. Gender as a predictor of internet access and internet use displays a different pattern. Gender is not a significant predictor for internet access in all the countries by 2010. The association of gender and frequency of use follows a similar pattern as only three of the eleven countries show significance by 2010.

This study also contributes to understanding of the digital divide with its investigation of the role of internet use (i.e., less frequent user and high frequent user) and age on time spent using traditional media systems. A negative association between being frequent internet user and the time spent watching television was evident in 2002 but gradually decreased in the later time periods. Regarding age, older citizens spent more time on traditional media systems than younger citizens, as the number of countries with this pattern of results increased across time periods. No such association was evident for frequent internet users with time spent reading newspapers or listening to the radio use.

In summary, this study is the first to investigate the patterns of socioeconomic status, demographics, and traditional media systems, collectively, and across multiple nations and time periods. Diverse strategies are needed such that internet training sessions not only include personal computers, but other devices and media sources that citizens traditionally or more

confidently use. Researchers, policy makers, and others with agendas to help minimize the internet disparities among citizens, should consider approaches that assist in the individual adoption and use of the internet. With the exception of Poland, the nations used in this study are listed in the top 50 countries with the highest internet diffusion rates (Internet World Stats, 2013). This illustrates how, even in countries with above average internet diffusion rates, groups of citizens continue to be without internet access or are less frequent users of the internet. This study presents a broader picture of why digital divides exist which may assist in reducing the disparities of ICT access and use among citizens.

Chapter 3

The Role of Human Values in the Digital Divide

Research on culture and information systems began as early as the 1980's. Many studies have incorporated Hofstede's (1980, 1991) the role of national-level cultural dimensions (see Leidner and Kayworth, 2006), while others have adopted these cultural dimensions at the individual level using espoused national cultural values (e.g., Srite and Karahanna, 2006; Zhang and Maruping, 2008). Compared to the work of Hofstede, Schwartz (1992) cultural values framework is theoretically derived and contains a more comprehensive set of values that were collected in a more recent time period using more diverse countries (Ng, Lee, and Soutar, 2007). Surprisingly, given its popularity in culture research, IT research generally lacks application of Schwartz's values framework to explain IT phenomena, and is specifically devoid of studies that address the influence of Schwartz's values on diffusion and adoption of information and communication technologies (ICTs).

The present study explores the affect of higher-order values (i.e., independent values and interdependent values) on digital inequality, defined as "a refined understanding of the digital divide that emphasizes a spectrum of inequality across segments of the population depending on differences among several dimensions of technology access and use" (Hargittai, 2003:822). The higher-order values are derived from Schwartz (1992) value survey items that measure the ten motivational value types, each discussed in the subsequent sections. By specifically studying personal computer (PC) use behavior, this investigation sheds light on which value characteristics may be responsible for differential use of ICTs.

According to Schwartz (2006) values theory, values are defined as, "desirable, trans-situational goals, varying in importance that serves as guiding principles in people's lives."

Individuals vary in the values that are central to them and, as a result, those that drive behavior (Verplanken and Holland, 2002; Erumban and de Jong, 2006; Johnson and Jackson, 2009). Given the nature of Schwartz's work on culture, the values he developed have the advantage that they can be used both at group and individual levels, and include dimensions similar to those advanced by Hoftstede (Schwartz, 1994a; Ng et al., 2007). Schwartz's values have been applied to explore topics of fair trade consumption (Doran, 2009), organizational values (Johnson and Jackson, 2009), immigration consequences (Vecchione, Caprara, Schoen, Castro, and Schwartz, 2011), personality factors (Roccas, Sagiv, Schwartz, and Knafo, 2002), and sex differences in value priorities (Schwartz and Rubel, 2005), to name a few. Yet even with this broad applicability of Schwartz's values, no research has been published that relates the human values to the diffusion of IT and adoption.

This study introduces Schwartz's values (Schwartz, 1992; Schwartz, 2006) and investigates which set of values influence on personal computer use at an individual level. Following the method of Johnson and Jackson (2009), the present study clusters the individual-motivational values into independent and interdependent factors and tests their association with PC use. The findings of this research clarify whether individual values can explain variance in individuals' technology behavior beyond that accounted for by the socio-demographic factors that typically explain technology access and use.

This study answers two specific calls for future research. The first is proposed by Shneiderman (2000), who draws attention to challenges that should be considered, specifically the ability to accommodate different users of ICTs in what he calls 'user diversity'. Shneiderman states that, "user diversity involves accommodating users with different skills, knowledge, age, gender, disabilities disabling conditions, literacy, culture, income, and so forth"

(Shneiderman, 2000:89). The present study investigates users' diversity in relation to their individual values. This is important because, since not all individuals hold the same values (Verplanken and Holland, 2002), a pool of different users may be generated that also fluctuates in relation to their use of ICTs. The second call addressed by the present research comes from van Dijk (2006), who asserts that future research in the digital divide ought to be more interdisciplinary. Schwartz's framework lies within the social psychology discipline and is integrated to study an information systems phenomenon. The present research is justified because it is important for researchers and practioners to understand which values are inherent to technology use in order to develop strategies that can make the technology more attractive to those on the disadvantaged side of the digital divide.

LITERATURE OVERVIEW

For the purpose of the present study that explores individual-level cultural values, a sample of the surveyed literature is presented in the next section. This research consists of technology-related studies that include some cultural element(s) conceptualized and/or measured at an individual level, particularly in IT diffusion.

Culture and IT Adoption

Researchers assert that culture has an influence on individuals' adoption and use of technology (Straub, Keil, and Brenner, 1997; Lee, Choi, Kim, and Hong, 2007), as well as the difference in ICT adoption rates between countries (e.g., Erumban and Jong, 2006). Some studies have been published on the topics that primarily focus on national culture dimensions developed by Hofstede (1980) to explain individual behavior (see Leidner and Kayworth, 2006 for a comprehensive list). Ford, Kotze, and Marcus (2005) criticize the latter type of studies claiming that "not every citizen of that country [in study] has the same cultural profile," which is a

problem to the extent that it results in stereotypical views of citizens. Ford et al.'s (2005) work coincides with that of Lee et al. (2007); Lee and colleagues state that national culture definitions that explain macro-level behaviors "lack precision in explaining behavior at the individual level" (p. 13). Given that individual cultural profiles may differ from the country cultural profiles, one should be cautious in the interpretation of cultural studies.

One of the first studies to examine cultural influences in technology adoption was conducted by Straub, Keil, and Brenner (1997). These authors tested whether Davis' (1989) technology acceptance model (TAM) would hold across three countries—the United States, Switzerland, and Japan. These countries were selected based on variation in Hofstede's (1980) cultural dimensions of power distance, uncertainty avoidance, individualism, and masculinity. The authors found that TAM significantly predicted behavior in the United States and Switzerland, but not in Japan. This result the authors partially attributed to differences in Hofstede's cultural dimensions across the countries.

In other technology studies, authors have used culture as either a moderator or antecedent of TAM. Srite and Karahanna (2006) used Hofstede's cultural dimensions as moderators of TAM. The authors explain, however, that using national cultural dimensions would advance an ecological fallacy, and thus, argue that using espoused national cultural values is more appropriate. Subsequently, the authors conclude that all but one dimension (masculinity/femininity) significantly contributed to their extended model. Around the same time, a study by Lee et al. (2007) used portions TAM and Hofstede's cultural dimensions to examine post-adoption beliefs of mobile internet technology in Korea, Hong Kong, and Taiwan. In their study, uncertainty avoidance and individualism were modeled as antecedents of TAM predictors. Results of this research indicate that individuals with high uncertainty avoidance

perceived the technology less favorably, and those who were individualistic had positive perceptions of the technology and an indirect intention of continued use.

As evidenced by the studies reviewed above, much of the research undertaken to investigate the association of culture values in information systems employs Hofstede's dimensions, rather than Schwartz's (1992) cultural values or the individual value framework, to justify behavioral differences of individuals across multiple countries (e.g., Straub et al., 1997; Sia et al., 2009). The present study employs the under-used human values to explore individuals' computer use across countries. This research is motivated by an interest in how individual-level culture values (particularly those developed by Schwartz, 1992) influence differences in individuals' ICT use behavior, which ultimately defines the digital divide.

THEORETICAL BACKGROUND

A number of scholars assert that culture is based on shared values that exert influence over individuals in their earlier stages of life (Hofstede, 1991; Schwartz, 1994b; Straub et al. 2002). Collectively, as groups of individuals share common values, a common culture is developed that shifts values from individuals to a group. Individuals, along with the values they share, are grouped by geographical boundaries (Straub et al., 2002). This is related to Hoftstede's (1980) definition of culture as "the collective programming of the mind which distinguishes the members of one human group from another" (p. 260).

The work of Hofstede (1980, 1991) is frequently cited in works of culture and information system studies (Leidner and Kayworth, 2006). Hofstede introduced national dimensions (i.e., power distance, uncertainty avoidance, individualism-collectivism, and masculinity-femininity) after testing 32 value statements with subjects in 40 nations in the late 1960's. After Hofstede published his national dimensions, Schwartz tested 56 values statements

with participants in 38 countries throughout the late 1980s and early 1990s (Ng et al., 2007). From this work, Schwartz introduced ten distinct motivational values (see Table 1) and seven national culture types (conservatism, intellectual autonomy, affective autonomy, hierarchy, mastery, egalitarian commitment, and harmony). Schwartz asserts that his work includes the dimensions developed by Hofstede. He further claims that these dimensions can be analyzed at an individual *or* cultural level since the measure of respondents' values are based on their own experiences as well as "normative cultural influence" (Schwartz, 1994b; Ng et al., 2007). In contrast, Hofstede's work is mainly analyzed at a national level, though some researchers have applied Hofstede's cultural dimensions at an individual level using espoused national culture values (e.g., Srite and Karahanna, 2006; Zhang and Maruping, 2008).

Values research began decades ago (see Rokeach, 1973 and Feather, 1988); however, I specifically focus on contemporary studies of values related to the work of Schwartz's (1992, 1994a). Scholars have cautioned students of culture to be wary of ecological fallacies (Straub et al. 2002; Ford et al., 2005; Srite and Karahanna, 2006)—that is, one cannot assume that an individual belonging to a group will have the average values of that group. Lee et al. (2007) states, "two individuals may have different cultural characteristics even though they live in the same country" (p. 11). Moreover, an individual may be associated with more than one culture or "subcultures" due to affiliations of religion, ethnicity, or other social groups (Straub et al., 2002). Thus, to remedy this deficiency in which macro-level phenomenon is used to justify individual-level behaviors, the present research accounts for individual cultural characteristics using motivational values from Schwartz (1992).

Values Theory

Values differ from norms and attitudes; values serve as standards for an individual and are prioritized based on importance to the person and can influence the way one selects action (Schwartz, 1994a, 2006). Schwartz defines the values theory as, "desirable, transsituational goals, varying in importance, that serve as guiding principles in people's lives or other social entity" (1994:21). Also recognized as a motivational construct (Schwartz, 2006), values influence the goals individuals may attempt to attain, and thus guide individual behaviors (Schwartz, 1994). The motivational values are recognized universally and, as such, are assumed to hold across all cultures (Schwartz, 2006). The ten individual-level values introduced by Schwartz, are presented in Table 1. This table is reproduced from Schwartz (1992) and exhibits ten motivational distinct value types followed by their definition.

Table 1: Motivational Types of Values

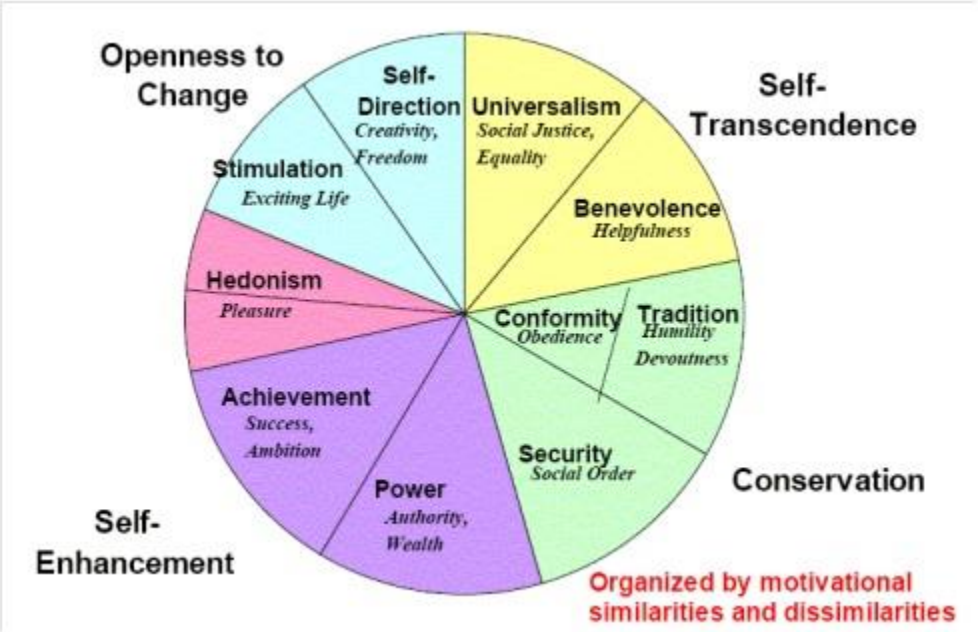
Self-direction: Independent thought and action-choosing, creating, exploring.
Power: Social status and prestige, control or dominance over people and resources
Security: Safety, harmony, and stability of society, of relationships, and of self.
Hedonism: Pleasure and sensuous gratification for oneself.
Benevolence: Preservation and enhancement of the welfare of people with whom one is in frequent personal contact.
Achievement: Personal success through demonstrating competence according to social standards.
Stimulation: Excitement, novelty, and challenge in life.
Conformity: Restraint of actions, inclinations, and impulses likely to upset or harm others and violate social expectations or norms.
Universalism: Understanding, appreciation, tolerance, and protection for the welfare of all people and for nature.
Tradition: Respect, commitment, and acceptance of the customs and ideas that traditional culture or religion provide.

Source: Schwartz (1992)

Figure 1 presents the relationship between the ten motivational values (at the lower level). The circumplex structure illustrates how the values relate to each other—the closer the values are to each other (e.g., achievement and power), the more similar the values are in motivation. Schwartz (2006) states, "the pursuit of achievement values may be compatible with the pursuit of power values—seeking personal success for oneself is likely to strengthen, and to be strengthened by, actions aimed at enhancing one's own social position and authority over others" (p. 2). In contrast, values that are on the opposite side of each other (e.g., achievement and benevolence) are considered antagonistic (Schwartz, 2006), weakly associated (Johnson and Jackson, 2009), or tradeoffs (Ng et al., 2007).

The four labels on the edge of the circular structure represent integrated structure values (i.e., openness to change, self-enhancement, self-transcendence, and conservation), also known

as higher-order dimensions. Each higher-order value type contains a number of individual motivational value types. Openness to change consists of stimulation, self-direction, and hedonism values, while its polar opposite--conservation--contains motivational values of conformity, tradition, and security. Self-enhancement is expressed with hedonism (shared with openness to change), achievement, and power values, while its polar opposite--self-transcendence--is made up of universalism and benevolence (Schwartz, 1994a).



Source: Schwartz (2006)

Figure 1: Theoretical model of relations among ten motivational types of values

The degree to which values are prioritized differs among individuals and is typically influenced by one's experiences or situations (Schwartz, 2006). For example, an individual with a job that provides him/her with empowerment likely prioritizes values associated with self-enhancement. Another example is related to women who live in gender bias or stereotypical societies; here one

would find more priority given to values associated with conservation and less priority given to values consistent with female power. Overall, these life circumstances affect individuals' value priorities, which have consequences to learning, abilities, social roles, expectations, and sanctions, and which may affect behavior such as the adoption and use of ICTs.

Independent and Interdependent Values

The present research makes use of the research conducted by Johnson and Jackson (2009), who clustered the ten basic human values into two higher-order factors using data reduction methods. The first of these factors is referred to as *independent values*, which are those values that "target a person's own self-interest and personal growth, development and accomplishments" (p. 918). This factor is associated with openness to change and self-enhancement. The second factor, *interdependent values,* are those values that "emphasize the importance of social harmony, equality, and adherence to group norms and customs" (p. 918), and consists of personal values affiliated with self-transcendence and conservation. In general, values that serve the interest of the individual are: power, achievement, hedonism, stimulation, and self-direction while the values that serve as collective interest are: benevolence, security, universalism, tradition, and conformity (Schwartz, 1992; Oishi et al., 1998; Lawal, 2009).

Johnson and Jackson's (2009) investigated the relationship of self-identity (i.e., collective identity and individual identity) and espoused independent/interdependent values with employment turnover intentions and affective organizational commitment. The conclusion of this work was that lower turnover intentions and higher affective organizational commitment are a result of the interaction of collective identity and interdependent values and the interaction of individual identity and independent values. Since there is evidence that independent values and

interdependent values determine differences in attitudes and behavior (Johnson and Jackson, 2009), the present study uses these two dimensions to understand how each set of values influences individuals' technology use. Figure 2, reproduced from Johnson and Jackson (2009), depicts the relationship of the independent and interdependent higher order dimensions with the ten Schwartz values (1992).

Source: Johnson and Jackson (2009)

Figure 2: Two-Dimensions: Interdependent Values and Interdependent Values

Johnson and Jackson's (2009) study on independent and interdependent values can be supported to some extent by Markus and Kitayama's (1991) study of culture and the self. These authors posit that there are two construals of the self—the interdependent construal, also referred to as one being collective or sociocentric, and the independent construal, consistent with one being individualistic or autonomous. Table 2 below, from Mark and Kitayama (1991), distinguishes between the two self-construal types.

There is a history of research that has explored the relationship between values (Schwartz, 1992) with independent and interdependent individuals (Markus and Kitayama, 1991). Triandis (1995) found individuals who associate with independence are also comparable to those with individualism attributes, whereas individuals associated with interdependence are similar to those with collectivism attributes. Similarly, a study by Oishi et al. (1998) revealed a systematic relationship between the individualism and collectivism Schwartz values (Triandis, 1995) and the independent self-construal and interdependent self-construal, respectively (Markus and Kitayama, 1991). Moreover, the use of Schwartz's values has been used to investigate constructs of independence and interdependence such as the research of Kam, Zhou, Zhang, and Ho (2012). These authors conducted an advanced factor analysis using Schwartz value survey in which items were grouped by their relation to either independence or interdependence. Items that related to independence were derived from values of self-direction, self-enhancement, and creativity, while items that related to interdependence drew from security, benevolence, conformity, and in-group responsibilities. Results supported the bidimensionality between independent self-construal and interdependent self-construal.

Table 2: Summary of Key Differences between an Independent and an Interdependent Construal of the self

Feature compared	Independent	Interdependent
Definition	Separate from social context	Connected with social context
Structure	Bounded, unitary, stable	Flexible, variable
Important features	Internal, private (abilities, thoughts, feelings)	External, public (statuses, roles, relationships)
Tasks	Be unique	Belong, fit-in
	Express self	Occupy one's proper place
	Realize internal attributes	Engage in appropriate action
	Promote own goals	Promote others' goals
	Be direct: "say what's on your mind"	Be indirect: "read other's mind"
Role of others	Self-evaluation: others important for social comparison, reflected appraisal	Self-definition: relationships with others in specific contexts define the self
Basis of self-esteem	Ability to express self, validate internal attributes	Ability to adjust, restrain self, maintain harmony with social context

Source: Markus and Kitayama (1991)

It is possible that behavioral differences in ICT use based on values of independent and interdependent add to the understanding of inequalities in ICT use. As posited by Verplanken and Holland (2002), a subset of values that are central to an individual will lead the person to a particular behavior. Independent and interdependent values represent such subsets of values and may lead to inequalities in PC use by individuals.

HYPOTHESES

The constructs of independence and interdependence are applicable in the explanation of inequalities in the use of technology. Based upon the literature cited above, the proposed theoretical model is presented in Figure 3.

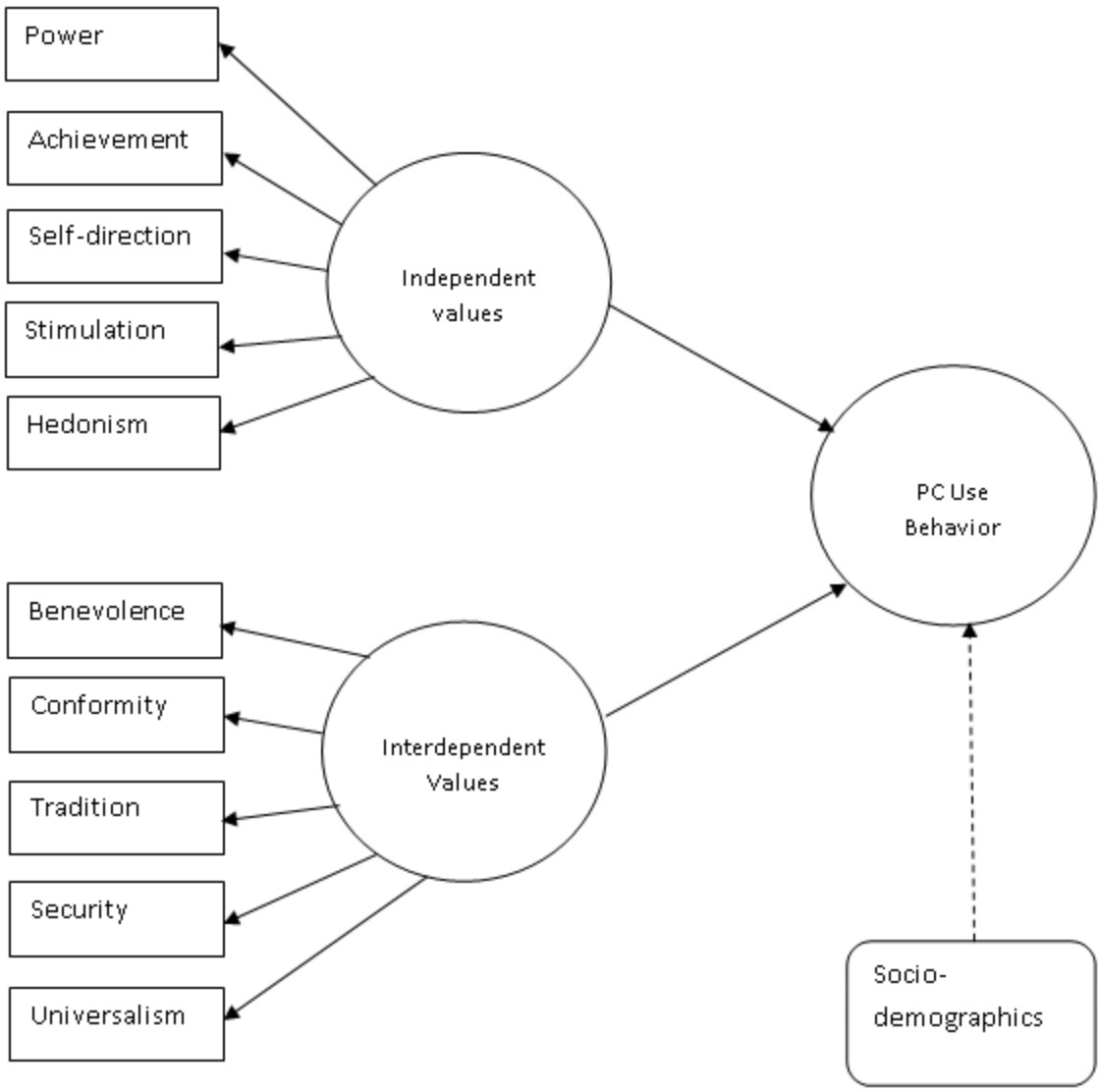


Figure 3: Proposed Model

Independent Values

Independent values contain values of self-direction, stimulation, hedonism, achievement, and power (Kam et al., 2012). Based on empirical research, one would expect that, combined, these values would contribute positively to PC use. In the next section, evidence from the literature that supports a positive association between the independent factor and ICT behavior, as related to the component values of the independent factor, is presented following a definition of each individual value.

Self-direction is characterized by traits such as independence and curiosity. A report by Inteco found curiosity to be the primary motivation to surf online (Cheng, Wang, Lin, and Vivek, 2009). Though, this study was based on internet use in the late 1990's, it is related to computer use because, at that time, internet use largely required a personal computer (compared to the variety of devices with internet capability available today; Lin, 1998). Similarly, individuals who value s*timulation*, defined by Schwartz (1992) as, "excitement, novelty, and challenge in life," can have a positive impact ICT use. Cheng et al. (2009) point out perceived novelty and arousal of curiosity is considered to have a positive effect on ICT use. Furthermore, risk-taking is a trait within stimulus-oriented values and is associated with individual ICT adoption and use (Straub, 1994, Bagchi et al., 2004; Srite and Karahanna, 2006). Individuals who shop online face more risk than shopping in traditional, brick-in-mortar establishments due to various factors such as disclosure of personal and financial information (Lee et al., 2007).

The experience of pleasure, sensuous gratification, and enjoyment constitutes the core of *hedonic* values (Schwartz, 1992), traits that have been extensively explored in technology adoption and use research (e.g., Davis, Bagozzi, and Warshaw, 1992; Lin, 2001, Anandarajan, Igbaria, and Anakwe, 2002). In their research, Heilman and Brusa (2008) found perceived enjoyment to positively impact computer usage among college students. In another study, Heijden (2004) found similar support for perceived enjoyment, leading her to state, "the hedonic nature of an information system is an important boundary condition to the validity of the technology acceptance model". The myriad of activities that an individual can perform with a computer may lead the individual to experience excitement and feel challenged to perform certain jobs. One may sense gratification through technology use as it offers a variety of hedonic and utilitarian purposes (Nysveen, Pedersen, and Thorbjornsen, 2005).

Achievement is defined as, "personal success through demonstrating competence according to social standards," and encompasses traits of being successful, capable, ambitious, and influential (Schwartz, 1992). Those who value achievement may rely on technology to fulfill a variety of achievements. For example, contrary to the research in technology diffusion, which has demonstrated that age (younger people) predicts ICT adoption and use, research by Hoskins and van Hooff (2005) indicates students who value achievement were typically older individuals who accessed and utilized ICT software more than younger students. In an organizational context, Davis (1989) states that information technology use can advance work performance and performance gains are hindered by individuals being unwilling to accept and use these systems. To approach success and avoid failure, individuals who value achievement are likely to utilize systems that will help them perform in their job (Covington, 1984). Moreover, individuals who value *power* may want to utilize technology more to improve their work performance because it enhances one's image or status (Schwartz, 1992; Rogers, 1995; Venkatesh and Brown, 2001) and leads to rewards, including extra monetary compensation (wealth) (Davis, 1989).

Based on the nature of the values that are central to the enhancement of the individual self, independent individuals are expected to utilize technology more than interdependent individuals.

> Hypothesis 1: Individuals with independent values will be more likely to be frequent users of personal computers.

Interdependent Values

Interdependent values are associated with the collectivism dimension (Triandis, 1995) and contain values of universalism, benevolence, conformity, tradition, and security (Kam et al.,

2012). One would expect that, combined, these values would have a different influence on computer use compared to independent values. Research on Schwartz's value taxonomy has distinguished two dimensions, termed higher-order values. These dimensions are polar opposites; one is made up of openness to change and conservation and the other includes self-enhancement and self-transcendence (see Figure 1). Given the construction of these dimensions, I anticipate different ICT behavioral patterns based on an individual's association with independent values and interdependent values because the interdependent values coincide with self-transcendence and conservation, and the independent values coincide with openness to change and self-enhancement. Evidence from the literature of such differences in ICT behavior is reviewed, along with the related values, below.

The value of *tradition* is defined as, "respect, commitment, and acceptance of the customs and ideas that traditional culture or religion provide the self" (Schwartz, 1992). Individuals who value tradition may view ICTs negatively since technologies provide new information that may be in conflict with customs. In a study that examines cultural perceptions of ICT through the lens of a collectivist/traditional nation, Albirini (2006) found participants to be concerned with the "morally damaging effect of ICTs" (p.49). Other studies claim that the development of technology is culturally biased (Hill, Loch, Straub, and El-Sheshai, 1998), which may lead to force-fitting cultures to the technology (Loch, Straub, and Kamel, 2003). Additionally, religious nations are negatively associated with the diffusion of technologies. This is evident in the research of Hill et al. (1998), who find that ICTs less often transfer to nations that are more religious and are highly conservative compared to countries that are otherwise.

Fostering relationships are important to individuals who value *conformity and benevolence.* The *conformity* value denotes individuals restraining from violating social

expectation and norms, while *benevolence* signifies maintaining the wellbeing of personal contacts (Schwartz, 1992). IT research has corroborated the correlation of ICT use and relationships. For example, in a study that investigates the consequence of using the internet on social involvement and psychological wellbeing, Kraut et al. (1998) found that greater use of the technology has a negative impact on family communication and local social circles and a greater impact on loneliness, stress, and depression. Similarly, other research has determined that frequent ICT use leads to anti-social behaviors and social isolation (e.g., Loch and Conger, 1996; Chak and Leung, 2004). There is also evidence of social isolation with frequent use of ICTs (Chak and Leung, 2004). Lastly, conformity and uncertainty avoidance are consistently associated with one another, and the latter has been shown to negatively impact ICT use (Straub, 1994; Bagchi, Hart, and Peterson, 2004; Srite and Karahanna, 2006; Lee et al., 2007).

The *security* value pertains to the safety and stability of the society and the self (Schwartz, 1992). Security and privacy concerns are particularly problematic in relation to ubiquitous computing (Dourish, Grinter, Delgado, and Joseph, 2004). At a societal level, developing countries have significantly less secured internet servers compared to developed countries (World Bank, 2007). At an individual level, those who use ICTs, such as personal computers and the internet, risk the chance of their personal information being viewed, stored, or manipulated by an unauthorized party (Chellappa and Pavlou, 2002). Also when using ICTs, it is possible for the user's activity to be logged and tracked back to the user (Zimmerman, 2000). Lastly, the perceived security of websites has been found to have an influence on online purchase intentions (Salisbury, Pearson, Pearson, and Miller, 2001).

Individuals who value *universalism* bear traits of social justice, equality, unity with nature, and protecting the environment (Schwartz, 1992). Universalism is a value that may be

threatened by ICT use. For example, Hilty, Som, and Kohler (2004) found that the use of ICT has potential risk to human health, society, and on the environment. Consistent with this view, a qualitative study on the risks of pervasive computing by Hilty et al. (2004) revealed that certain ICTs cause health hazards to users through exposure of non-ionizing radiation (NIR) and raise concern from the public regarding their long-term effects. This coincides with studies that speculated that one reason individuals do not use PCs is because they think PCs negatively impact health and the environment (e.g., Koehler and Erdmann, 2004). In addition, risks of unintended social effects, like feelings of injustice, are evident when persons are forced to use technology due to a change in structure (e.g., online banking). Separately, Houghton (2009) found that the negative impact of ICTs vary from "energy consumption, short product life cycle, and e-waste" (p.40).

Based on the values that adhere to relationships and group norms, interdependent individuals are expected to utilize technology less than independent individuals.

> Hypothesis 2: Individuals with interdependent values will be less likely to be frequent users of personal computers.

METHODOLOGY

Sample and Data

The sample consists of over a thousand individual participants from the World Values Survey. The World Values Survey has been conducted in six cross-sectional waves, beginning in 1990 and continuing into 2012. The present research makes use of the data collected during the 2005 to 2007 wave period. The World Values Survey consists of questions that relate to individual attitudes toward gender equality, culture, environment, and family (to mention a few). The survey is conducted in person as part of structured interviews with participants from nearly 100

nations. Seven countries were selected for hypothesis testing after the factor analysis was conducted on the survey items from the World Values Survey that captured individuals' orientation to Schwartz human values.

The response scales of the human values questionnaire items were reverse coded (1 = *Not at all like me* to 6 = *Very much like me*). As noted by Johnson and Jackson (2009), since the values are interrelated as shown in the circumplex in Figure 2, the oblique rotation (also known as oblimin) used in the factor analysis (see Table 3). Two factors were derived from the items that captured the ten human values. The first factor was that identified by Johnson and Jackson (2009) as independent values, which are those human values on the left half of Schwartz's circumplex diagram that qualify as motivations of self-enhancement and openness to change. The second factor identified was the interdependent values, which consists of the human values on the right half of Schwartz's circumplex diagram that consist of self-transcendence and tradition motivations. All ten human value items were included in the factor analysis, which distinguishes it from Johnson and Jackson's (2009) analysis that only made use of eight of the values (universalism and power were dropped because of item loading issues).

A series of logistic regressions were run to test the hypotheses. First, a pooled logistic regression was conducted that combined the data from all seven countries followed by individual logistic regression models for each country separately. The following details the dependent and independent variables used in the analyses:

Dependent variable: A dichotomized variable coded '1' for frequent users of personal computers and coded '0' for non-users of personal computers.

Independent variables: The two factors derived from the factor analysis—independent values and interdependent values–are the predictor variables. The factors are reflective of the ten

human values items. Refer to Table 3 for the full list of human values survey items used in the factor analysis. Socio-demographic variables of income, age, gender, education, and employment status were entered as control variables in the analyses.

Table 3: Human Value Items

Factor	Human Values	Survey Item
Independent Values	Self-direction	Important to this person: to think up new ideas
	Power	Important to this person: to be rich
	Hedonism	Important to this person: to have a good time
	Achievement	Important to this person: being very successful
	Stimulation	Important to this person: adventure and taking risks
Interdependent Values	Security	Important to this person: living in secure surroundings
	Benevolence	Important to this person: to help the people
	Conformity	Important to this person: to always behave properly
	Universalism	Important to this person: looking after environment
	Tradition	Important to this person: tradition

RESULTS

Presented in Table 4 are the descriptive statistics for the sample. Listed in the first column are the socio-demographic variables (i.e., employment status, gender, education, and age) followed by the non-user/frequent user of personal computers variable. By percentage, non-users of personal computers are most common in Rwanda (96%) compared to South Africa (83%), Morocco (81%), and Moldova (80%), Indonesia (78%), Mexico (73%), and Taiwan (50%).

Table 4: Descriptive Statistics

	Mexico	S Africa	Taiwan	Moldova	Indonesia	Morocco	Rwanda
Unemployed	46%	57%	32%	48%	41%	13%	20%
Employed	54%	43%	68%	52%	59%	87%	80%
Gender (Males)	49%	50%	47%	46%	52%	48%	51%
Education – Mean (Std Dev.)	5.07 (2.54)	5.49 (2.07)	6.26 (2.56)	6.14 (1.57)	6.49 (2.27)	2.71 (2.52)	3.04 (1.74)
Age – Mean (Std Dev.)	40 (16)	39 (17)	44 (16)	43 (17)	36 (14)	37 (13)	35 (14)
Non-User	73%	83%	50%	80%	78%	81%	96%
Frequent User	27%	17%	50%	20%	22%	19%	4%
Sample size	1295	2604	942	785	1487	977	1215

Using SPSS 20, factor analyses were conducted using maximum likelihood estimation. Prior to running the analyses, questionnaire responses were inversely recoded to facilitate the interpretation of the results (so higher values represented more frequent computer use rather than less frequent use). Since the Schwartz-like value items are interrelated, an oblique rotation (oblimin) was applied (Johnson and Jackson, 2009). Initially, 45 countries were factor analyzed with the result that 22 of them consisted of a 2 factor-solution and 23 countries returned a 3-factor solution. Countries with a 3-factor solution were eliminated given that the specific reduction method was a confirmatory factor analysis and a 2-factor solution was expected based on Johnson and Jacksons' (2009) theoretical framework. Of the 22 countries with a 2-factor solution, 15 countries contained item loadings that did not represent the interdependent and

independent factors that were anticipated. Consequently, those countries were also eliminated from further analysis and a total of seven countries were retained for further investigation. The results of the final factor analysis are shown in Table 5, which illustrates each of the seven countries' item-loadings, as well as loadings for the combined sample that are composed of the two-factors—interdependent values and independent values. The items loadings were all greater than .50 and therefore considered to be satisfactory as articulated by Papanastasiou (2005). Together the factor items explain 46% of the factors' combined variance when the factor analysis is conducted with the seven-country sample.

Table 5: Factor Analysis Item Loadings

Factor Analysis

	Mexico		S Africa		Taiwan	
	Interdependent	**Independent**	**Interdependent**	**Independent**	**Interdependent**	**Independent**
Self-direction	.317	**.514**	.345	**-.534**	.231	**.576**
Power	-.068	**.669**	.034	**-.733**	.100	**.545**
Security	**.600**	.282	**.625**	-.195	**.688**	.125
Hedonism	.278	**.633**	.230	**-.717**	.114	**.681**
Benevolence	**.692**	.198	**.681**	-.186	**.650**	.287
Achievement	.452	**.578**	.381	**-.674**	.102	**.715**
Stimulation	.033	**.665**	.059	**-.678**	-.181	**.651**
Conformity	**.574**	.141	**.673**	-.158	**.597**	.129
Universalism	**.737**	.077	**.586**	-.226	**.716**	.071
Tradition	**.609**	.034	**.655**	-.063	**.649**	-.208

	Moldova		Indonesia		Morocco	
	Interdependent	**Independent**	**Interdependent**	**Independent**	**Interdependent**	**Independent**
Self-direction	.299	**.536**	.308	**.650**	.114	**.550**
Power	.021	**.692**	.156	**.790**	.019	**.588**
Security	**.555**	.230	**.587**	.453	**.642**	.090
Hedonism	-.096	**.729**	.153	**.626**	.022	**.700**
Benevolence	**.706**	.119	**.728**	.298	**.750**	.123
Achievement	.305	**.722**	.380	**.774**	.364	**.595**
Stimulation	-.009	**.673**	.282	**.662**	-.068	**.704**
Conformity	**.702**	-.008	**.810**	.195	**.644**	.079
Universalism	**.762**	.163	**.807**	.268	**.724**	.088
Tradition	**.648**	-.119	**.698**	.222	**.718**	-.060

	Rwanda		All Countries	
	Interdependent	**Independent**	**Interdependent**	**Independent**
Self-direction	.431	**.566**	.290	**.622**
Power	.098	**.691**	.071	**.721**
Security	**.707**	.219	**.600**	.304
Hedonism	.139	**.536**	.148	**.635**
Benevolence	**.730**	.192	**.708**	.198
Achievement	.450	**.591**	.350	**.719**
Stimulation	.201	**.624**	.114	**.654**
Conformity	**.779**	.193	**.668**	.210
Universalism	**.582**	.275	**.697**	.119
Tradition	**.607**	.200	**.654**	.095

The means and standard deviations of the interdependent items and independent items are listed in Table 6 and Table 7, respectively. Presented in the tables is a comparison of the average responses to human value survey items for non-users and frequent users of personal computers in each country. The greater than or less than sign represents the magnitude of the average responses between non-users and frequent users for a given item. For example, citizens in Mexico who are non-users of personal computers, on average, value security less than frequent personal computer users (refer to Table 3 that elaborates each item).

When considering the average responses between non-users and frequent users for each factor (i.e., interdependent and independent), it was presumed that non-users will, on average, identify more with items related to the interdependent factor. In contrast, frequent users were expected, on average, to identify more with items that reflect the independent factor. Consistent with these expectations, the items that reflect the independent factor were valued more by frequent users compared to non-users in all seven countries. Contrary to expectations, however, the averages for the interdependent factor revealed mixed results. Non-users of personal computers in Taiwan, Moldova, Indonesia, and Morocco put greater value on the majority of items (at least three of five items) that relate to the interdependent factor compared to frequent-users in these countries.

Table 6: Average Value Responses for Non-Users and Frequent-Users – Interdependent Values

Interdependent Items

Mexico	Non-Users			Freq-Users	
	μ	σ		μ	σ
Security	4.66	1.44	<	5.03	1.13
Benevolence	4.77	1.26	<	5.04	0.95
Conformity	4.08	1.74	<	4.18	1.50
Universalism	4.83	1.22	<	4.88	1.13
Tradition	4.72	1.47	>	4.38	1.51

Taiwan	Non-Users			Freq-Users	
	μ	σ		μ	σ
Security	5.03	0.91	>	4.80	1.01
Benevolence	4.62	1.15	<	4.83	0.89
Conformity	4.49	1.19	=	4.49	1.05
Universalism	4.58	1.12	>	4.24	1.10
Tradition	4.73	1.18	>	3.83	1.36

South Africa	Non-Users			Freq-Users	
	μ	σ		μ	σ
Security	5.03	1.02	<	5.20	1.00
Benevolence	4.81	1.04	<	4.82	0.99
Conformity	4.97	1.07	>	4.76	1.21
Universalism	4.32	1.30	<	4.69	1.18
Tradition	4.87	1.12	>	4.60	1.31

Moldova	Non-Users			Freq-Users	
	μ	σ		μ	σ
Security	4.39	1.31	>	4.34	1.29
Benevolence	4.60	1.11	<	4.63	0.99
Conformity	4.42	1.25	>	4.39	1.16
Universalism	4.44	1.10	>	4.35	1.16
Tradition	4.82	1.11	>	4.54	1.20

Indonesia	Non-Users			Freq-Users	
	μ	σ		μ	σ
Security	4.62	1.14	>	4.45	1.14
Benevolence	4.78	0.96	<	4.97	0.92
Conformity	4.94	1.04	>	4.87	1.01
Universalism	4.96	0.94	>	4.84	0.99
Tradition	5.08	0.96	>	4.83	1.01

Morocco	Non-Users			Freq-Users	
	μ	σ		μ	σ
Security	4.97	1.13	<	5.12	0.98
Benevolence	4.79	1.15	>	4.69	1.17
Conformity	4.51	1.41	>	4.50	1.32
Universalism	4.70	1.26	>	4.36	1.35
Tradition	5.30	0.98	>	4.93	1.11

Rwanda	Non-Users			Freq-Users	
	μ	σ		μ	σ
Security	5.00	1.11	<	5.11	1.23
Benevolence	4.82	1.12	<	4.89	1.11
Conformity	5.03	1.12	<	5.27	1.01
Universalism	4.49	1.40	>	4.31	1.53
Tradition	4.59	1.25	>	4.20	1.58

Table 7: Average Value Responses for Non-Users and Frequent-Users – Independent Values

Independent Items

Mexico

	Non-Users			Freq-Users	
	μ	σ		μ	σ
Self-direction	4.06	1.55	<	4.78	1.15
Power	2.06	1.29	<	2.45	1.32
Hedonism	4.02	1.65	<	4.32	1.47
Achievement	3.86	1.62	<	4.35	1.40
Stimulation	2.61	1.66	<	3.37	1.69

Taiwan

	Non-Users			Freq-Users	
	μ	σ		μ	σ
Self-direction	3.45	1.40	<	4.23	1.20
Power	2.53	1.21	<	2.69	1.19
Hedonism	3.26	1.46	<	4.11	1.27
Achievement	2.66	1.20	<	3.42	1.22
Stimulation	1.83	0.88	<	2.77	1.25

South Africa

	Non-Users			Freq-Users	
	μ	σ		μ	σ
Self-direction	4.84	1.09	<	5.11	0.96
Power	4.09	1.49	>	3.93	1.44
Hedonism	4.34	1.33	<	4.50	1.25
Achievement	4.60	1.21	<	4.74	1.22
Stimulation	3.61	1.62	<	3.87	1.42

Moldova

	Non-Users			Freq-Users	
	μ	σ		μ	σ
Self-direction	4.01	1.39	<	4.84	1.12
Power	2.83	1.38	<	3.33	1.32
Hedonism	2.82	1.45	<	3.64	1.38
Achievement	3.59	1.44	<	4.38	1.12
Stimulation	2.57	1.50	<	3.50	1.46

Indonesia

	Non-Users			Freq-Users	
	μ	σ		μ	σ
Self-direction	4.19	1.34	<	4.63	1.20
Power	2.83	1.55	<	3.05	1.54
Hedonism	3.58	1.36	<	3.87	1.32
Achievement	3.57	1.50	<	4.00	1.28
Stimulation	3.75	1.49	<	4.23	1.25

Morocco

	Non-Users			Freq-Users	
	μ	σ		μ	σ
Self-direction	4.61	1.37	<	5.09	1.05
Power	4.17	1.52	<	4.28	1.49
Hedonism	3.49	1.59	<	4.02	1.40
Achievement	4.25	1.46	<	4.47	1.38
Stimulation	3.25	1.74	<	3.43	1.62

Rwanda

	Non-Users			Freq-Users	
	μ	σ		μ	σ
Self-direction	4.36	1.30	<	4.59	1.15
Power	3.70	1.48	>	3.67	1.28
Hedonism	3.25	1.56	<	3.63	1.56
Achievement	4.19	1.39	<	4.47	1.38
Stimulation	3.70	1.69	<	3.76	1.68

Tables 8 through Table 11 summarize the results of the hypotheses testing. The baseline model, consisting of control variables only, is represented by Model 1. Model 2 includes the control variables, the interdependent and independent factors, and country variables. As illustrated in Table 8, when considering the responses from all seven countries, it appears that individuals with interdependent values are less likely to be frequent users of personal computers ($\beta = .179$, $p < .01$) than individuals with independent values ($\beta = .245$, $p < .01$). The difference in the explained variance between the baseline model and the estimated model is six percent (from $R^2 = .529$ to $R^2 = .589$). Furthermore, the results in both Model 1 and Model 2 indicate that age, gender, employment status, and income are all statistically significant. As expected, age is negatively associated with being a frequent user of personal computers while employment status and income are positively associated with being a frequent user. Also consistent with expectations, males are more likely to be frequent users of personal computers than females. Primary education was not statistically significant in the baseline model but is statistically significant for the full model. In summary, younger males who are employed with higher education, higher income, and associate with independent values are more likely to be frequent PC users.

Table 8: Pooled Logistic Regression

	Model 1				Model 2			
	β		**S.E.**	**O.R.**	**β**		**S.E.**	**O.R.**
Age	-.044	***	.003	.957	-.043	***	.003	.958
Gender	.182	***	.069	1.199	.208	***	.075	1.232
Employed	.743	***	.075	2.102	.526	***	.081	1.691
Inc. primary edu	.290	n.s.	.372	1.336	1.619	***	.401	5.046
Comp. primary edu	.404	n.s.	.331	1.497	2.131	***	.366	8.423
Inc. secondary edu	1.850	***	.270	6.361	3.654	***	.327	38.644
Comp. secondary edu	3.031	***	.258	20.711	4.978	***	.319	145.252
Some University	4.815	***	.280	123.380	6.851	***	.346	944.850
Comp. University	5.084	***	.266	161.474	7.227	***	.333	1376.652
Medium Income	.840	***	.086	2.317	.782	***	.093	2.185
High Income	1.428	***	.117	4.170	1.383	***	.126	3.985
Interdependent	-	-	-	-	-.179	***	.045	.836
Independent	-	-	-	-	.245	***	.044	1.277
Constant	-3.759	***	.282	.023	-5.956	***	.391	.003
R^2	.529				.589			

Note: Each country was assigned a value of 1 and 0 otherwise. The reference point is Rwanda.
Gender (male = 1); * p <.10, **p <.05, ***p <.001

Presented in Table 9 and Table 10 are the results of the estimated model for each individual country. The first column contains the control variables and the interdependent and independent factors. Subsequently, the beta, standard error, and odds ratio are presented for each variable. The interdependent factor is negatively associated with being a frequent user of personal computers for Mexico (β = -.176, $p < .10$), South Africa (β = -.145, $p < .10$), Indonesia (β = -.329, $p < .01$), and Morocco (β = -.329, -.372, $p < .05$). South Africa was the only country for which results were contrary to expectations; the independent factor was negatively associated with being a frequent user of personal computers. As predicted, the independent factor was positively associated with being a frequent PC user in Mexico (β = .399, $p < .01$), Taiwan (β = .397, $p < .05$), Moldova (β = .623, $p < .01$), and Indonesia (β = .404, $p < .01$). Overall, of the seven countries individually analyzed, only Mexico and Indonesia contained statistically

significant results that are in the hypothesized direction for both interdependent and independent factors. Furthermore, with the exception of Rwanda, at least one factor is significant for each country. Refer to Table 11 that summarizes the support of the hypotheses.

Support for the control variables of age, gender, employment status, education, and income is mixed across countries. With the exception of citizens in Rwanda, younger citizens are more likely to be frequent PC users than older citizens. Gender is significant only for Indonesia, where males were more likely to be frequent users than females. Employed citizens in Mexico, South Africa, and Moldova were more likely to be frequent PC users. In Taiwan, Morocco, and Rwanda however, employment status was not significant and in Indonesia, being employed was negatively associated with PC use. Several education variables were included in the model that ranged from incomplete primary education to completed university education. In general, citizens who completed higher levels of education were more likely to be frequent users of personal computers. Results for Moldova and Indonesia indicate a significant but negative association between some education levels and frequent use of personal computers. Also with the exception of Moldova and Indonesia (for which the income variables were not significant), citizens with higher income levels were more likely to be frequent PC users.

Table 9: Logistic Regression Results

	Mexico				Taiwan			
	β		S.E.	O.R.	β		S.E.	O.R.
Age	-.055	***	.008	.947	-.117	***	.011	.890
Gender	.207	n.s.	.226	1.231	.417	n.s.	.258	1.518
Employed	.472	**	.226	1.602	.450	n.s.	.303	1.569
Inc. primary edu	-.942	n.s.	.947	.390	-	-	-	-
Comp. primary edu	-.608	n.s.	.818	.544	-3.354	***	.788	.035
Inc. secondary edu	.538	n.s.	.794	1.713	-2.438	***	.606	.087
Comp. secondary edu	.896	n.s.	.765	2.450	-1.386	***	.366	.250
Some University	3.252	***	.815	25.833	-	-	-	-
Comp. University	3.485	***	.778	32.609	1.882	***	.436	6.564
Medium Income	.856	***	.233	2.353	1.018	***	.272	2.769
High Income	1.941	***	.274	6.968	1.416	*	.799	4.121
Interdependent	-.176	*	.103	.838	.155	n.s.	.157	1.168
Independent	.399	***	.112	1.490	.397	**	.172	1.487
Constant	-1.266		.838	.282	4.613		.651	100.818
R^2	0.64				0.78			

	South Africa				Moldova			
	β		S.E.	O.R.	β		S.E.	O.R.
Age	-.021	***	.005	.980	-.092	***	.012	.912
Gender	.194	n.s.	.131	1.214	-.263	n.s.	.264	.769
Employed	1.240	***	.136	3.454	.439	n.s.	.285	1.551
Inc. primary edu	-	-	-	-	-	-	-	-
Comp. primary edu	-	-	-	-	-	-	-	-
Inc. secondary edu	2.202	***	.523	9.041	-2.274	***	.724	.103
Comp. secondary edu	3.598	***	.514	36.530	-.702	n.s.	.643	.496
Some University	4.818	***	.815	123.779	1.252	*	.667	3.496
Comp. University	5.294	***	.546	199.188	-	-	-	-
Medium Income	1.149	***	.193	3.155	.191	n.s.	.322	1.211
High Income	1.844	***	.233	6.321	.013	n.s.	.445	1.014
Interdependent	-.145	*	.082	.865	-.075	n.s.	.150	.928
Independent	-.138	*	.081	.871	.599	***	.153	1.820
Constant	-5.434		.569	.004	2.409		.885	11.123
R^2	0.44				0.54			

Notes: Gender (male = 1); * p <.10, **p <.05, ***p <.001

Table 10: Logistic Regression Results (continued)

	Indonesia				Morocco			
	β		**S.E.**	**O.R.**	**β**		**S.E.**	**O.R.**
Age	-.030	***	.007	.970	-.054	***	.012	.947
Gender	.499	***	.167	1.647	-.212	n.s.	.266	.809
Employed	-.531	***	.174	.588	-.662	n.s.	.423	.516
Inc. primary edu	-	-	-	-	-	-	-	-
Comp. primary edu	-2.181	*	1.170	.113	1.106	**	.477	3.023
Inc. secondary edu	-1.033	n.s.	.944	.356	2.440	***	.426	11.468
Comp. secondary edu	.759	n.s.	.622	2.136	4.875	***	.401	130.946
Some University	2.378	***	.656	10.782	-	-	-	-
Comp. University	2.986	***	.622	19.810	-	-	-	-
Medium Income	.044	n.s.	.200	1.045	1.020	***	.386	2.773
High Income	.232	n.s.	.289	1.261	3.623	***	.569	37.442
Interdependent	-.325	***	.107	.722	-.372	**	.145	.690
Independent	.403	***	.089	1.496	.154	n.s.	.144	1.166
Constant	-1.685	**	.676	.186	-.923		.670	.397
R^2	0.43				0.64			

	Rwanda			
	β		**S.E.**	**O.R.**
Age	-.027	n.s.	.018	.974
Gender	.492	n.s.	.432	1.635
Employed	-.788	n.s.	.499	.455
Inc. primary edu	-.936	n.s.	1.105	.392
Comp. primary edu	-	-	-	-
Inc. secondary edu	1.544	**	.656	4.683
Comp. secondary edu	3.406	***	.546	30.137
Some University	-	-	-	-
Comp. University	5.325	***	.975	205.391
Medium Income	1.202	**	.483	3.327
High Income	1.792	*	.964	6.001
Interdependent	-.147	n.s.	.234	.863
Independent	.308	n.s.	.253	1.361
Constant	-3.879		.856	.021
R^2	0.46			

Notes: Gender (male = 1); * p <.10, **p <.05, ***p <.001

Table 11: Hypotheses Support Summary

	Interdependent < Freq. Users	Independent > Freq. Users	Support
All Countries	Yes	Yes	Yes
Indonesia	Yes	Yes	Yes
Mexico	Yes	Yes	Yes
Moldova	No	Yes	Partial
Morocco	Yes	No	Partial
Rwanda	No	No	No
South Africa	Yes	No	Partial
Taiwan	No	Yes	Partial

Note: 'All Countries' represents the pooled sample

DISCUSSION

In general, factors of interdependent values and independent values predicted citizens' PC use behavior. Specifically, the results of the pooled analysis indicated that citizens who associate more with interdependent values more likely to be non-users of personal computers whereas citizens who associate more with independent values were more likely to be frequent PC users. The results for the individual country analysis are, to some extent, consistent. Either the interdependent or the independent factor was significant in predicting PC use behavior: interdependent values negatively associated with PC use or independent values positively associated with PC use in all but Rwanda, and both factors were significant for citizens in Indonesia and Mexico.

Gudykunst, Matsumoto, Ting-Toomey, Nishida, Kim, and Heyman (1996) argue that an individual's behavior is affected by his or her value priorities is one justification for why the frequency of PC use may be influenced by interdependent and independent values. Further, Bretones and Gonzalez (2011) argue that predominate values are dissimilar across nations, which can explain why citizens are likely to identify with one or the other set of values, and also

explain why both factors did not predict PC use behavior for the majority of countries. There is also an explanation for both interdependent values and independent values being significantly associated with PC use behavior in Mexico and Moldova. According to Gudykunst et al., (1996) and Triandis (1995), individualism and collectivism are evident in all nations and, while predominate values do exist, it is possible that "the respondents in the sample may not represent the predominate cultural individualism-collectivism tendency," (Gudykunst et al., 1996:514) or in this case, the independence-interdependence orientation.

Results for the control variables warrant attention. The role of gender was contrary to expectations, as gender was only significantly associated with PC use in Indonesia. Interestingly, gender is significant for Mexico, Taiwan, and Rwanda when the interdependent and independent factors are excluded from the model, but remains non-significant for South Africa, Moldova, and Morocco. This suggests a potential values divide rather than a gender divide in PC use. Further investigation is warranted that examines gender's association with values that affect ICT use.

Regarding age, six of the seven countries indicate that younger citizens were more likely to be frequent PC users than older citizens. The non-significance of age in Rwanda is likely due to the rarity of personal computer use in the country, as descriptive statistics indicate that of the Rwandans sampled, 96 percent of them are non-users of personal computers.

For the majority of countries, employment status (being employed) was not a significant predictor of PC use behavior. The results for Mexico and South Africa, however, were as anticipated; there was a positive association between current employment and PC use. In Indonesia, being employed was negatively associated with PC use. This unexpected result for Indonesia is possibly justified by the type of work citizens are engaged in, as the country's main

industries (e.g., agriculture, mining, textile and apparel; InterNations, 2013) likely require limited, if any, use of personal computers.

For the majority of countries, higher education and income is associated with frequent PC usage. Results for Moldova and Indonesia, however, indicate that lower education levels were negatively associated with PC use. This suggests that not all education levels are created equal when it comes to their influence on ICT use; primary and secondary education in particular seems less relevant than higher education. Further investigation revealed that both countries ranked low in the number of PC owners per 1000 (in 2004 Moldova, 29; and Indonesia, 14; World Bank, 2013), compared to the other countries in the sample. It is possible that Moldova's declaration as an independent state and Indonesia's financial crisis, both occurring in the 1990's, had a long-term effect on factors (e.g., socioeconomic status and unemployment) associated with ICT adoption and use. Future research on ICT use in Moldova and Indonesia will be particularly valuable as the Moldovan and Indonesian governments have introduced initiatives to improve ICT access and use as a means to improve national economic development (OpenNet Initiative, 2013).

CONCLUSION

The empirical results support my hypotheses that individuals who associate with interdependent values are more likely to be frequent PC users compared those who associate with independent values. I used data from a global research project that consisted of items that pertained to the ten universal human values developed by Schwartz (1992). The two anticipated factors—interdependent values and independent values—were then used to test the estimated model, which controlled for socioeconomic and demographic variables. Results indicated that interdependent values and independent values, indeed, have opposite associations with PC use

behavior. One limitation of this study is that the number of items per human value is constricted, which limited the number of countries used in the analysis. Future research will determine whether multiple items per human value makes a difference in the factor analysis and number of countries their items loadings.

Chapter 4

The Digital Divide's Gender Gap: A Biosocial Theory Perspective

Gender inequality has existed for centuries and is universally evident in all countries (Gillard, Howcroft, Mitev, and Richarson, 2008). Though gender equality is pertinent to the development of a society (MDG, 2010), women in the United Sates have had the right to vote for less than a century and disparities in public and private life persist across the globe. While attending a conference in Saudi Arabia, Bill Gates was asked about the likelihood of the country becoming a top nation in the world in technology. To the audience seated in segregation by gender, of which four-fifths were men, he answered, "Well, if you're not fully utilizing half the talent in the country, you're not going to get too close to the Top 10" (Kristof and Wudunn, 2009). As governments embrace the importance of females to achieving prosperity, legislation continues to be passed that ensures equal treatment of women under the law. For example, the Lilly Ledbetter Equal Pay Act, guarantees equal compensation for equal work in the US by strengthening existing equal pay laws. The Act was passed by the Federal Government in 2009 and was the first piece of legislation Barack Obama signed following his presidential inauguration. Although laws are changing to provide females with equal rights and greater opportunities, cultural bias toward females persists and disproportionately disadvantages women and girls.

Studies that address gender as a contributing factor to the digital divide are part of *gender divide* research (refer to Table 1a-c for a summary of the literature). These studies are categorized as gender divide research because they tests for differences in access or use of ICTs by gender and/or investigate (potential) *reasons* for differences in access or use of ICTs by males and females. Studies that can be classified as the latter, answer a call by Kennedy, Wellman, and

Klement (2003) for researchers to move from describing gender divides by simply testing to confirm or deny they exist, to explaining gender divides by exploring the reasons why they manifest in the first place; these studies, however, are in the minority. I argue that gender inequality may be one such reason for variation in ICT use and that, because gender equality is a cultural variable, it should be treated homogeneously within countries and therefore used accordingly to predict differences in ICT use between countries.

While examining gender differences in digital divides has been common practice by IT researchers, a majority of them have not investigated the gender divide using theoretical reasoning. Rather, gender has been treated as an individual-level variable that can inherently predict variability in ICT access and use. Researchers have offered post-hoc explanations for gender divides, but explanations grounded in theories of culture and sociology are less common (van Dijk, 2006).

Table 1a: Review of Digital Divide Research That Consider Gender

Citation	Sample	Control	Theory	Sample	Significant	Comments
Akhter (2003)	Individuals	No	No	US	Yes	-Men are more likely to make purchases over the internet than women.
Belanger (2009)	Individuals	No	No	US	Yes	-Gender is not predictor of access divide.
Bimber (2000)	Individuals	No	No	US	Yes	-Gender gap in internet access exists but not because of gender itself but rather socioeconomic factors. Same result found for internet use but also attributes gender-specific factors.
Broos (2005)	Individuals	No	No	Europe	Yes	-Women have more negative attitude toward ICTs than men.
Chen & Wellman (2004)	Country	n/a	n/a	Multiple	n/a	-Men are more likely than women to access and use internet, however, the gender divide is narrowing in more than half of their country sample.
Cooper (2006)	Individuals	No	No	US	Yes	-Females primed with their student identity performed better than student primed with their female identity.
Hargittai & Hinnant (2008)	Individuals	Yes	No	US	Yes	-Women more likely to report lower levels of understanding Internet-related terms.
Hargittai & Shafer (2006)	Individuals	No	No	US	Yes	-Women report lower self-assessed skills than men. Online abilities did not significantly differ between men and women.
Hargittai (2002)	Individuals	No	No	US	No	-No significant difference between men and women finding content on the web.
Hassani (2006)	Individuals	Yes	No	US	Yes	-Women search health information more than men.

Table 1b: Review of Digital Divide Research That Consider Gender

Citation	Sample	Control	Theory	Sample	Significant	Comments
Hsieh et al., (2008)	Individuals	No	Yes	US	Yes	-Gender moderates the relationship between self-efficacy and perceived behavioral control.
Kennedy, Wellman, and Klement (2003)	Individuals	No	Yes	US & Canada	Yes	-Women use the internet more for social reasons while men use internet more for instrumental and solo recreational activities. Care-giving for children at home limits internet use for women more than men.
Korupp and Szydlik (2005)	Individuals	No	Yes	Germany	Yes	-Women less likely to use the computer or internet than men.
Loges & Jung (2001)	Individuals	Yes	No	US	Yes	-Differences in internet access.
Martin & Robinson (2007)	Individuals	Yes	No	US & Europe	Yes	-Sex differences in internet use found European and US--Europe equalizing more slowly.
Odell, Korgen, Schumacher, and Delucchi (2000)	Individuals	No	No	US	Yes	-Gender gap in internet use is not evident. Sex differences in the purpose of using the internet.
Ono and Zavodny (2003)	Individuals	No	No	US	Yes	-Internet access gap between sexes ameliorated over time. Gender gap persists with frequency of use.

Table 1c: Review of Digital Divide Research That Consider Gender

Citation	Sample	Control	Theory	Sample	Significant	Comments
Ono and Zavodny (2005)	Individuals	No	No	US & Japan	Yes	-Gender differences in IT use and skill existed during mid 1990's in the US and Japan. The US gender gap later diminished for the US but continue to be an issue for Japan.
Shashaani and Khalili (2001)	Individuals	No	No	Iran	Yes	-Gender differences regarding ender-stereotypical beliefs about computers.
Wasserman and Richmond-Abbot (2005)	Individuals	No	No	US	Yes	-Women use internet less frequently than man. SES does not influence frequency of use. Gender difference on how internet is used is evident.
Wei et al. (2011)	Individuals	No	Yes	Singapore	Yes	-Females have lower computer self-efficacy than males. Home computer use is lower for females than males.

Research commentaries on the directions for future digital divide research do not suggest it is necessary to further investigate the influence of gender on ICT adoption and use (e.g., Chon, 2001; Dewan and Riggins, 2005; Hargittai, 2003; Payton, 2003). To the contrary, Kennedy, Wellman, and Klement (2003) argue that, the inclusion in digital divide studies of gender as a primary predictor of divides absent any theoretical support for this idea, is evidence that more research is warranted to understand how gender divides actually come to be.

It is assumed that access divides between males and females will eventually narrow as gaps in socioeconomic factors (i.e., income and education) narrow (e.g., Bimber 2000); however, in countries (e.g., United States) where the gender income gap continues to increase (Beck, 2011), this is a problematic determination. Some research concludes that the gender access divide in Northern America and North-Western European countries no longer exists but other

inequalities, such as skills and use, continue to grow (van Dijk, 2006). From yet another perspective, Korupp and Szydlik (2005) relate that human capital and the social context that consists of generation, gender, ethnic background, and region are more influential factors on private computer and internet use than that of economic capital.

A limited number of studies have specifically examined the gender gap in ICT adoption and use, but further investigation of the gender divide is warranted for several reasons. First, when gender is examined in relation to the digital divide it has been studied as both a between-country and within-country phenomenon. Theoretically and statistically this issue deserves clarification to the extent that a single factor cannot both be homogeneous within countries and predict variance within countries (Klein, Dansereau and Hall, 1994). Second, when the digital divide is studied between countries, cultural dimensions are (a) rarely used to predict the divide, and (b) when incorporated, have not been used to choose sample countries in a way that works to control potential confounding factors (like dimensions of national culture that are not used as predictors). Third, digital divide research continues to be limited by geographic scope, with a disproportionate number of studies being conducted in the United State or between/among the US and other country/countries. Finally, studies of gender divide rarely invoke theory that can explain the disparity between males and females (exceptions are Wei et al., 2011 and Chen and Wellman, 2004).

The present research concentrates on the gender divide, defined as the gap between the sexes in their opportunities to access and use information and communication technologies. Gender gaps in the access and use of technology require a theoretical explanation and more careful investigation into such differences. Economic opportunities are at stake as research

shows that the ability to use ICTs provides advanced economic incentive in employment and the like (Ono and Zavodny, 2003).

Answering several calls for research, the purpose of this essay is to bring the issue of the gender divide in ICT use to the forefront of digital divide research and to provide a theoretical foundation and an understanding of a phenomenon that prior studies have taken for granted. Kennedy et al. (2003) made a call for more research to explain how disparities in technology access and use come about and why various divides, including the gender divide, manifest. In addition, van Dijk (2006) suggested there is a need for research that is theoretical and that is interdisciplinary to understand the role of social, cultural, and psychological causes associated with ICT inequalities. Finally, and more recently, Gillard, Howcroft, Mitev, and Richardson (2008) found few studies on the theme of gender and ICT in their quantitative review of relevant studies from several journals between the years of 2000 and 2006.

The approach to the present research is an examination of the gender divide in personal computer use based on an analysis of gender role attitudes of citizens across countries across. Following a methodology similar to Sia et al. (2009) who select their country samples based on differences on a national culture measure, the countries investigated in this study were chosen based on the GLOBE project's (House et al., 2001) gender egalitarianism practice measure. To my knowledge, this will be the first study to examine the impact of gender attitudes on ICT use. This perspective is distinct from past research that examines individual attitudes towards ICTs but does not account for cultural influences (e.g., Broos, 2005; Kennedy, Wellman, and Klement, 2003). The biosocial theory of Wood and Eagly (2002) is adopted to justify the assertion that it is not the innate physical attributes of the sexes that perpetuates the gender divide but rather the

societal structure developed by individuals within their homogeneous group that contributes to gender role expectations and, thus, expectations of ICT use behavior for males and females.

THEORETICAL BACKGROUND

Biosocial Theory

Although there is a lack of research that provides theoretical research to explain the digital divide (Cilan, Bolat, and Cscokun, 2009; van Dijk, 2006), which is generally evident in the subject area of gender and IT (Trauth, 2004; 2006), there are exceptions to this deficiency. One such exception is Trauth's (2002) application of essentialist and social constructionist perspectives to formulate an alternative theory for women in the IT workforce—the Individual Differences Theory of Gender and IT—derived from the author's study conducted in Australia and New Zealand. In the same year, Wood and Eagly (2002) published a more thorough investigation of both essentialist and social constructionist theories and extensively analyzed the research on a variety of observed gender differences. In contrast to Trauth's theory that is limited to explanation of gender trends in the IT workforce, biosocial theory can be applied to explain the multitude of behavioral differences exhibited by males and females.

The present research employs biosocial theory that was developed by Wood and Eagly (2002) and that states gender differences in social behavior that vary across societies is a function of both innate physical attributes of males and females and the social structure of societies. This theory combines two prominent perspectives—social constructionist theory and essentialist theory—that have been used to explain sex differences. Social constructionist theory is a sociology theory that assumes that gender difference in sex-typed behaviors vary across societies and are mainly attributed to cultural beliefs of the people themselves. Essentialist theory is part of evolutionary psychology and attributes gender differences in social behavior to

biological differences between males and females that are fixed and inherent and from which evolve sex-specific psychological dispositions (Wood and Eagly, 2002).

According to the biological aspect of the theory, there are physical attributes specifically associated with males and females. Males typically have skill that consists of greater speed, size, and body strength compared to females who have childbearing and nursing capabilities. Wood and Eagly (2002) state that the physical differences between males and females interact with the societal structure to influence the roles taken on by men and women since certain tasks are more efficiently accomplished by one or the other sex. In short, sex-typed roles within a society are primarily determined by:

> (a) the essential sex differences represented by each sex's physical attributes and related behaviors, especially women's childbearing and nursing of infants and men's greater size, speed, and upper-body strength and (b) the contextual factors represented by the social, economic, technological, and ecological forces present in a society (Wood and Eagly 2002:702).

Biosocial theory can be used to explain variance in gendered behavior across groups of people. Based in culturally prevalent values and beliefs, traditional gender roles are related to the fulfillment of domestic activities (e.g., cooking) for women and productive activities (e.g., resource acquisition) for men. These stereotypical beliefs and expectation of behavior are formulated and, in turn, are further reinforced when the division of labor along gender lines continues. One task commonly associated with the female gender is the nurturing of infants (Wood and Eagly, 2002), which can hinder women's capital enhancing opportunities. As women leave their jobs to tend to their family their acquired job skills become limited (Estevez-Abe, 2005). To combat this problem, cultures have evolved; many post-industrial societies now encompass widely available alternatives such as third party child-day care and early supplemental feeding of infants that allow women to participate in other productive activities.

Wood and Eagly (2002) argue that gender roles result from social expectations and actual behaviors of individuals and can be described in the following way (p.701):

> ...gender roles emerge from the productive work of the sexes; the characteristics that are required to carry out sex-typical tasks become stereotypic of women and men. To the extent that women more than men occupy roles that involve domestic activities (e.g., cooking, provision of emotional support), the associated skills, values, and motives become stereotypic of women and are incorporated into the female gender role. To the extent that men more than women occupy roles that involve economically productive activities (e.g., resource acquisition, construction of goods for exchange), the associated skills, values, and motives become stereotypic of men and are incorporated into the male gender role.

Sex-typed behavior based on traditional gender roles is typical of *patriarchy,* defined as "men possessing structural control of economic, legal, and political institutions" (Glick and Fiske, 1996:492). Patriarchy reinforces traditional gender roles and is believed to be a universal social structure. Though the form and severity of patriarchy vary across cultures (Glick and Fiske, 1996), its severity is significantly and negatively related to gender equality across countries (Glick et al., 2000). Biosocial theory dictates that patriarchy emerges differently across cultures based on the degree to which men's physical size and strength facilitate, and women's reproductive activities conflict with, the efficient performance of tasks that produce the most status and power (Wood and Eagly, 2002). The consequences of patriarchy are that women lack authority, power and control and that economic activities are regarded as superior to reproductive activities, which undoubtedly leads to greater social status being attached to men than to women (Wood and Eagly, 2002).

HYPOTHESIS DEVELOPMENT

Gender roles vary to some extent across societies. Wood and Eagly (2002) state, "sex-typed behavior is a product of the sexes' reproductive activities and physical attributes in conjunction with the organizational demands of societies and the local environments" (p.709).

The authors found that some societies accepted females conducting tasks that are often male dominated in other societies. In some modern societies, males are often seen as better fit than females as political leaders, business executives, and breadwinners (House et al., 2004). This social mentality hinders female opportunities to participate in such economic and civic roles, as expectations of sex-typical tasks contribute to stereotypical views of what domains are appropriate for males and females (Wood and Eagly, 2002).

The perception of traditional gender roles, which contribute to gender inequality, in itself exemplifies a degree of gender stereotyping that leads to assumptions by males and females of what is expected of them (Wood and Eagly, 2002). This is consistent with the idea that traditional gender-oriented work results in unequal socioeconomic status of women compared to men and contributes to the disparities of technology access and use between the sexes (Wasserman and Richmond-Abbott, 2005). As related to technology, research has indicated that the disadvantage of females compared to their male counterparts can result in a technology gender divide, in addition to education and employment divides (Charles, 1992 and Klasen, 2000).

The present research asserts that, while the essentialist dimension of biosocial theory is certainly important to the explanation of behaviors that favor either male or female physical attributes, it does not logically explain gender differences in technology use because men's greater size and strength or women's childbearing and nursing capabilities are irrelevant to functioning of ICTs. This explanation is supported by research that supports the relationship between gender and IT as a socio-cultural manifestation rather than one inherent to biology (Trauth, 2002; Trauth et al., 2004). More generally, Schwartz and Rubel (2005) also challenge

the essentialist perspective and the ability of evolution to explain sex differences in value priorities; they suggest the social element as the more likely justification for the disparity.

As suggested by biosocial theory, there is empirical support for the idea that contexts represented by the social and ecological conditions present in societies codify gender roles and other social structures that influence one another, and in turn impact behavior, like the use of technology. In the US, for example, Bimber (2000) finds gender parity in internet access, and cites influential factors such as women's status in the societal structure and their human capital as the primary drivers of the equality. The author also suggests, however, that online content may widen the gender gap in internet use as the content and services of the web "might then reinforce stereotypes" (Bimber, 2000:8). In contrast to Bimber's justification, Wasserman and Richmond-Abbot (2005) advocate that the internet, in and of itself, will lessen the gender divide in web knowledge in two primary ways. First, the internet provides more opportunity for women to engage in social activities (e.g., financial, scientific, governmental) than was available to them prior to the medium. Second, females' online participation will naturally improve their internet-related knowledge. This expanded increase in female internet-related knowledge is expected to lead to greater use of the internet, perpetuating the cycle of knowledge gain and increased internet use. While the internet is certainly a medium that provides the opportunity to both sexes to learn and engage in more social activities, societies with high gender inequality and strong gender stereotypes may especially influence females' ability to access, and willingness to use, technology to begin with.

Attitudes toward traditional gender roles are expected to be homogeneous within cultures and vary across cultures that differ on scores of gender equality. That is, individuals living in lower gender equality countries are more likely to support traditional gender roles than

individuals living in higher gender equality countries (Glick et al., 2000). Specific to technology, personal computer use by females is predicted to be less consistent with traditional gender roles than PC use by men; therefore, the gender divide in personal computer use should be greatest in cultures with the lowest gender equality.

That males will more frequently use PCs than females is consistent with a) the idea that as technologies are introduced in patriarchal societies, men are usually assigned the task of learning and utilizing these new systems (Wood and Eagly, 2002), and b) the definition of technology gender divide. Wood and Eagly (2002) have attributed such divides to the knowledge and skills advantage that men have had time to develop and from which women are deprived due to the disruption of their reproductive activities and related expectations. Therefore, based on the logic of biosocial theory, attitudes that attribute greater technology use by males to their innate ability rather than their advantage of opportunity are gender bias and increase the gender inequality in cultures generally and the gender divides in technology use in particular.

In addition to being consistent with biosocial theory, the idea of gender influence on technology use is also supported by the literature. Overall, research shows that gender stereotypes, particularly in fields that are supposedly masculine or male dominated (e.g., information technology, science, and mathematics) negatively impact females in their engagement and/or performance in these fields (Anderson, 1987; Hargittai and Shafer, 2006). More specifically, technology use has a certain level of prestige attached to it, both because it takes evolving skill to utilize it and because it is associated with productive economic activity. Thus, the higher status and power that men experience in society likely leads them to utilize technologies more than women. This idea is also empirically supported by much of the digital

divide research that has shown men use computers and the internet more than women (See Table 1 in Chapter 1) and that gender stereotypes surrounding computer use do exist (Cooper, 2006; Shashaani and Khalili, 2001). Supported by this empirical work and based on biosocial theory, I argue that attitudes that are consistent with traditional gender roles will increase the gender divide in PC use.

Patriarchal attitudes, such as traditional beliefs that men should be the bread-winners and women be the caregivers, are negatively related to gender equality (Glick et al., 2000). As a result, it is likely that gender disparities in technology use uniformly manifest in societies based on the degree to which men have come to establish an advantage over women in certain skills and knowledge required to utilize technologies. Therefore, males' extensive participation with technology should subsequently result in technology use being attributed primarily to males and the institutionalization of tradition that favors providing opportunities to men over women generally, and specifically where technology is concerned. Furthermore, given that power and economic opportunity are associated with ICT use (van Dijk, 2006), patriarchal attitudes associated with gender equality that support the idea that economic opportunities are more important for males than females should also work to increase the gender divide in PC use. **Therefore, patriarchal attitudes are expected to vary based on the** culture individuals live in and be negatively associated with the frequency of computer use by females across countries; however, this association is expected to be stronger in countries with low gender equality than in countries with high gender equality. Based on biosocial theory that associates patriarchal attitudes negatively with gender equality, the following hypothesis is stated:

> Hypothesis 1*: The positive association between gender egalitarian attitudes and frequency of personal computer use will be stronger in lower gender egalitarian countries than in high gender egalitarian countries.*

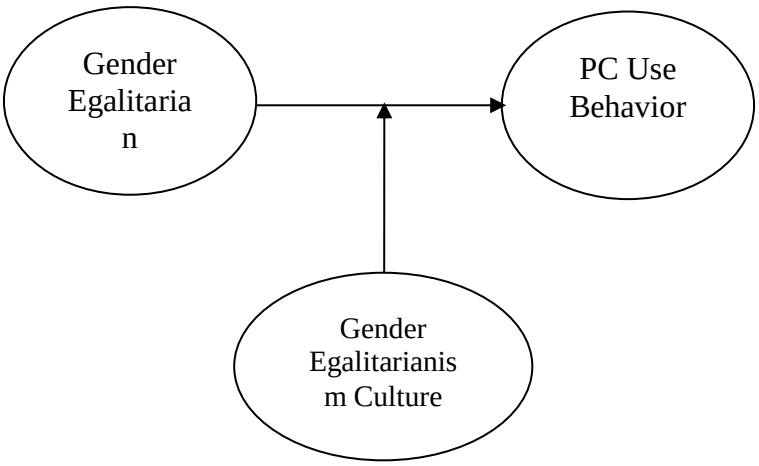


Figure 1: Gender Egalitarian Attitudes Theoretical Model

METHODOLOGY

Sample and Data

The sample consisted of 3,296 individual participants in the World Values Survey from three countries—Poland (1,000 participants), Japan (1,096), and South Korea (1,200). The World Values Survey has been conducted in six cross-sectional waves that began in 1990 and has continued into 2012. The present research makes use of the data collected during the 2005 to 2007 wave period. The World Values Survey consists of questions that relate to individual attitudes toward gender equality, culture, environment, and family (to mention a few). The survey is conducted in person as part of structured interviews with participants from nearly 100 nations.

Following the rationale of Sivakumar and Nakata (2001), Poland, Japan, and South Korea were chosen as sample countries based on their respectively high, moderate and low levels of gender egalitarianism practice and similar scores of gender egalitarianism value (see Table 2), both measured by the Global Leadership and Organizational Behavior Effectiveness (GLOBE)

project (House et al., 2004). According to House et al. (2004), gender egalitarianism is defined as, "the extent to which an organization or a society minimizes gender role differences and gender discrimination." This approach has been employed in order to maximize the variance of the variable of interest—gender egalitarianism practice—while holding relatively constant the potential confounding factor of gender egalitarianism value.

Table 2: Gender Egalitarianism Measure

Country	Band (Level)	Score	Sample Size
Poland	A	4.02	1000
Japan	B	3.19	1096
South Korea	C	2.50	1200

Operationalization and Measurement

Dependent Variables

The dependent variable is *PC use behavior*, which was coded dichotomously: 0 for non-users of personal computers and 1 for frequent users of personal computers.

Independent Variables

The *gender attitudes* factor was operationalized with four questions related to individuals' level of support for behaviors and ideas associated with traditional gender roles. An example question is, "University is more important for a boy?" *(4-point scale from strongly agree to strongly disagree).* *Egalitarianism* is modeled as a moderator and is varied using Poland, Japan, and South Korea (Sharma, Durand, and Gur-Arie, 1981).

Control Variables

Controls of age, education, income, and employment status are included in the analysis. Age is a continuous variable. Education levels are dichotomized as *1 = completed and 0 not completed* for primary, secondary, and tertiary education levels. Income levels are also dichotomized, for example, *1 = High Income and 0 otherwise*. Employment status is coded as *1 = Employed and 0 = Unemployed*.

Statistical Analysis

Prior to running the estimated model, a factor analysis was conducted on the items that related to gender attitudes. The generated latent variable was used in a series of logistic regressions for each country in the study. An illustration of the statistical model is shown in Figure 2. An alternative method using structural equation modeling is presented in Appendix B.

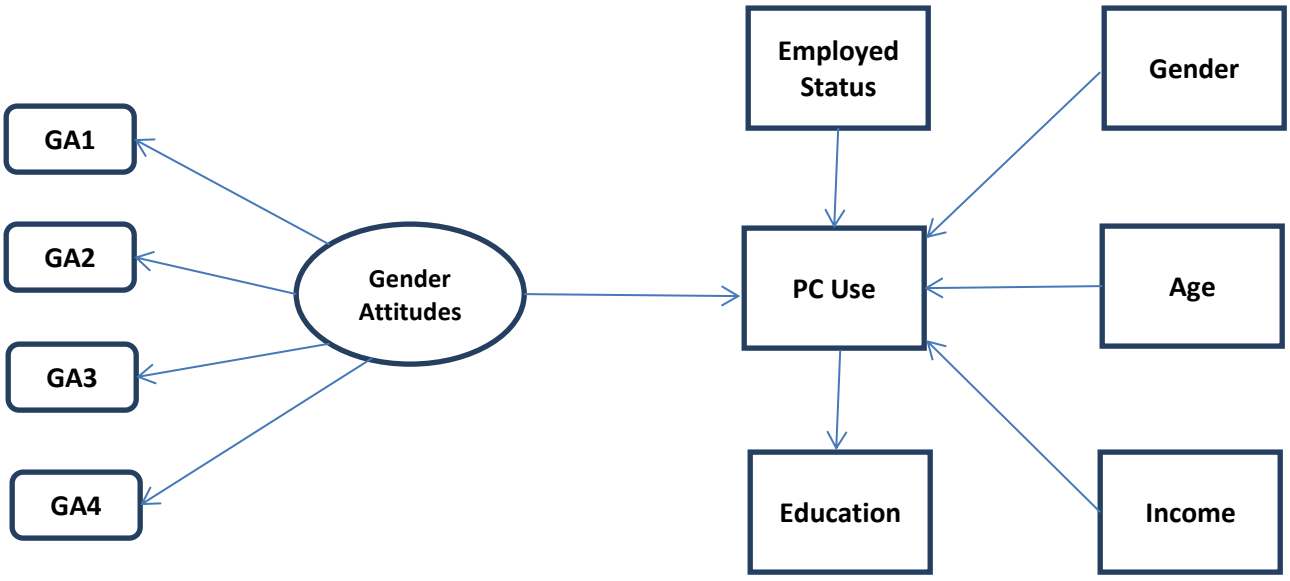


Figure 2: Gender Attitudes Statistical Model

RESULTS

Table 2 presents descriptive statistics for the socio-demographic variables and frequency of personal computer use. After the first column, sample countries are subdivided by males and females to facilitate comparison. As illustrated in Table 3, male citizens in all three countries are more frequent personal computer users than females; however, Poland has less of gender gap in PC use behavior than Japan and South Korea.

Table 3: Descriptive Statistics

	Poland		**Japan**		**South Korea**	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
Sample size	512	488	483	613	598	602
***Personal Computer* - Non-user**	34%	35%	17%	34%	10%	18%
***Personal Computer* - Frequent User**	17%	14%	29%	20%	40%	32%
Unemployed	25%	29%	9%	24%	14%	32%
Employed	26%	19%	35%	32%	34%	20%
Education - Mean (Std Dev.)	4.95 (1.685)	5.30 (2.039)	7.19 (1.836)	6.64 (1.573)	7.60 (1.819)	7.13 (1.970)
Age- Mean (Std Dev.)	46 (18)		48 (16)		41 (14)	

Relative to gender egalitarianism practice, questionnaire items were considered that relate to respondents' attitudes towards gender roles. I began with 10 items from the World Values Survey that appeared to be relevant to gender attitudes. Then, separate exploratory factor analyses for each country were run on these items. For each country a 3-factor structure resulted but the items that loaded on two of the three factors were not uniform across countries. The items that that did not coincide with the theory and whose coefficients were less than .50 were

removed (Papanastasiou, 2005, p. 18). Due to this result, I maintained the single factor for which the items loaded consistently, and accepted this as the gender attitudes construct.

Table 4 displays the aforementioned questionnaire items utilized in the present study followed by the factor analysis results of the measurement models, including those for the pooled sample. Dimension reduction was accomplished using principal component analysis with varimax rotation on seven items with a sample from another time period. This reduction resulted in a one-factor measurement model of gender attitudes that account for 52.8%, 60.8%, and 61.4% of the variance for Poland, Japan, and South Korea, respectively.

Table 4: Measurement Models

		Poland	**Japan**	**South Korea**
	Items	**Item Loading on Construct**	**Item Loading on Construct**	**Item Loading on Construct**
Gender Attitudes	Men should have more right to a job than women	.520	.645	.618
	Men make better political leaders	.786	.782	.821
	University is more important for a boy	.743	.810	.821
	Men make better business executives than women do	.822	.867	.854

A multicollinearity test was performed on the four items in which all TOL indices were >.10 and all VIF measures < 3, which indicated no presence of multicollinearity (Belsley, Kuh, and Welsch, 1980; Hair, Anderson, Tatham, and Black, 1995). Thus, the final measurement model results were utilized to estimate the logistic models.

Presented in Table 5 for each country are the mean and standard deviation of the items that make up the latent variable. The scale for each item ranged from 1 (strongly agree) to 4 (strongly disagree). Poland has higher mean values indicating that more citizens disagree with

the notion that men should be, or are considered to be, more deserving over women when it comes to jobs, politics, and education solely because of their gender. Compared to Poland, the mean values for Japan are lower and are yet lower for South Korea. The only exception is the average for item three since more citizens in South Korea than Japan disagree that higher education is more important for boys than girls. The pattern of average responses is consistent with expectations given the GLOBE gender egalitarianism score for the three countries (House et al. 2004).

Table 5: Mean and Standard Deviation of Gender Attitude Items

	Poland		**Japan**		**South Korea**	
	Mean	**Std Dev.**	**Mean**	**Std Dev.**	**Mean**	**Std Dev.**
Men should have more rights to a job than women	2.24	0.88	1.93	0.70	1.93	0.78
Men make better political leaders	2.57	0.81	2.65	0.70	2.44	0.83
University is more important for a boy	3.03	0.74	2.86	0.72	2.96	0.84
Men make better business executives than women do	2.80	0.80	2.76	0.75	2.58	0.88

Note: All scales range from 1 (Strongly Agree) to 4 (Strongly Disagree)

The results of the pooled logistic regression are presented in Table 6. The first column contains the control variables (gender, age, employment status, education, income, and country dummies) and the predictor variable, gender attitudes. With the exception of secondary education, all the control variables are significant and in the expected direction. Gender and age are negatively associated with PC use, meaning males and younger citizens are more likely than females and older citizens to be frequent PC users. Employed citizens are also likely to use the PC more

often than unemployed citizens. Furthermore, the more education and income individuals have, the more likely they are to be frequent PC users. Finally, with respect to country variables, citizens of both Japan and South Korea are more frequent PC users, on average, than Polish citizens.

Table 6: Pooled Logistic Regression

	β		S.E.	O.R.
Gender	-.814	***	.168	.443
Age	-.097	***	.006	.908
Employed	.881	***	.165	2.414
Some Secondary Education	.231		.323	1.259
Completed Secondary Education	1.216	***	.310	3.373
Some University Education	1.860	***	.385	6.422
Completed University Education	2.814	***	.356	16.681
Medium	1.079	***	.179	2.943
High Income	1.715	***	.320	5.558
Gender Attitudes	.374	***	.084	1.453
Japan	.900	***	.253	2.459
South Korea	1.066	***	.219	2.905
Constant	1.775	***	.388	5.900

Note: Gender (Male = 0)
* p <.10, **p <.05, ***p <.001

The individual country results of the logistic regression are presented in Table 7. The first column contains the control variables and the predictor variable, gender attitudes. The results are categorized by country. The following columns show the results for Poland, Japan and South Korea, respectively. The gender attitudes factor was not statistically significant for Poland but was significant for Japan ($\beta = .755$, $p < .01$) and South Korea ($\beta = .365$, $p < .05$). Interpreting the positive coefficients for the gender attitudes variable, the likelihood that citizens will be frequent PC users increased for citizens who disagree with the idea that males should have an advantage over females in education, politics, and employment.

In addition to the gender attitudes factor, gender, age, employment status, education, and income were included in the analysis as control variables. With regards to gender in all three

countries, males were more likely than females to be frequent PC users, hence the negative association (male = 0). These results corroborate similar results from the extant research (e.g., Bimber 2000, Korupp and Szydlik, 2005, and Wasserman and Richmond-Abbot, 2005). Age was negatively associated with an individual being a frequent PC user for all three countries. In all three countries there was a positive association between tertiary education and frequent computer use. Additionally, secondary education for Polish citizens was significant with frequent PC use, but only if completed. Secondary education for citizens in Japan and South Korea was not significant. As for individuals' income, citizens who are medium or high income earners were more likely than low income earners to be frequent PC users in all three countries.

Table 7: Logistic Regression Results for Poland, Japan, and South Korea

	Poland				Japan				South Korea			
	B		S.E.	O.R.	B		S.E.	O.R.	B		S.E.	O.R.
Gender	-.418	*	.249	.658	-1.125	***	.355	.325	-1.131	***	.362	.323
Age	-.092	***	.009	.912	-.071	***	.012	.931	-.130	***	.014	.878
Employed	.587	**	.254	1.798	.852	**	.335	2.345	.865	***	.331	2.376
Some Secondary Education	.351		.410	1.420	1.043		1.025	2.837	.456		.744	1.578
Completed Secondary Education	2.039	***	.471	7.683	.992		.723	2.697	.866		.567	2.378
Some University Education	1.301	**	.530	3.672	.098		1.194	1.103	2.499	***	.724	12.169
Completed Unveristy Education	1.568	**	.671	4.797	2.554	***	.771	12.862	2.947	***	.635	19.042
Medium Income	.995	***	.262	2.704	.939	***	.344	2.557	1.290	***	.385	3.632
High Income	2.326	***	.661	10.239	1.385	***	.443	3.994	1.471	*	.837	4.354
Gender Attitudes	.146		.130	1.157	.755	***	.175	2.128	.365	**	.163	1.441
R^2	0.57				0.62				0.77			

In addition to the logistic regressions analyzed with SPSS, a series of structural equation models (SEMs) were conducted using MPLUS 6.0. Although the logistic regression analyses are sufficient to test the hypothesis, SEM was also used because it has gained popularity in social

sciences, including the IS field, and further validates the findings from the former analyses. This dual method has been suggested by Gefen, Straub, and Boudreau (2000) because it allows researchers to combine and evaluate the measurement model and structural model simultaneously. The latent variable, gender attitudes, contained four reflective items which represent the construct. Reflective observed variables are utilized for the reason that the SEM analysis is co-variance based and the present research attempts to test rather than build on theory (Chin, 1998). The results obtained from the MPLUS models are similar to those found using SPSS. The SEM results can be found in Appendix B. For more information on comparing analyses regression and SEM analyses, refer to Gefen et al. (2000).

DISCUSSION

Investigation into PC use behavior is important because, despite newer technologies (e.g., Tablets, Smart Phones) gaining popularity, personal computers continue to have greater computing capability and remain dominate over other similar technology devices (Dearman and Pierce, 2008). Given the advantages of PCs and ICTs, it is alarming that the extant research reveals the adoption and use of these technologies to be consistently dominated by males. Even with such a persistent gender gap, however, the majority of the research does not systematically investigate nor explain *why* such a gender gap exists.

The present research examines individuals' attitudes toward traditional gender roles and how they may impact PC use behavior, particularly that of females. Using data from the GLOBE Project (House et al., 2004), Poland, Japan, and South Korea were selected for investigation because of their variation in gender egalitarianism practice scores—high, medium, and low, respectively.

The model for the pooled sample of Poland, Japan, and South Korea citizens resulted in a positive association between gender attitudes and frequent PC use. The analysis was subsequently conducted for each country separately to see if the results would hold. Evidently, the gender attitudes factor is not significant in explaining PC use behavior in Poland but is significant in explaining the same behavior in Japan and South Korea. Japanese citizens and Korean citizens were more likely to be frequent PC users when they disagreed that men should have an advantage over women in terms of higher education, jobs, and leadership positions.

Although the gender of individuals was a significant predictor of PC use across countries, the distribution of non-users and frequent PC users varied. An approximated equal distribution was evident for non-users and frequent users between males and females in Poland compared to citizens in Japan and South Korea. At the weakest accepted significance level, the result of the statistical analysis showed that Polish males are more likely to be frequent PC users than Polish females. Furthermore, the gender attitudes factor was not significant, which may indicate that gender attitudes of citizens have less variance in high gender egalitarian societies than low gender egalitarian societies. In contrast, there was a skewed distribution of non-users and frequent users between males and females in Japan and South Korea. The statistical analysis indicated a strong significance for gender and gender attitudes variables in both Japan and South Korea, but the association of gender attitudes was stronger in Japan than South Korea. These results suggest that Japanese citizens may vary more in their attitudes towards gender roles compared to Polish citizens, who favor gender egalitarianism, and South Korean citizens, who favor men and women in traditional roles.

Overall, there is a possibility that nations have fewer gender disparities in technology use (e.g., PC use) when their citizens have more gender-egalitarian attitudes. This was expected

because technology use can be considered an economically productive activity and, according to Wood and Eagly (2002), roles related to economically productive activities are systematically assigned to men. The results support this idea since the strength and magnitude of the negative association of being female with using personal computers decreases from its highest strength and magnitude in South Korea to its lowest strength and magnitude in Poland. Further research is needed that investigates the influence of gender attitudes on technology use to determine if this is a phenomenon that holds with different technologies.

Consistent with the hypothesis, results suggest that attitudes associated with gender inequality negatively impact PC use behavior in males and females. For females, it can be presumed that those with gender egalitarian attitudes are more likely to defy social norms that reinforce the idea of certain (economically productive) activities being more appropriate for males than females. Therefore, under the assumption that technology use is traditionally considered an activity most appropriate for males (see Shashaani and Khalili, 2001); females with gender egalitarian attitudes that counter this idea are more likely to use PCs. It is, however, curious that males who hold more gender egalitarian attitudes are also more likely to be frequent users of PCs. As a post hoc analysis, an interaction between gender and gender attitudes was tested to see if the attitudes of females was driving the significance of the association between gender attitudes and PC use behavior, but this interaction was not significant.

One potential explanation for men's gender egalitarian attitudes contributing to their being more likely to be frequent PC users is related to occupational sex segregation across countries. Charles (1992) found that countries with high gender egalitarianism tended to have high levels of occupational sex segregation. In other words, the women in these countries were more likely than men to work in occupations traditionally assigned to females (e.g., nursing and

education) and the distribution of men and women working in occupations traditionally assigned to females was greater in higher gender egalitarian countries. Charles also determined that the counterintuitive high levels of occupational sex segregation in more gender egalitarian countries are not likely explained directly by gender egalitarianism, but rather by other variables that are also present in gender egalitarian countries, including: employee-based labor markets; large service sectors; and the mediating role of corporatism. Given Charles (1992) empirical findings and interpretation, it is possible that the result of the present study—that men with gender egalitarian attitudes are more likely to be frequent users of PCs—is driven by a correlation of men with these attitudes more likely residing in countries that score high in gender egalitarianism. This would mean that the correlation of gender egalitarianism with occupational sex segregation (Charles, 1992) possibly translates to men with gender egalitarian attitudes being more likely to be employed in occupations that require more computer use than is required in occupations that women are typically employed in. This argument is given additional support by employment status being a significant predictor of computer use in the present study.

A second plausible explanation for men's gender egalitarian attitudes contributing to their being more likely to be frequent PC users is related to gender rank inequality in occupational status, in other words, a disparate distribution of males and females in high-status jobs, like management. Semyonov and Jones (1999) found a positive association between female labor force participation and such occupational inequality by gender. Since countries with high gender egalitarianism typically have high levels of female workforce participation (House et al., 2004) it is possible that countries with high gender egalitarianism have high levels of occupational inequality that contribute to males working in jobs that provide them more opportunity to use personal computers. Therefore, similar to the argument related to occupational sex segregation,

it is possible that the above scenario translates to men with gender egalitarian attitudes being more likely to be employed in jobs with higher rank that incidentally require more computer use than is required in jobs that women are typically employed in.

Results for the control variables were largely consistent with expectations grounded in the literature. A negative association between age and PC use was the outcome for all the models. The traditional socioeconomic variables—education and income—account for much of the variance in PC use. Some secondary education has no significant association with PC use, while completed secondary education is positively associated with PC use for Polish citizens only. Completed university education was found to be most strongly and positively associated with PC use behavior. Along with education and income, whether or not one is employed is also an important predictor of citizens PC use in all three countries.

In societies where gender attitudes that represent gender inequality are common, there is a hindrance effect on ICT use. This means that nations where attitudes are consistent with gender inequality are likely to be laggards in minimizing the digital divide. While it is difficult to change culture, results of the present research provide evidence that education and awareness campaigns targeted at gender equality are one way to accelerate the process of minimizing, and eventual eliminating, gender disparities in ICT use.

CONCLUSION

This is the first study that investigates the role of gender egalitarianism and gender attitudes on the gender digital divide. This study is also unique because it provides a theoretical justification to explain the gender gap in technology use. Using biosocial theory this research supports the tenet that individuals vary in their PC use behavior based on the cultural influence of gender egalitarianism and their individual attitudes towards related to traditional gender roles. The four

questionnaire items that reflect the gender attitudes factor loaded universally across the three sample countries chosen for their variation in gender egalitarianism practice scores. The analysis revealed that the gender attitudes factor did not predict PC use behavior in Poland, a nation that ranked high in gender egalitarianism practice but did predict PC use behavior in Japan and South Korea, which ranked medium and low, respectively. This research argues that relevant policy makers and institutions cannot simply expect citizens to utilize technology once it is made widely available. A divide in the use of technology between males and females may persist because of societal influences on gender attitudes.

Study 3 makes two primary contributions. First, by introducing biosocial theory to explain and empirically test the gender digital divide, I address Kennedy et al. (2003) and van Dijk's (2006) calls for digital divide research that is more theoretical and interdisciplinary. Second, I tested the hypothesized model in countries that varied in geography and culture, which addresses Selwyn's (2004) suggestion that research consider how geography influences the gender gap.

While this research is comprehensive because it is a theoretically-justified, empirically-tested, multinational study that introduces a new concept into the digital divide research, it is not without limitations. The use of secondary data, which assists in multi-national investigations such as this study, raises issues of data quality (Cooper and Schindler, 2006). Though the data comes from a reliable source, the results should be interpreted with caution. Future research can focus on a set of countries that vary in gender egalitarianism measures using different data sources and alternative gender equality indices to validate the present findings.

Summary of Research

Refer to Table 1 for a summary of each study's data source, country samples, time periods, and statistical analyses used in this dissertation. Refer to Table 2a-d for a summary of the hypotheses that were posited in the three studies and which countries supported each premise.

Study 1, *"The Digital Divide: A Knowledge Gap and Displacement Hypotheses Perspective,"* utilized data from the European Social Survey to investigate the role of traditional media systems, socioeconomic status, and demographics on internet access and internet use (Hypotheses 1a–8b). The hypotheses were tested using 68 logistic regressions. First, for each of two models—internet access and internet use—for eleven countries and three time periods (2002, 2006, and 2010). Second, two pooled logistic regressions were tested that controlled for the time periods and the countries sampled. Study 1 also tested the role of internet use and age (hypotheses 9a–10c) on the time spent with traditional media systems. A total of 102 linear regressions were conducted using a methodology similar to that used to test the first set of hypotheses. Three models—television, newspaper, and radio use—for eleven countries and three time periods. Three pooled linear regression models were also tested.

Next, Study 2, *"The Role of Human Values in the Digital Divide,"* used data from the World Values Survey, collected from 2005 to 2007, to examine which set of human values predict PC use behavior. After conducting a series of factor analyses, seven countries that contained item loadings that confirmed expectations were selected for testing the hypotheses. A total of eight logistic regressions were run—one for each of the seven countries and a pooled logistic regression that controlled for country effects.

Finally, Study 3, *"The Digital Divide's Gender Gap: A Biosocial Theory Perspective,"* also used the World Values Survey data to develop a factor of gender role attitudes and

empirically test its role on PC use behavior. Four logistic regressions were run—one for each of the three countries and a pooled logistic regression that controlled for country effects. Additionally, three logistic structural equation models were run using MPlus 6.0. Results from the SEM analysis were somewhat similar to results from the logistic regression analyses for individual countries (see the SEM results in Appendix B). The three countries in this study were selected based on the variation in their gender egalitarianism scores as ranked by the GLOBE Project (House et al., 2004).

Table 1: Summary of Studies

Study	Theory	Data	Main Sample	Time Period (Waves)	Analysis
Study 1: The Digital Divide: A Knowledge Gap and Displacement Hypotheses Perspective	Knowledge Gap Hypothesis & Displacement Hypotheses	European Social Survey	Belgium, Denmark, Finland, Netherlands, Norway, Poland, Slovenia, Spain, Sweden, Switzerland, United Kingdom	2002, 2004, 2006, 2008, and 2010	68 Logistic Regressions, 102 Linear Regressions
Study 2: The Role of Human Values in the Digital Divide	Values Theory	World Values Survey	Indonesia, Mexico, Moldova, Morocco, Rwanda, South Africa, Taiwan	2005-2007	8 Factor Analyses, 8 Logistic Regression
Study 3:The Digital Divide's Gender Gap: A Biosocial Theory Perspective	Biosocial Theory	World Values Survey	Poland, Japan, South Korea	2005-2007	4 Factor Analyses, 4 Logistic Regressions, 3 Structural Equation Models

Note:
-All three studies were investigated at an individual level of analysis.
-Five of time periods were analyzed in Study 1 for the pooled analysis while three time periods (2002, 2006, and 2010) were analyzed for the individual country analysis.
-One time period was analyzed for Study 2 and Study 3 (2005-2007).
-Sample of countries used in Study 1's pooled analysis: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Russia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom

Table 2a: Summary of Hypotheses and Support

Study 1		
	Hypothesis	**Support**
1a	Education will be positively associated with internet access.	All time periods and Countries
1b	Education will be positively associated with internet use.	All time periods and Countries
2a	Income will be positively associated with internet access.	All time periods and Countries
2b	Income will be positively associated with internet use.	Year 2002: All but Norway, Spain, and Sweden Year 2006: All but Norway, Spain, and Sweden Year 2010: Denmark, Netherlands, Norway, Sweden
3a	Knowledge and skills training will be positively associated with internet access.	Year 2002: All Year 2006: All Year 2010: All but Netherlands
3b	Knowledge and skills training will be positively associated with internet use.	Year 2002: All but Sweden Year 2006: All Year 2010: All but Sweden
4a	The amount of time spent watching television will be negatively associated with internet access	Year 2002: All but Slovenia, Switzerland Year 2006: All but Belgium, Slovenia, Spain, Switzerland Year 2010: Poland, Sweden, Switzerland, United Kingdom
4b	The amount of time spent watching television will be negatively associated with internet use.	Year 2002: Norway, Poland, Spain Year 2006: Denmark, United Kingdom Year 2010: United Kingdom

Table 2b: Summary of Hypotheses and Support

Study 1		
	Hypothesis	**Support**
5a	The amount of time spent reading the newspaper will be positively associated with internet access	Year 2002: All but Norway, Sweden, Switzerland Year 2006: Denmark, Poland, Spain, Switzerland Year 2010: Spain
5b	The amount of time spent reading the newspaper will be positively associated with internet use.	Year 2002: Denmark, Finland, Slovenia, Sweden Year 2006: Belgium, Denmark, Netherlands, Spain Year 2010: Netherlands, Spain, Sweden
6a	The amount of time spent listening to the radio will be positively associated with internet access	Year 2002: No Year 2006: Slovenia, United Kingdom Year 2010: Belgium, Slovenia, Spain
6b	The amount of time spent listening to the radio will be positively associated with internet use.	Year 2002: No Year 2006: No Year 2010: Netherlands, Spain
7a	Age will be negatively associated with internet access.	All time periods and Countries
7b	Age will be negatively associated with internet use.	All time periods and Countries
8a	Males are more likely to have internet access more than females.	Year 2002: Belgium, Netherlands, Norway, Spain, Sweden, Switzerland Year 2006: United Kingdom Year 2010: None
8b	Males will use the internet more frequently than females.	Year 2002: All but Finland and Poland Year 2006: All but Slovenia and Spain Year 2010: Belgium, Norway, Switzerland

Table 2c: Summary of Hypotheses and Support

Study 1		
	Hypothesis	**Support**
9a	Frequent users of the internet will spend less time using traditional media systems (Television).	Year 2002: Belgium, Netherlands, Norway, Poland, Slovenia, Spain Year 2006: Belgium, Denmark, Finland, United Kingdom Year 2010: United Kingdom
9b	Frequent users of the internet will spend less time using traditional media systems (Newspaper)	Year 2002: Denmark, Finland Year 2006: Belgium, Netherlands, Spain Year 2010: Netherlands, Spain
9c	Frequent users of the internet will spend less time using traditional media systems (Radio)	Year 2002: Norway Year 2006: No Year 2010: No
10a	Age will be positively associated with the likelihood to be a frequent user of traditional media systems (Television).	Year 2002: All but Belgium, Netherlands, Poland, Spain, Sweden Year 2006: All but Norway and United Kingdom Year 2010: All
10b	Age will be positively associated with the likelihood to be a frequent user of traditional media systems (Newspaper).	Year 2002: All but Poland and Spain Year 2006: All Year 2010: All
10c	Age will be positively associated with the likelihood to be a frequent user of traditional media systems (Radio).	Year 2002: Norway and Sweden Year 2006: All but Denmark, Spain, United Kingdom Year 2010: All but Poland and Spain

Table 2d: Summary of Hypotheses and Support

	Hypothesis	Support
Study 2		
1	Individuals with independent values will be more likely to be frequent users of personal computers.	Indonesia, Mexico, Morocco, South Africa
2	Individuals with interdependent values will be less likely to be frequent users of personal computers.	Indonesia, Mexico, Moldova, Taiwan
Study 3		
1	The association between gender attitudes and the frequency of personal computer use will be stronger in low gender egalitarian countries than in high gender egalitarian countries.	Japan, South Korea

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Appendix

Appendix A

Impact of Internet Use on Traditional Media Systems – With Control Variables Results

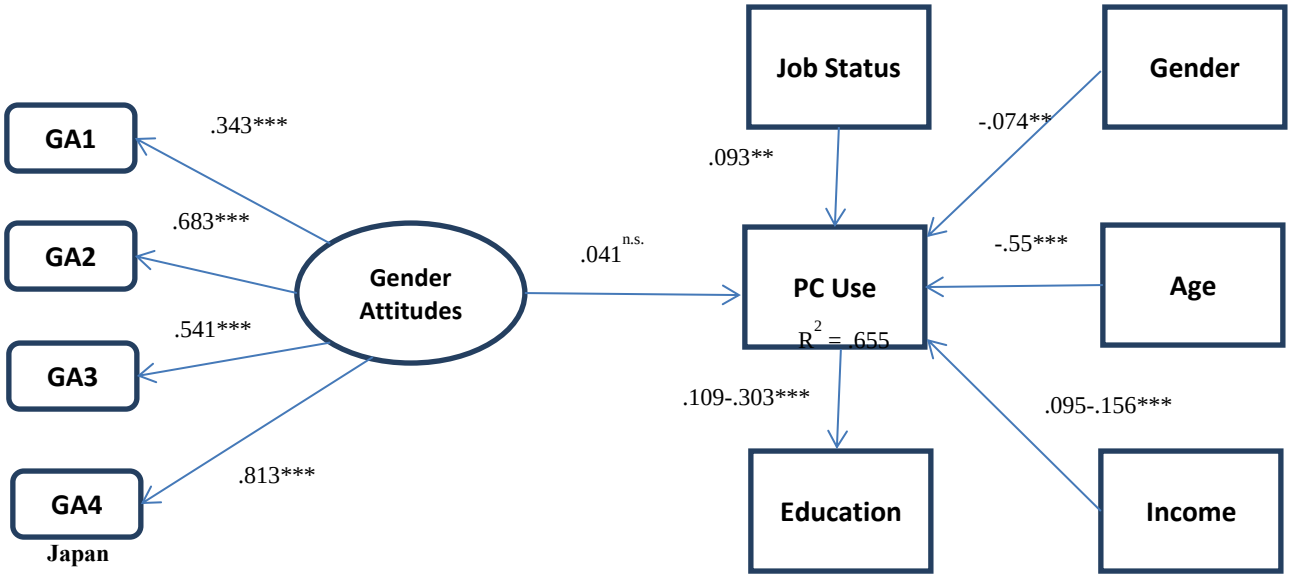
2010TV	Belgium		Denmark		Finland		Netherlands		Norway		Poland		Slovenia		Spain		Sweden		Switzerland		UK	
Education	-.174	***	-.094	**	-.089	**	-.176	***	-.181	***	-.110	**	-.067	*	-.187	***	-.204	***	-.154	***	-.166	***
Income	-.078	**	-.151	***	.008		-.056	*	-.090	**	-.080	**	-.119	**	-.074	**	-.116	***	-.107	**	-.106	***
Age	.203	***	.224	***	.274	***	.182	***	.096	**	.172	***	.204	***	.138	***	.144	***	.174	***	.103	***
Gender	-.016		.018		-.020		-.010		-.013		.025		.104	**	-.034		-.027		.066	**	.025	
Internet Use	-.036		-.003		-.040		-.024		-.007		-.070		-.052		.055		-.028		-.038		-.052	**
R-sqr	.108		.087		.107		.092		.056		.091		.073		.077		.096		.078		.078	
2006TV	Belgium		Denmark		Finland		Netherlands		Norway		Poland		Slovenia		Spain		Sweden		Switzerland		UK	
Education	-.176	***	-.144	***	-.156	***	-.154	***	-.179	***	-.131	**	-.072	*	-.106	**	-.164	***	-.317	***	-.177	***
income	-.168	***	-.083	**	-.066	**	-.127	***	-.031		.007		-.045		-.195	***	-.087	**	.011		-.109	***
Age	.177	***	.172	***	.162	***	.066	**	-.012		.179	***	.091	**	.194	***	.083	**	.129	***	.048	
Gender	.029		.006		.025		.004		-.010		-.031		.105	**	-.049		.039		.076	**	.036	
Internet Use	-.075	**	-.110	**	-.070	*	-.046		-.040		-.051		-.031		.016		-.044		-.051		-.109	**
R-sqr	.160		.095		.108		.061		.041		.078		.034		.131		.053		.125		.093	
2002TV	Belgium		Denmark		Finland		Netherlands		Norway		Poland		Slovenia		Spain		Sweden		Switzerland		UK	
Education	-.207	***	-.184	***	-.181	***	-.187	***	-.171	***	-.081		-.059		-.008		-.149	***	-.151	***	-.142	***
Income	-.147	***	-.045		-.100	**	-.064	**	-.037		-.119	**	.046		-.192	**	-.105	**	-.087	**	-.157	***
Age	.036		.075	**	.098	**	.008		-.001		-.008		.131	**	.001		.033		.144	***	.104	**
Gender	.068	*	.031		.024		-.076	**	.065	**	.005		.117	**	.031		.066	**	-.019		-.022	
Internet Use	-.077	*	-.043		-.034		-.078	**	-.095	**	-.183	**	-.083	*	-.140	*	-.034		-.028		-.042	
R-sqr	.114		.053		.088		.071		.052		.077		.041		.051		.046		.067		.080	

2010RD	Belgium		Denmark		Finland		Netherlands		Norway		Poland		Slovenia		Spain		Sweden		Switzerland		UK	
Education	-.030		-.102	**	-.140	***	-.105	**	-.119	***	.090	**	-.012		-.059		-.018		-.169	***	.018	
Income	.052		.051	*	.027		-.037		-.025		-.039		-.025		.027		-.025		.003		.074	**
Age	.058	*	.121	***	.134	***	.077	**	.149	***	.026		.116	**	.044		.163	***	.087	**	.076	**
Gender	.038		.041		.044		.013		.065	**	-.006		-.052		.085	**	.046		-.011		.059	**
Internet Use	.027		-.020		.017		.111	***	.002		.012		.076		.087	**	-.021		.049		.064	**
R-sqr	.003		.026		.044		.024		.041		.001		.006		.009		.029		.026		.015	
2006RD	Belgium		Denmark		Finland		Netherlands		Norway		Poland		Slovenia		Spain		Sweden		Switzerland		UK	
Education	-.030		-.077	**	-.078	**	-.020		-.044		.055		-.064		-.001		-.080	**	-.125	***	-.027	
income	.056		-.020		-.015		-.020		.048	*	.081	*	-.020		.010		-.021		.082	**	.125	***
Age	.098	**	.042		.067	**	.059	*	.116	***	-.088	*	.110	**	-.019		.141	***	.087	**	.037	
Gender	-.036		.094	**	.041		.006		.043		-.095	**	-.071	**	.080	**	.044		-.016		.048	*
Internet Use	.078	*	-.025		-.016		.049		-.024		-.037		.030		-.010		-.039		.064	*	.031	
R-sqr	.006		.015		.015		.000		.019		.017		.018		-.001		.032		.017		.016	
2002RD	Belgium		Denmark		Finland		Netherlands		Norway		Poland		Slovenia		Spain		Sweden		Switzerland		UK	
Education	.037		-.149	***	-.228	***	-.083	**	-.150	***	-.045		-.018		-.019		-.117	**	-.199	***	-.072	*
Income	.050		-.012		.029		-.008		.005		.065		-.103	**	-.018		.018		-.016		-.011	
Age	-.062		.047		.013		-.033		.116	***	-.165	**	-.077	*	-.037		.079	**	-.041		.014	
Gender	.065	*	.019		.027		.018		.036		-.141	**	-.027		-.075		.015		-.015		.099	**
Internet Use	-.057		-.046		-.003		.002		-.069	**	.060		-.036		-.024		.015		.013		.008	
R-sqr	.077		.182		.139		.141		.093		.022		.046		.029		.112		.061		.019	

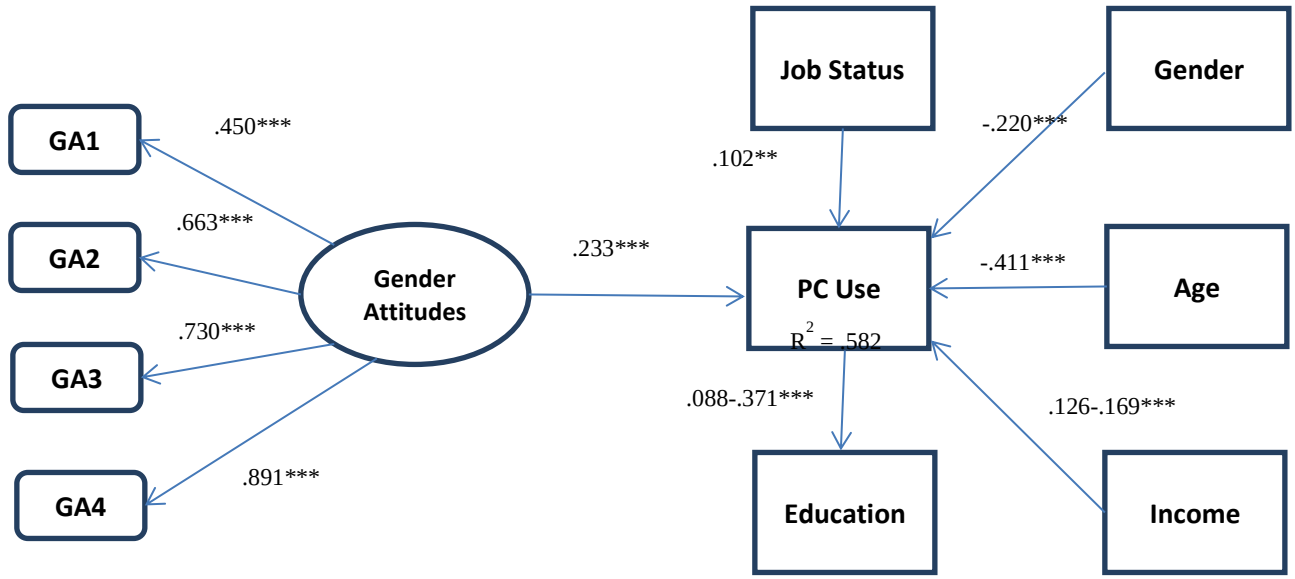
2010NP	Belgium		Denmark		Finland		Netherlands		Norway		Poland		Slovenia		Spain		Sweden		Switzerland		UK	
Education	.047		.073	**	.108	***	.059	**	.117	***	.086	**	.059		.164	***	.042		.022		.018	
Income	.024		.067	**	.034		.111	***	.007		.107	**	.054		.091	**	.010		.078	**	.021	
Age	.188	***	.395	***	.408	***	.384	***	.246	***	.188	***	.311	***	.226	***	.313	***	.283	***	.151	***
Gender	.107	***	.116	***	-.020		.079	**	.121	***	-.105	**	.025		.137	***	.063	**	.139	***	.070	**
Internet Use	.022		-.019		-.011		.081	**	-.022		.005		.035		.138	**	.033		.033		-.013	
R-sqr	.042		.182		.160		.153		.088		.054		.074		.110		.092		.098		.026	
2006NP	Belgium		Denmark		Finland		Netherlands		Norway		Poland		Slovenia		Spain		Sweden		Switzerland		UK	
Education	.053		.059	*	.066	**	.005		.100	**	.072		-.010		.188	***	-.010		.041		.011	
Income	.055		.027		.067	**	.087	**	.044		.100	**	.139	***	.127	**	-.013		.010		-.014	
Age	.245	***	.428	***	.408	***	.314	***	.274	***	.087	*	.374	***	.272	***	.340	***	.319	***	.171	***
Gender	.144	***	.116	***	.006		.040		.034		-.072	*	-.021		.128	**	.030		.071	**	.102	***
Internet Use	.068	*	.042		-.020		.110	***	.006		.049		.020		.202	***	-.003		.035		-.008	
R-sqr	.075		.197		.158		.097		.086		.021		.111		.143		.113		.102		.036	
2002NP	Belgium		Denmark		Finland		Netherlands		Norway		Poland		Slovenia		Spain		Sweden		Switzerland		UK	
Education	.053		.103	**	.135	***	.105	**	.044		.162	**	.105	**	.126		.076	**	.022		-.010	
Income	.078	**	.025		-.023		.082	**	.024		.021		.078	*	.082		.027		.044		-.005	
Age	.250	***	.427	***	.452	***	.382	***	.318	***	.074		.216	***	.072		.342	***	.257	***	.157	***
Gender	.167	***	.077	**	.056	*	.029		.036		-.058		.021		.135	**	.065	**	.068	**	.042	
Internet Use	.021		.071	*	.098	**	-.005		.030		.042		.060		.024		.046		.023		.032	
R-sqr	.077		.182		.139		.141		.093		.022		.046		.029		.112		.061		.018	

Appendix B – MPLUS Results using Structural Equation Modeling

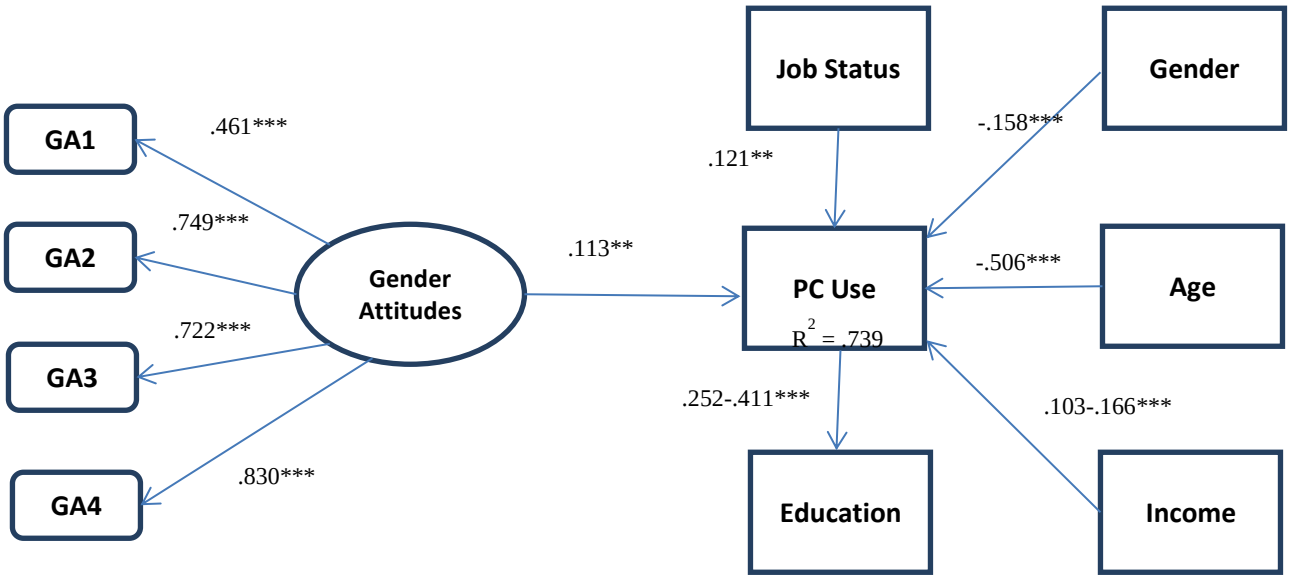
Poland:



Japan:



South Korea:



Model Fit

Chi-Square Test of Model Fit	
Value	1.496
P-Value	0.4733
CFI	1.000
TFI	1.001
SRMR (Standardized Root Mean Square Residual)	0.006

Item Questions

	Gender Attitudes
GA1	Men should have more right to a job than women
GA2	Men make better political leaders
GA3	University is more important for a boy
GA4	Men make better business executives than women do

Note: Scale ranges from 1 (Strongly Agree) to 4 (Strongly Disagree)

Vita

Dr. Belal Abdelfattah earned a PhD in International Business with a concentration in Information Systems. Dr. Abdelfattah's research is driven by his interest in contemplating issues of disparity among individuals and organizations. His research interests center on IT diffusion and are primary focused are on IT adoption/adaptation, organizational social media strategies, and cultural influences on technology use. Dr. Abdelfattah appreciates opportunities to work on multidisciplinary research projects and he welcomes the challenge of integrating varied theories and methods in his research.

Dr. Abdelfattah teaches courses related to information systems and has contributed to academic scholarship with journal publications and conference proceedings. In addition to his doctoral degree, Belal earned an MBA degree from the University of Texas at El Paso and has several years of industry experience, working as a Programmer Analyst. Dr. Abdelfattah is pursuing a career in academia.

Dr. Abdelfattah's dissertation, Essays on the Digital Divide, was supervised by Dr. Kallol Bagchi.

Permanent address: 9329 W.H. Burges
El Paso, TX 79925

This thesis/dissertation was typed by Belal M.T. Abdelfattah.